RED GOLD RUSH

MANAGING QUALITY FOR AFGHAN SAFFRON EXPORTS

International Trade Centre

TRADE IMPACT FOR GOOD

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Managing Quality for Afghan Saffron Exports

About the guide

Saffron, the world's most expensive spice, offers great potential for Afghan exporters. Developing a consistent brand for quality is the key to unlocking a 'red gold' rush, a priority sector of Afghanistan's national export strategy.

This guide outlines how to build a quality saffron sector based on mandatory requirements, voluntary standards and market preferences for three major markets: Europe, India and China.

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Foreword

Supporting greater diversification of products and export markets is a priority for Afghanistan and its development partners. This is a concrete aim of the work of the International Trade Centre (ITC) in the country and is fundamental to the *Afghanistan National Export Strategy 2018-22*.

Saffron – the 'red gold' of the spices sector – has great potential for Afghanistan. As a priority sector of the country's national export strategy, the success of Afghan saffron will bring significant economic and social advantages to the country.

As the highest-value spice in the world, the long-run profits generated from quality saffron cultivation could be an important incentive to farmers to pivot away from illicit opium production towards an industry with genuine export potential. The high labour requirements of saffron production offer significant employment opportunities in both peak and off-peak seasons, especially for women and youth.

International spice connoisseurs have already acknowledged that Afghanistan has the potential to produce globally competitive saffron, as shown by awards received at international competitions. Yet, quality problems persist and consistency must improve for Afghan saffron to develop a brand identity that is synonymous with high quality.

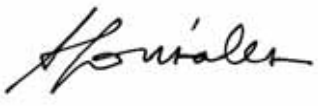
Navigating the quality arena can be a challenge for any small firm. Quality tends to be a fast-moving target anchored in a large array of technical regulations, standards and rapidly evolving consumer preferences.

In this context, we are pleased to launch this guide for the saffron sector, as a complement to the *Afghanistan National Export Strategy 2018-22*. The publication is an implementation action of the export strategy roadmap and serves as an important tool toward developing Afghanistan's export potential and creating an environment where entrepreneurship can grow.

The guide sheds light on quality-related requirements for Afghan saffron, as well as elaborating on the three key markets identified in the strategy: China, Europe and India.

We look forward to this guide contributing to a deeper understanding of saffron quality requirements among stakeholders in the Afghanistan saffron sector. The hope is local and international partners will widely disseminate this publication and that ITC and national initiatives associated with quality will help make the 'red gold' rush a reality in Afghanistan.

ITC would like to thank the European Union for its support to the 'Advancing Afghan Trade: EU Trade Related Assistance' project and the Ethical Food and Fashion Initiative in Afghanistan. This important work would not be possible without its commitments to the vision of 'Peace through Prosperity, Prosperity through Trade', the stakeholders' quality management vision 'Quality brings changes and boosts prosperity', and the national sector vision, 'Saffron: spicing up Afghan exports'.



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Acronyms, abbreviations and symbols

Unless otherwise specified, all references to dollars ($) are to United States dollars, and all references to tons are to metric tons.

AGMARK	Agricultural Mark
CAC	Codex Alimentarius Commission
CCP	Critical control point
CFU	Colony-forming unit
EMS	Environmental management system
ESA	European Spice Association
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FSMS	Food safety management system
FSSAI	Food Safety and Standards Authority of India
FSSC	Food Safety System Certification
GAP	Good Agricultural Practices
GB	Guobiao (China national standard)
GB/T	Guobiao (China recommended standard)
GFSI	Global Food Safety Initiative
GHP	Good Hygiene Practices
GMO	Genetically modified organism
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis and Critical Control Point
HS	Harmonized System
IFS	International Featured Standards
IS	Indian Standard
ISO	International Organization for Standardization
ISPM	International Standard for Phytosanitary Measures
ITC	International Trade Centre
MAIL	Ministry of Agriculture, Irrigation and Livestock
µg	Microgram
MRL	Maximum residue limit
NES	National export strategy
nm	Nanometre
PAH	Polycyclic aromatic hydrocarbons
QR	Quick Response
SQF	Safe Quality Food
TCM	traditional Chinese medicine

Executive summary

Saffron production has shifted away from developed countries due to two factors: high labour costs and the labour-intensive nature of production activities. The variety of uses, combined with economic growth in the global South, has resulted in rising demand. However, much of this value is captured by major re-exporting nations that excel in processing, packaging and branding.

The Afghan saffron sector has immense potential to produce high-quality saffron. The key to triggering the 'red gold' rush in Afghanistan is developing a brand identity based on consistent high quality. This can only be realized if stakeholders understand, comply and demonstrate compliance with quality requirements in strategic export markets.

Saffron is a uniquely delicate spice that possesses distinct properties. Measuring these properties through laboratory analysis largely determines the quality level and market appeal. If targeted specifications can be attained, the result is objectively high-quality saffron.

Saffron quality for three target markets

There are many ways to approach and understand the concept of quality. This guide outlines an approach to saffron quality requirements on three levels:

- Mandatory legal requirements set forth in regulations;
- Voluntary standards serving as major facilitators of trade; and
- Market preferences, trends and buyers' requirements.

Quality requirements for saffron in the key markets of Europe, India and China indeed vary.

In Europe, high quality is the make-or-break parameter. Grade I specifications according to *ISO 3632 -1:2011 Preview Spices -- Saffron (Crocus sativus L.) -- Part 1: Specification* are a common baseline for many European buyers, while some have moved beyond this standard and have developed their own specifications and quality protocols. European Union legislation is quite strict for traceability and food safety.

Some buyers require that suppliers be certified against a food safety management system based on Hazard Analysis and Critical Control Point principles before even considering buying saffron. Strong buyer relationships based on trust and built over time are a critical success factor. Sustainability issues and transparency are valued more by European consumers than elsewhere, signalling opportunities for niche market branding.

India has experienced major issues with food safety in the past, so buyers and consumers seek compliance with food safety regulations set forth by the Food Safety and Standards Authority of India. Because most saffron exported to India is used to meet domestic demand, complying with the specifications outlined in national standards such as the AGMARK grading and marking rules for saffron is advisable.

In China, food safety laws are under constant revision to better align with international standards. Navigating food safety legislation in China, outlined primarily in a series of 'Guobiao' national standards, can be tricky, especially when considering the language barriers to overcome. Like in India, food safety scandals have left a strong imprint in the minds of consumers. Moreover, the Chinese market is flooded with adulterated or fake saffron. Consequently, buyers will want assurances that the saffron is pure and authentic, and that it is harvested and handled in a safe and proper manner.

Saffron testing for today and tomorrow

The biggest issue in saffron quality testing today is adulteration. This is a global concern that negatively affects all stakeholders in the industry. Saffron and saffron powder are adulterated in numerous ways. While some forms of adulteration are easy to spot, others are not. There are well-established and widely used

testing methods to detect adulteration, but the development of new technologies that offer greater scrutiny is ongoing.

Buyers often request assurances of food safety or saffron quality before purchasing the product. These can be offered through a certificate of analysis issued by a competent laboratory. Well-equipped, specialized laboratories can test levels of all the saffron quality characteristics that may interest buyers. A dedicated laboratory for saffron in Herat province in Afghanistan performs 19 different tests on the spice.

The versatility of saffron

While culinary applications of saffron are dominant, there are alternative uses.

The nutraceutical industry is booming in the West, Ayurvedic medicine is ever-present in India and traditional Chinese medicine is a giant, accounting for nearly a third of the value of the pharmaceutical industry in China. These industries use saffron for its medicinal properties. Saffron buyers may assign importance to chemical compounds in saffron, such as crocin, picrocrocin, crocetin and safranal, which are responsible for many of the health claims.

Saffron is also used in the cosmetics and perfume industry. Cosmetic and fragrant applications of the spice go back thousands of years. Safranal is the key chemical compound associated with saffron aroma, so these industries may target saffron with high levels of safranal. Although the colouring properties of saffron remain sought after in the textile industry, this use is declining due to the associated high cost and less expensive alternatives.

Prevention is better than inspection

The benefits of systematic, preventative approaches to food safety far outweigh systems that over-rely on inspection. Risks are minimized and costs are reduced. Cultivating, harvesting and processing safe, quality saffron requires adherence to Good Hygiene Practices, Good Agricultural Practices and Good Manufacturing Practices – all of which serve as the foundation of a Hazard Analysis and Critical Control Point (HACCP) system. All saffron producers in Afghanistan should abide by good practices and use them as the basis to develop an HACCP system within their operations.

CHAPTER 1 TOP QUALITY SAFFRON: KEY TO ACHIEVING EXPORT POTENTIAL

Chapter highlights

- Saffron production has shifted away from developed countries due to two factors: the high labour costs and the labour-intensive nature of production. The variety of product combined with economic growth in the global South has resulted in a rising demand. However, much of this value is captured by major re-exporting nations who excel in processing, packaging and branding activities.
- The key to triggering the 'red gold' rush in Afghanistan is developing a brand identity based on consistent high quality. This will require improvements in a number of areas.
- Saffron is a uniquely delicate spice that possesses distinct properties. Measuring these various properties through laboratory analysis largely determines the quality level and market appeal. If certain specifications can be met, the result is objectively high-quality saffron.
- The quality of saffron begins with the selection of high-quality corms. There is abundant evidence that the size and weight of mother corms can significantly influence saffron yield and quality. The production process – from the picking of flowers to preparing the stigmas for packaging – involves activities that, when performed improperly, are detrimental to saffron quality. Thus, good practices must be followed.

Saffron, or *red gold*, is a timeless spice due to its biological properties and unyieldingness to mechanization, which has resulted in a relatively similar harvesting process for hundreds of years. The meticulous and labour-intensive process involved in harvesting the fragile stigmas of the crocus flower is a critical factor in the high price of the spice, and explains why much of the world's production has shifted away from highly developed countries toward the developing world. In Afghanistan, between 150,000 and 170,000 collected crocus flowers generate only 1kg of saffron, and this requires around 40 hours of labour.

Saffron's complex chemistry includes more than 150 compounds, resulting in distinct qualities and unmistakable colour, flavour and aroma. The dried stigmas are used in their whole 'thread' form, processed into powder, or made into liquid extracts. With a variety of final uses ranging from culinary applications to medicines, textiles and cosmetics, demand for saffron continues to outpace supply, despite improvements in saffron yields per acre. This trend is likely to continue. Afghanistan has a genuine opportunity to capitalize on this industry momentum and become a major player in saffron production and export.

According to Afghanistan's national export strategy (NES) for the saffron sector 2018–22, several issues limit the sector's capacity to compete, connect and change. Among the mentioned issues are the following:

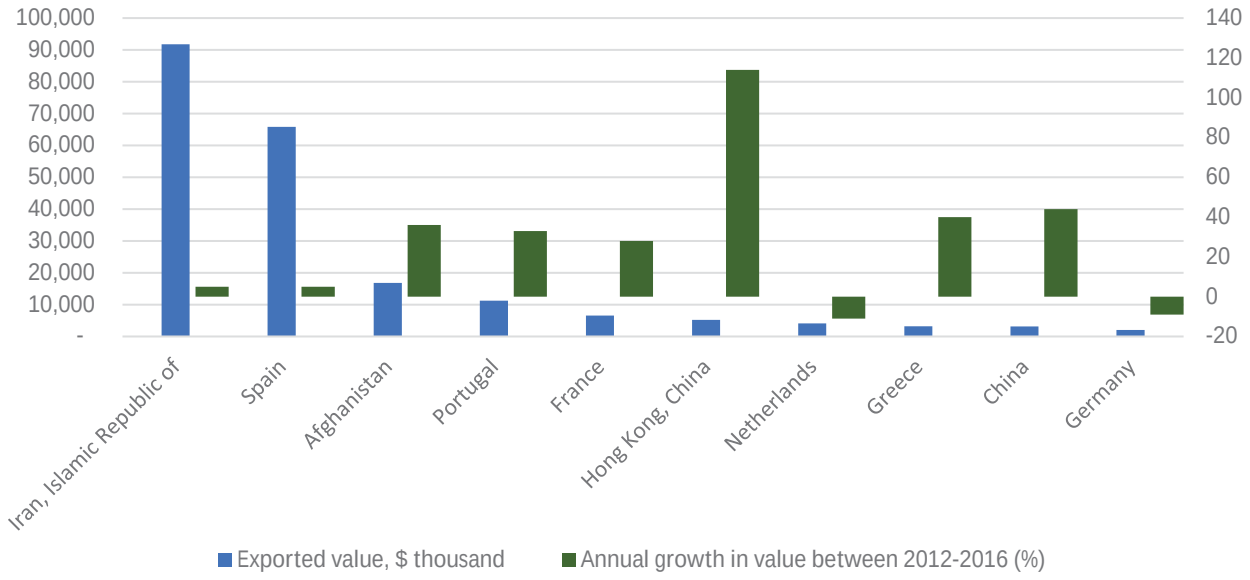
- Insufficient access to market information
- Lack of compliance with standards
- Difficulty tapping into emerging trends
- Weaknesses in quality management.

Capturing growing demand

The global market for saffron imports reached $213 million in 2016. Imports expanded an average of 7% per year between 2012 and 2016, which indicates potential for long-term sustainable growth.[1] Today, global production of the spice is skewed heavily towards one country: the Islamic Republic of Iran accounts for more than 90% of the worldwide production of saffron.

One would not know this by simply looking at export value figures. Major re-exporting countries including Spain, France and Italy capture more than half of this value by importing Iranian saffron in bulk, performing value-added activities such as processing, packaging and branding, and then re-exporting. Thus, the final export numbers, in terms of value, look much different (Figure 1).

Figure 1 World's top exporters of saffron, 2016



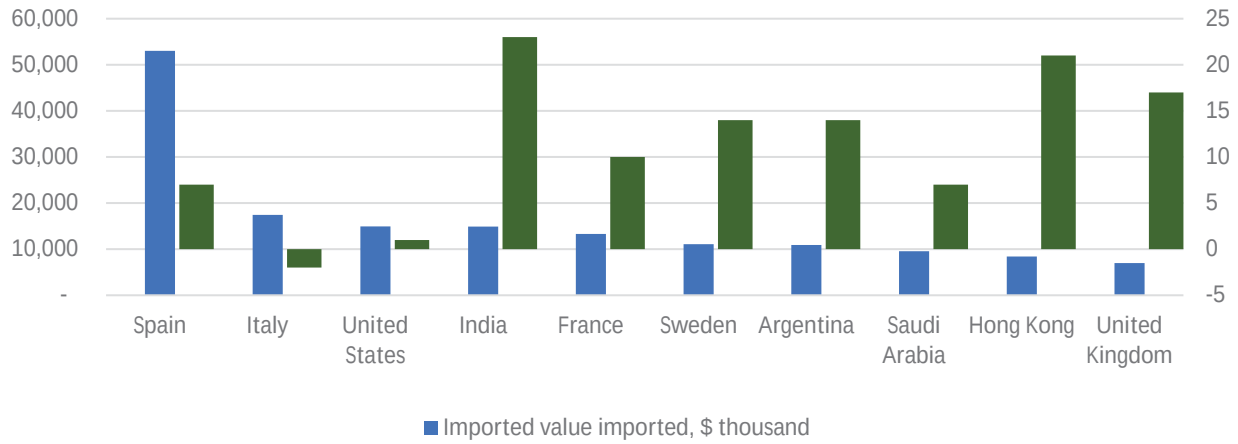
Source: ITC Trade Map.

[1] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

India, the fourth-largest saffron importer and a major producing country, drives strong demand in South Asia. Continued reliance on imports to keep up with domestic demand is expected in India, as ongoing economic growth translates to more households buying saffron.

Saffron demand has also surged in other economies in the global South, such as Saudi Arabia, Argentina, Kuwait and China, due largely to fast economic growth. The expectation is that the global market will swiftly absorb any future increases in saffron production for years to come due to high demand.

Figure 2 World's top saffron importers in 2016



Source: ITC Trade Map.

Anchoring the Afghan brand identity on quality

Saffron production in Afghanistan dates back more than a century. Cultivation began to experience a renaissance in the mid-1990s, when Afghan refugees started to return home, bringing with them saffron corms they had obtained when they cultivated the spice in Iran. More than 43 companies are now engaged in saffron production in 31 Afghan provinces, compared with just 15 in a single province a decade ago.

Afghanistan may be a new entrant in the global saffron marketplace, but it has already become one of the larger exporters of the spice. These exports have increased an average of 36% annually over the last five years. Afghanistan exported $17 million worth of saffron to international markets in 2016, up from $4.6 million in 2012. Saffron is an increasingly important export crop for Afghanistan. The country's total export basket was worth $421 million in 2016, of which saffron ranked fifth, comprising 5% of the value.[2]

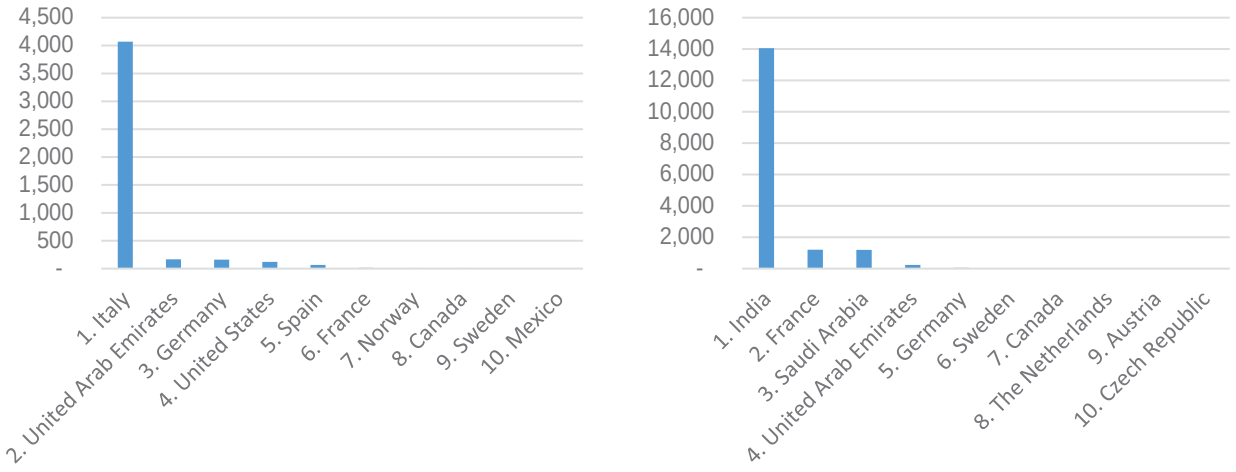
Figure 3 Exported value of Afghan saffron, 2005–16 ($ thousand)

Source: ITC Trade Map. Based on Comtrade mirror data.

[2] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

The top destinations for Afghan saffron in 2016 were India ($14 million), France ($1.2 million), Saudi Arabia ($1.2 million), the United States of America ($238,000) and Bahrain ($110,000).[3] This basket of countries looks quite different from the top export destinations of 2012 (Figure 4), illustrating the dynamic nature of Afghan saffron exports and the need to develop strong and stable relationships in key destination markets.

Figure 4 Top 10 export destinations of Afghan saffron, 2012 vs 2016 ($ thousand)



Source: ITC Trade Map.

Despite improvements, the Afghan saffron sector continues to suffer from quality-related problems, resulting in less demand, lower negotiated prices or rejection of consignments due to food safety issues. Certain needs must continue to be addressed for Afghan saffron to truly thrive in international markets, including:

- Improved corm quality, supply and access
- Upgraded planting, harvesting and post-harvest techniques
- Standardized saffron-processing centres
- Modernization of drying equipment and processes
- Improved storage facilities and practices
- Standardized packaging materials, equipment and processes
- Increased awareness of existing international standards
- Accreditation of laboratories according to ISO 17025
- Established Afghan-origin brand identity.

Creating a strong brand identity for saffron from Afghanistan is instrumental to the long-run success of the sector. Too often, Afghan saffron is treated like an unbranded commodity, which results in a position of weakness when negotiating prices and terms with buyers. Developing a reputation that is synonymous with high quality and unique from that of Iran, India or any other saffron-producing country facilitates international market access. A high-quality product reputation can shift the balance of power into the hands of producers with premium pricing.

It is widely known that Afghanistan can produce some of the best saffron in the world, as shown by awards won at international competitions. However, quality remains irregular and consistency must improve if the Afghan brand is to offer international guarantees of quality. Greater participation at relevant trade fairs such as Gulfood in Dubai could improve the visibility of the Afghan saffron brand and the stories of the people behind it.

This emphasis on a strong brand identity and other improvements can be seen when comparing the existing saffron value chain and the future saffron value chain based on the three strategic objectives of the national export strategy (Appendix I). Once Afghan saffron becomes a recognized brand in international markets,

[3] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

producers can move up the value chain closer to the end consumer, better capturing the premiums associated with the value-added activities now enjoyed by major re-export markets.

Quality begins with the corm

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Saffron quality starts with the identification and selection of high-quality saffron bulbs or 'corms'. Producers must be very attentive to corm size as it is a primary indicator of future productivity. There is abundant evidence that corm size is a major determining factor for saffron yields and quality.

Two of the most economically important attributes of saffron are the number of flowers/stigma produced per corm and the number and size of resulting progeny corms used for future planting. Both of these attributes are dependent on corm size.

A research study[4] illustrates this correlation. The three-year study analysed the impact of mother corm weight on progeny corm number and weight, flower number and fresh stigma yield. A selective summary of the study results is shown in Table 1 and Figure 5.

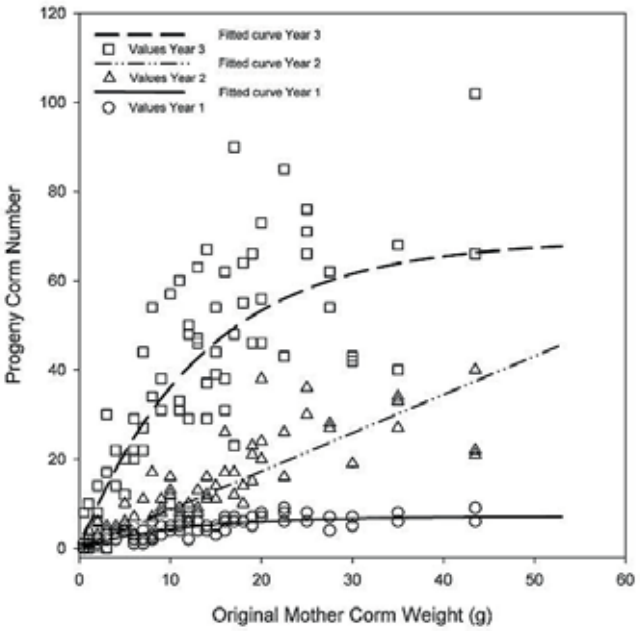
Table 1 Influence of corm weight on number of flowers and stigma in the first three years

Harvest Year	Corm weight	Average number of flowers/corm	Average fresh stigma weight (mg/corm)
Year 1	38-53 g	4.5	113.25
	34-36 g	-	-
	22-30 g	1.5	42.94
	16-20 g	1.07	35.49
	11-15 g	0.97	28.95
	6-10 g	0.45	12.21
Year 2	38-53 g	17.16	698.29
	34-36 g	13.79	554.84
	22-30 g	10.14	407.43
	16-20 g	6.60	267.34
	11-15 g	4.32	171.01
	6-10 g	2.65	101.31
Year 3	38-53 g	60.83	2358.16
	34-36 g	35.76	1453.33
	22-30 g	29.12	1337.57
	16-20 g	25.75	1164.16
	11-15 g	20.48	906.06
	6-10 g	16.89	717.24

Source: Douglas, M. et al. (2014). Saffron (Crocus sativus L.): The effect of mother corm size on progeny multiplication, flower and stigma production. *Scientia Horticulturae, 166*, 50-58.

[4] Douglas, M. et al. (2014). Saffron (Crocus sativus L.): The effect of mother corm size on progeny multiplication, flower and stigma production. *Scientia Horticulturae, 166*, 50-58.

Figure 5 Influence of corm weight on number of progeny corms in the first three years



Source: Douglas, M. et al. (2014). Saffron (Crocus sativus L.): The effect of mother corm size on progeny multiplication, flower and stigma production. *Scientia Horticulturae, 166*, 50-58.

The research shows that there is a positive correlation between mother corm weight and average number of flowers produced/corm, average fresh stigma weight/corm and number of resulting progeny corms. Some of the key highlights from the study are the following:

- Large production gains in stigma yield and progeny corm number were realized by planting mother corms that weighed at least 20 grams
- Corms weighing more than 30 g resulted in 2.4 times more stigma production than corms in the 11–15 g range over a period of three years
- Smaller corms, on average, flowered five to seven days later than the largest corms and very small mother corms produced very few flowers.
- Progeny corm numbers continued to rise each year; however, by the third year, progeny corms smaller than 10 g dominated production.

While this particular study took place in New Zealand, it was not the first, nor will it be the last, to show this clear correlation between mother corm size and productivity. It is also important to note that size is not the only important factor. Corms should have no signs of damage or infection. If cultivation of organic saffron is the goal, then the corms used should be certified organic.

In terms of corm collection and storage, ideally corms should be planted as soon as they are removed from the field and sorted, as storage can negatively affect flower yield. If storage is necessary, then corms should be stored at least 20 centimetres off the ground in dark, cool, dry and well-ventilated conditions.

Basics: Harvesting and processing quality saffron

This section serves as a reference that outlines key activities and inputs that can dramatically affect saffron quality.

Some of the suggested practices take very little time, investment or effort to improve. Other areas may require significant changes and investment, for example, the sourcing of high-quality corms or the necessary physical infrastructure to process, dry and test saffron in ideal conditions.

On this subject, in early 2017 the Afghan government announced the development of 10 saffron processing centres. The guidance in this chapter should be used in parallel with the practices outlined in Appendix II. GHP, GAP and GMP should always be followed when performing harvesting and processing activities.

Collecting flowers

Harvesting begins roughly two to three weeks after the first irrigation, usually near the end of October or the beginning of November. The harvesting period for saffron is extremely labour intensive, but this is a necessity to ensure that flowers are harvested at the right moment. The harvest period lasts only two to three weeks and individual saffron flowers have roughly a 48-hour lifespan during which they must be picked.

Within the harvest period is an intensified blossoming stage which may last anywhere from two to six days. Flowers need to be picked daily. Ideally, workers will begin picking flowers early in the morning immediately after sunrise before the flowers are open. Sunlight negatively affects the chemical structure of the saffron stigma (e.g. crocin degradation) and open flowers expose the stigmas to dust. Higher relative humidity levels present later in the day can also damage saffron quality, so flowers should be picked early and intensively.

Hygiene must be the critical consideration during collection of flowers. Workers need to be healthy and free from any bacteria or viruses. Hands must be freshly washed with cleanly cut fingernails. Workers should be dressed in clean clothes and hair should be covered. Any tools used during collection, such as tweezers, scissors and baskets, must be perfectly clean and food-grade to avoid introducing extraneous matter into the collection of flowers.

Contact with soil during flower collection should be avoided. Hygienic, standardized, shallow (10 cm max) plastic baskets ought to be used to collect and transfer saffron flowers. Plastic bags or sacs should never be used as they are not as secure and can result in contamination or damaged flowers. Dust can be minimized during collection by harvesting in the early morning and using covers for baskets.

Vehicles used to transport the saffron flowers to the processing (or storage) facility should be completely enclosed, clean, free of dust and pests, absent of sunlight and temperature controlled. A built-in shelving system can be used to place the baskets and hold them securely in place. Collected flowers should be transported as quickly as possible to a processing centre for stigma separation.

Temporary flower storage

Ideally, saffron processing would begin immediately after flower collection. However, if flowers are to be stored temporarily prior to processing, storage areas should be dry and cool (as close to 0°C as possible). The storage area must be sufficiently large, clean and completely devoid of sunlight, dust, pests and other pollution. The room would ideally have marbled floors and tiled walls and entry would only be granted to a limited number of specified individuals.

Containers used to store the flowers should be relatively shallow, no more than 10 cm deep, so the flowers are not pressed under their own weight, resulting in stigma damage. Flower containers should be placed on shelves that are at least 20 cm above the ground and with at least 20 cm between each level of storage (shelving system). Saffron flowers can be kept for up to seven days in ideal storage conditions, but the sooner the processing happens, the better.

Stigma removal

The quality of saffron is greater if the stigma is separated from the flowers immediately after harvesting. Flowers should be transported to hygienic, specialized processing facilities where the three stigmas can be delicately separated from each flower.

The room where stigma separation occurs needs to be sufficiently large, perfectly clean, cool with no sunlight, pest-free and as free from dust as possible. Like storage rooms, the processing room should ideally have marbled floors and tiled walls. The table on which stigmas are removed should be hygienic and not made of any material that can contaminate the saffron. Any table covers that are used should be clean and white in colour to prevent any contamination or incidental colour transfer. Chairs or stools for workers should be clean and without any fabric or upholstery present.

All workers who enter the processing area should have freshly changed clothes and shoes prior to entering. Stigma separation must be a very controlled process performed by healthy individuals free from bacteria or viruses, with freshly washed hands (antibacterial soap or antiseptic gel) and clean, cut fingernails. These

workers ought to be dressed in clean white clothes, wearing a white mask and white gloves to minimize the risk of contaminant and colour transfer to the stigma. Wearing white is important because coloured fabrics can inadvertently transfer artificial colour to saffron threads, which could then be detected and interpreted as adulteration during laboratory testing. Hair should always be covered, as many buyers have a zero tolerance for hair in any saffron that they buy.

Flowers should be brought into the processing room in food-grade containers. A second food-grade container should be present for the separated stigmas. Stigmas should be delicately removed from the flower by hand. Applying too much pressure to the stigmas during removal can damage their quality. Great care should be taken to not include any flower debris with the separated stigmas. For the highest quality grades, yellow styles should be completely removed from the stigmas. There is a market for lower grades of saffron as illustrated by standards such as ISO 3632, so inclusion of styles may be a market decision between producers and buyers. Greater linkages and higher levels of communications between buyers and workers throughout the supply chain can ensure that saffron produced matches saffron demanded.

Stigma removal should be done batch by batch. This should be performed separately if flowers from multiple farms are being processed, and records should be kept that link flower/stigma batches to the farm where they were grown. This can be done by placing batch code labels on the food-grade containers used to hold the flowers when they are brought in for processing. The same batch code label can be placed on the food-grade container into which the worker places the separated stigmas. This batch code label can then follow the stigmas all the way to packaging activities.

Stigma drying

To obtain the highest quality, stigmas should be dried immediately after separation from the flowers. Drying, like stigma removal, needs to take place in near-laboratory grade facilities in terms of hygiene and controlled environment. Stigmas should never be dried in an area with direct sunlight as this deteriorates the chemical structure of the saffron.

Air-drying is often used in Afghanistan. This is not a good method, however, because it can take up to a week, which results in more exposure to dust or sand as well as more variability in achieving optimal moisture levels. Charcoal ovens are also commonly used, but these degrade saffron quality and can result in excess levels of polycyclic aromatic hydrocarbons (PAHs), which are regulated by food safety law in some markets such as the European Union.

Electronic drying machines, kiln dryers or dehydrators are preferable because they permit a much more controlled process and only take minutes as opposed to days. Target moisture levels of around 10%, an important quality characteristic of saffron, can be attained in a consistent manner using technological drying methods. Electric drying also results in more favourable levels of chemical constituents such as crocin, picrocrocin and safranal, as well as a better overall appearance of the saffron. Electronic drying equipment can be expensive and relies on consistent access to electricity, but the investment can pay off through drastically improved saffron quality.

During drying, stigmas lose around 80% of their initial weight. Drying saffron too little results in a product that is more susceptible to fungal infections and mycotoxins, as well as a decreased shelf life (plus, buyers do not want to pay for water weight). Drying saffron too much results in a very brittle product that breaks and crumbles too easily. Accurate drying to ideal moisture levels helps to preserve the saffron and ensures stability of the chemical compounds that characterize saffron quality. The drying stage is critical for the formation of safranal, which only develops during drying activities from its precursor picrocrocin.

Cleaning, sorting and grading

If proper practices were followed in earlier stages and floral waste, hair and other contaminants were controlled, cleaning should not be as significant of a concern. During cleaning, all foreign matter such as sepals, petals, styles, hair, wood, gravel and insects are removed. This should take place in a controlled environment, just like the stigma separation stage, and needs to be done meticulously by hand.

Cleaning can be very painstaking and time-consuming, thus, controlling for these aspects in the harvesting and processing stages makes more sense. Once saffron is dried, cleaned and sorted, samples of fully processed stigmas can be sent to qualified laboratories to undergo quality testing where different quality characteristics (physical, chemical, microbiological) will be assessed to determine its suitability for the market. Only saffron that has a certain level of quality should be designated for branding and marketing.

The competency of the laboratory performing these tests is of paramount importance, as international buyers will want assurances that the tests are valid and accurate. All testing laboratories should seek accreditation against ISO/IEC 17025, which outlines requirements for the capability of testing laboratories and is the standard by which most buyers will judge a laboratory technically competent.

Storing saffron

If dried, clean and sorted saffron is to be stored prior to packaging for sale; it ought to be stored in containers that protect its organoleptic or sensory characteristics. Containers made from materials that protect from exposure to air and sunlight, such as dark-coloured glass or aluminium containers with tight-fitting seals are good options for the temporary storage of saffron. These materials also prevent damage when containers are stacked vertically on top of one another. Saffron should be stored in dry, dark and cool conditions, because humidity, light and heat negatively affect quality. Saffron should never be refrigerated, as this results in excess moisture. This is important to prevent any growth of moulds, which can result in mycotoxin contamination over time.

Storage methods that help to preserve sensory characteristics result in saffron quality remaining at a higher level for a longer duration. It should be noted that no matter what storage methods are used, saffron quality inevitably deteriorates with time, thus it is best to limit the amount of time that saffron remains in temporary storage.[5]

[5] The following resources were used in writing the previous section: International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva; Danish Committee for Aid to Afghan Refugees - DACAAR (2009). *Saffron: Afghanistan's Red Gold*; Alonso Diaz-Marta et al. (2006). White Book: *Saffron in Europe – Problems and Strategies for improving the quality and strengthen competitiveness;* Katawazy, A.S. (2013). *A Comprehensive Study of Afghan Saffron.* Afghanistan Investment Support Agency – Research, Planning and Policy Directorate. April. Images by Mohammad Hashim Aslami.

Judging saffron: What gets measured

Saffron is a delicate spice possessing some very distinct properties. To understand better the market for saffron, it is important to recognize the underlying features of the product that will largely determine overall quality. Table 2 outlines and describes the various sensory, physical and chemical characteristics of saffron. Most of these parameters are determined through a variety of tests that should be performed by a qualified laboratory. Adherence to GAP, GHP and GMP can go a long way in controlling for some of these parameters, while others will be influence more by quality of inputs and cultivation methods. Most of these characteristics will be covered in more detail in subsequent chapters.

Table 2 Summary descriptions of saffron quality characteristics

Characteristic	Description
Sensory characteristics	
Flavour/bitterness (Picrocrocin)	The strength of the unique bitter flavour of saffron is determined by the level of the organic compound picrocrocin present in the saffron. High levels of picrocrocin must be observed during laboratory analysis for saffron to be considered high quality. Any abnormal taste present in the saffron different from the typical flavour profile is undesirable.
Aroma (Safranal)	The strength of the unique aroma of saffron is determined by the level of the organic compound safranal present in the saffron. The higher the observed level of safranal during laboratory analysis, the greater the associated aroma. Safranal is not present in fresh stigmas, and only forms during the drying process from its precursor, picrocrocin. The level of safranal depends largely on both drying and storage conditions. Importantly, saffron must also be free from any abnormal odour.
Colouring (Crocin)	The strength of colour of saffron is primarily determined by the level of the pigment crocin present in the saffron. High levels of crocin create a deep red colour that is desirable in quality saffron and also gives the rich, golden colour to saffron dishes. Low colour levels or abnormal colour or appearance is detrimental to product quality.
Other chemical and physical parameters	
Moisture and volatile matter content	Moisture in saffron leads to a shorter shelf life with a higher possibility of spoilage. Changes in moisture content can dramatically affect flavour and texture in addition to physical and chemical properties. Also, because the price of saffron by weight is so high, failing to properly dry saffron pushes up the price considerably, as moisture equals weight. Thus, it is important to remain under certain thresholds in terms of moisture. The climate in the origin market and post-harvest storage conditions can influence moisture levels.
Ash content	Ash can be defined as the inorganic matter that remains after organic matter and water have been removed from a sample via the application of very high heat. A maximum ash content percent is usually established as a quality requirement. Determination of acid-insoluble ash is often included in the test, which is primarily composed of sand.
Water activity (Aw)	The water activity of saffron and other spices affects potential microbiological growth, such as that of salmonella. Low-moisture foods like dried spices that become exposed to moisture in post-harvest activities are prone to this type of growth.
Solubility in cold water	Testing for solubility dates from the time when a major form of saffron adulteration was dipping saffron threads in sugar solutions, which would leave crystallized sugar on the outside of the thread. Measuring solubility allows for the detection of this form of adulteration.
Nitrogen content	Nitrogen content is influenced by the nitrogen fertilizers potentially used during cultivation. Traces of this nitrogen on the final product should be kept to a minimum.
Crude fibre	The generally expected level of crude fibre as a chemical constituent in saffron is no more than 6%.
Product purity	
Foreign or extraneous matter	Sand, soil, gravel, hair, wood, pollen, leaves or other debris, dead insects, etc. The maximum allowable levels for foreign and extraneous matter in saffron differ across

	standards and regulations; nonetheless their presence should always be tested. It is close to impossible to guarantee the absence of extraneous matter in saffron. Still, levels of extraneous matter present should be extremely low (around 0.1%). Many buyers have zero tolerance for some types of foreign matter, such as glass, hair and metal.
Floral waste	Related to other parts of the crocus sativus plant – floral petals, stamens, sepals, pollen, etc. that are unnecessarily and undesirably present in the saffron. The presence of these elements ought to be minimized. Along with foreign matter, floral waste is tested for using microscopic analysis.
Infestation	Saffron ought to be free from living or dead insects or fragments of insects and other impurities of animal origin.
Adulteration/artificial colouring	Saffron can be considered adulterated if its quality is negatively affected by the addition of a substance that is inferior or can be considered injurious to health, or by the removal of a substance that is nutritious. Buyers' quality departments tend to assert that any trace of colour is a sign of adulteration, and will reject a consignment where this has been detected. Adulterated saffron is a serious problem that can ruin the reputation of an exporter, or even an entire sector. Attempts to pass off dyed crocus styles, corn silk, safflower or even fake plastic saffron as real saffron are widespread and becoming more easily discovered through increasingly advanced testing methods.
Contaminants/residues	
Microbiology	Products need to be free of microbiological contamination at levels that pose a threat to human health. Microbiological contaminants include hazards such as salmonella, e. coli, enterococcus and other pathogens that are harmful to humans.
Pesticides	Pesticides ought to be applied in accordance with GAP. The maximum residue level tolerances differ from one country to the next, based on national regulations.
Heavy metals	Traces of heavy metals in food products can render them unfit for human consumption. Thus, the minimum limits set by national regulations must be met. These include metals such as cadmium, lead, arsenic, tin and mercury.
Mycotoxins (aflatoxin)	Spices such as saffron are susceptible to the growth of mycotoxins such as aflatoxin if not properly cultivated, harvested, handled, transported and stored. These substances threaten human health and thus maximum levels are set within national food safety laws.
Visual characteristics	
Stigma length	Generally speaking, the longer the stigma, the higher the quality. Stigmas can vary substantially in length. Some buyers have very high expectations for stigma length. Broken stigmas are much less desirable. Buyers who intend to process saffron into powder will care less about stigma length, and may care more about other parameters.
Style length	Styles are generally an unwelcome inclusion unless requested by buyers, and should not be added when processing powdered saffron. Styles have no culinary value, negatively affect chemical analysis parameters, and only serve as added weight. Inclusion of styles can also affect moisture levels in the saffron as moisture becomes more easily trapped in the styles, resulting in a 'musty' smell and decreased shelf life.

Attaining top quality: Common traits

As illustrated by the information in subsequent chapters, quality requirements for saffron can vary depending on the destination market and intended usage. For example, one country's requirements may be stricter than those of a second country. However, a review of legislation, standards and saffron buyers' technical sheets reveals a set of specifications that, when met, will result in objectively high-quality saffron, regardless of the market or usage.

Table 3 outlines the characteristics of top-quality saffron that can be determined through laboratory analysis. The purpose of the table is to aid in setting ambitious goals that will ensure Afghan saffron is considered high quality, regardless of where it is sold in the world. As always, the requirements of individual buyers will vary. Some buyers may only be interested in a few of these parameters, while others may be more comprehensive. Some may seek only to meet grades established by the ISO standard (e.g. crocin levels of at least 220 instead of 230 in the table). However, if saffron or saffron powder meets the following specifications, it will generally be considered top quality. Common testing methods are referenced in the table (note: some buyers may use different testing methods).

Table 3 Specifications for 'top quality' saffron and saffron powder

Characteristic	Stigma	Powder	Test Method
Colour (direct reading of absorbance of crocin at about 440 nm, on dry matter basis)	≥ 230	≥ 230	ISO 3632-2 CLAUSE 14
Flavour – bitterness (direct reading of absorbance of picrocrocin at about 257 nm, on dry matter basis)	≥ 85	≥ 85	ISO 3632-2 CLAUSE 14
Aroma (direct reading of absorbance of safranal at about 330 nm, on dry matter basis)	20-50	20-50	ISO 3632-2 CLAUSE 14
Styles	Absence	Absence	ISO 3632-2 CLAUSE 5
Stigma length (unbroken)	≥ 25mm		
Moisture and volatile matter content % by mass	≤ 10%	≤ 8%	ISO 939 & ISO 6571 & ISO 3632-2 CLAUSE 7
Foreign matter % by mass on dry matter basis	< 0.1%	-	ISO 927 and ISO 3632-2 CLAUSE 9
Glass	Zero tolerance	Zero tolerance	
Hair	Zero tolerance	Zero tolerance	
Metal	Zero tolerance	Zero tolerance	
Floral waste % by mass on dry matter basis	< 0.5%	-	ISO 3632-2 CLAUSE 8
Total ash % by mass on dry matter basis	≤ 5.5%	≤ 5.5%	ISO 928 & ISO 3632-2 CLAUSE 12
Acid-insoluble ash % by mass on dry matter basis	≤ 0.5%	≤ 0.5%	ISO 930 & ISO 3632-2 CLAUSE 13
Water activity	≤ 0.65	≤ 0.65	
Solubility in cold water % by mass on dry matter basis	≤ 65%	≤ 65%	ISO 941
Total nitrogen % by mass on dry matter basis	≤ 3%	≤ 3%	ISO 1871
Crude fibre % by mass on dry matter basis	≤ 6%	≤ 6%	ISO 5498
Artificial colouring	Zero tolerance	Zero tolerance	ISO 3632-2 CLAUSES 15 & 16
Aflatoxin B1	< 5 micrograms/ kilogram	< 5 micrograms/ kilogram	
Total Aflatoxin (B1+B2; G1+G2)	< 10 micrograms/ kilogram	< 10 micrograms/ kilogram	
Pesticide residues	EU Regulations	EU Regulations	
Salmonella	Absence in 25g	Absence in 25g	ISO 6579
Escherichia coli	< 10 cfu/g	< 10 cfu/g	ISO 16649
Enumeration of sulphite-reducing clostridia spores growing under anaerobic conditions	≤100	≤100	
Yeasts and moulds	< 10^4 cfu/g	< 10^4 cfu/g	ISO 21527-2
Total coliforms	< 10^4 cfu/g	< 10^4 cfu/g	ISO 4832
Total viable count	< 10^6 cfu/g	< 10^6 cfu/g	ISO 4833
Genetically modified organisms	Absence	Absence	
Allergens	Absence	Absence	
Irradiation	Absence	Absence	
Shelf life (in original packaging)	3-4 years	3-4 years	

CHAPTER 2 UNDERSTANDING QUALITY IN TRADE

Chapter highlights

- Quality is a tough nut to crack. There are many ways to approach and understand the concept of quality.
- Mandatory legal requirements: These requirements are set forth in legislation serving as the baseline for market access and are mostly concerned with protecting consumers and the environment.
- Voluntary standards: Certification against a standard, whether it is related to food safety, sustainability or quality management or is saffron-specific, offers additional assurances to buyers and makes saffron more competitive on the market. International standards such as ISO 3632-1:2011 for saffron serve as a major facilitator of saffron trade.
- Market preferences, trends and buyers' requirements: Familiarity with trends, consumer preferences and common buyers' requirements in the destination market can help to identify opportunities and stay ahead of the curve for quality expectations.

Mandatory requirements: A foot in the door

Quality is a much broader concept than safety, yet safety is a significant foundational piece of the quality puzzle, especially regarding food products.

One popular definition of quality is *fitness for purpose*. For food to fit this definition, it must be safe to consume. Food is one of the most regulated sectors in international trade for this reason.

Governments impose legal or official requirements in the name of safety and protection of people, plants animals and the environment. These are referred to as mandatory legal requirements and are enforced through regulations or directives, for example, Regulation (EC) 178/2002 of the European Union (EU) laying down the general principles and requirements of food law.

Mandatory requirements help a producer or exporter answer the question '*What must be done to access the market?'* They serve as the baseline for market access and can cover areas such as food safety, plant health, product characteristics, packaging, labelling and traceability. Depending on the experience level of the importer, buyers' requirements might not clearly state these mandatory requirements.

Therefore, it is very important to understand and conform to these regulatory aspects, or risk having saffron rejected at points of entry. Saffron exports should not be considered until the product proves compliant with legal requirements. Likewise, simply complying with mandatory requirements does not guarantee trade opportunities, as certain buyers may have stricter requirements.

Food safety

Consumers have the right to expect food to be safe. If it is not, it should not be on the market. Consumer health and safety are taken very seriously around the world, as illustrated by strict and dynamic food safety regulations.

Like other agricultural products, spices including saffron are susceptible to biological, chemical and physical hazards known as contaminants. There are different types of contaminants such as pesticide residues, metal contaminants and microbiological pathogens, and naturally occurring toxic substances like mycotoxins. These substances are not intentionally added to food; their presence is due to environmental exposure or poor practices during cultivation, processing, storage and transport.

To protect consumers, food safety authorities establish maximum limits on contaminants, based on scientific evidence of negative impacts on human health.

Producers, processors and exporters must become acquainted with food safety legislation in desired destination markets and continuously monitor food safety in all stages of production. A rejected or recalled saffron consignment due to contamination would cost the exporter or importer a lot of money, depending on the contractual arrangement. No matter the terms, a positive test for contaminants would jeopardize future relations with that particular buyer, as well as other buyers who may become aware of negative reputations.

Because it is impossible to remove many types of contaminants from saffron through additional processing, GAP and other controls are needed to prevent contamination in the first place. Best practices must be adopted to minimize all types of contamination so these risks are mitigated. One of the most basic, yet important systems used to help ensure food safety is HACCP. Read more about HACCP and GAP in Appendix II.

Pesticide residues

Pesticides can be effective tools in the battle against insects, weeds and other pests that are detrimental to crops. However, they can also harm human health if high levels of their residues remain on food products after harvest. According to GAP, the traces that pesticides leave in treated goods are called 'residues'. A maximum residue limit, or MRL, is the highest level of a pesticide residue legally tolerated in or on food or feed when pesticides are applied correctly. This limit provides reasonable assurance that no negative effects on consumer health will result over a lifetime of dietary exposure.

In food safety regulations, these limits are usually expressed as milligrams of pesticide residues per kilogram of food (mg/kg) or parts per million (ppm). Pesticide residues are not normally visible to the naked eye, so they are usually managed through systematic application and are determined by laboratory tests. Not all pesticides are registered for use on all crops.

MRL regulations differ among trading partners, so it is important to realize that compliance with one country's limit does not mean compliance with another's. If tests confirm that a pesticide residue exceeds the established limit, or detect the presence of an unregistered pesticide, the product cannot be legally sold on the market. The Codex Alimentarius Commission (CAC) has developed a pesticide database that outlines MRLs for different foods and food categories. Countries sometimes refer to this database in lieu of establishing their own MRLs within food safety regulations.[6]

Heavy metal contaminants

Heavy metals can contaminate food at different stages of production, threatening consumer safety. While the low-level presence of heavy metals such as copper, iron, zinc and nickel can be part of a healthy diet as essential minerals, high levels can be detrimental to human health. Moreover, heavy metals like lead, mercury and cadmium are toxic even at low levels, as the human body cannot metabolize them properly. Food safety authorities thus establish limits on the levels of heavy metal contaminants permissible in different foods.

Generally, the presence of metals in spices is less of a problem than with other food categories. This does not exclude potential problems, however. For example, environmental contamination from improper disposal of metallic objects such as batteries can lead to the presence of metal contaminants in spices. Lead contamination could occur in areas where saffron is grown alongside a road or near a factory with high emission levels. Like pesticide residues, metal contaminants are measured and expressed in mg/kg or part per million and testing takes place in specialized laboratories. If levels exceed those established by food safety laws of the importing country, the food should not be on the market.

Metal pieces may also become physical contaminants in spices during processing and packaging activities. For example, metal machinery that might be used during these stages could leave traces or small metal pieces in saffron. There is usually a zero-tolerance for metal pieces among buyers of saffron, so these physical contaminants need to be checked.

[6] Codex Alimentarius Commission (2018*). Pesticide Database, HS 0093 Spices*.

Microbiological contaminants

Diseases caused by microbiological contamination constitute a major safety hazard to consumers and food business operators, as well as national governments. Food-borne disease outbreaks are a worst-case scenario for all parties involved in a food supply chain, from farm to consumer.

Contact with unsafe water or waste, proximity to landfills or sewage could result in microbiological contamination such as salmonella or Escherichia coli. Salmonella contamination is the top concern for saffron and it can occur at all stages of production – growing, harvesting, storage, processing, packaging and transport. Poor sanitation practices, poor facilities or improper maintenance can cause salmonella contamination. Moisture level is the key parameter that must be controlled in storage and handling.

Food safety authorities have measures in place to mitigate risks of food-borne illness, and these are established in food safety regulations. In the event of a food-borne illness outbreak, food recall systems based on traceability quickly identify the source of the outbreak and eliminate the risk. The prevention and control of microbiological contaminants are international public health goals. Everyone – including farmers and growers, manufacturers and processors, food handlers and consumers – has a responsibility to ensure that food is safe and suitable for consumption. GHP, GAP and GMP as outlined in Appendix II can be adopted throughout the chain, from farmer to consumer.

Naturally occurring toxic substances

Mycotoxins are poisonous substances naturally produced by moulds that grow and thrive on food exposed to high temperatures and moisture levels. Initial contamination can occur at the farm level, but most of the growth will occur throughout post-harvest stages including processing, storage and transport. Warm and humid conditions combined with unhygienic storage conditions can lead to accumulation of mycotoxins such as aflatoxin. The danger of mycotoxins is that they can survive the high temperatures used during cooking or production processes. They can be invisible to the naked eye, so visual inspection for mould to detect their presence is not enough.

Mycotoxin exposure can occur not only through direct consumption of a contaminated product, but also through consumption of products from animals that are given mycotoxin-contaminated feed. Mycotoxins can cause illness, cancers, immunity problems and even death if consumed in large enough quantities. Food safety authorities across the world take mycotoxins very seriously, as they are considered carcinogens detrimental to human health. Laboratory analysis can determine whether a food is contaminated with mycotoxins. Those that are contaminated beyond regulated limits cannot be traded on the market.

Aflatoxin contamination is a leading cause of consignment rejection at points of entry around the world. It is important that all actors in the supply chain take preventative measures to mitigate their formation and spread. While mycotoxin contamination in saffron is not very prevalent, it can nonetheless occur. Proper handling and storage of saffron can mitigate many of the risks associated with mycotoxin contamination.

Irradiation

Irradiation is a process applied to foods to reduce risks of foodborne illness, to minimize or eliminate the presence of pests, or to improve shelf life. Many countries allow irradiation of spices, but this usually must take place in approved irradiation facilities in the destination country. While its effectiveness is undeniable, many consumers are wary of the long-term effects of eating irradiated foods, especially in the European market. Moreover, irradiation must be labelled on the final product, which causes rejection from consumers.

Steam sterilization is an alternative technology that is sometimes employed on food products in markets where irradiation is frowned upon. Steam sterilization accomplishes the same goals as irradiation, but the process uses no radiation and is therefore preferred in some markets. However, there are major drawbacks if this technology is used on spices like saffron. Steam sterilization has a highly negative impact on the taste of spices and herbs. Saffron is a very fragile and unique spice; steam sterilization can be very detrimental to product quality and should be avoided.

The key takeaway is that irradiation, steam sterilization and other technologies are not substitutes for good agricultural and manufacturing practices throughout the supply chain. The goal should be to prevent problems with pests and foodborne illness at the source, and not rely on these technologies after the fact.

Food additives

Food additives such as anticaking agents are used to prevent ground spices from sticking or clumping. However, given the rampant concerns about food adulteration in saffron and saffron powder, no additives should ever be present. Added colouring matter and/or inferior substances should never be added to saffron, as it would render it adulterated. Read more about saffron adulteration in Chapter 3.

Plant health

Consignments of saffron or any other plant-based food product can introduce pests, weeds or diseases that could harm humans, plants, or animals in the importing country. Phytosanitary or plant health requirements are in place to prevent the introduction and spread of harmful organisms. Hazards can be introduced not only by the product itself, but also through any wood packaging (such as wooden packaging) that may accompany it. Therefore, all consignments must be verified free of bacteria, viruses, pests and diseases that can harm animals or plants in the country. According to the *Protocol of Phytosanitary Requirements for Exports of Saffron Stigma from Afghanistan to China*, a pest risk analysis that was carried out showed that there are two primary pests of concern during the saffron growing period in Afghanistan: Myzus persicae and Lepidium draba (Figure 6).

Myzus persicae, also known as the green peach aphid, is a small green aphid that has been shown to transmit more than 100 plant virus diseases. While its toxic saliva can cause direct damage, most damage associated with the pest stems from the numerous viruses that the species transmits.[7]

Lepidium draba is a weed that is found in a wide range of habitats and can thrive in both high and low latitudes. It can invade all soil types and is a serious threat to many different agricultural systems and the environment at large. The weed is potentially harmful to human and animal health as it can host plant pathogens. Its resilience and ability to invade and reproduce in different ways make it very invasive, causing significant problems to man and natural resources.[8]

Figure 6 Myzus persicae (left) and Lepidium draba (right)

In most countries, the national plant protection organization (NPPO) is responsible for issuing phytosanitary certificates guaranteeing that saffron consignments are free from pests, weeds and disease, and meet the phytosanitary requirements of the destination market. For Afghanistan, the NPPO responsible for issuing phytosanitary certificates is the Plant Protection and Quarantine Directorate (PPQD) under the Ministry of Agriculture, Irrigation and Livestock (MAIL).

[7] CABI Invasive Species Compendium (2018). Myzus persicae (green peach aphid).

[8] CABI Invasive Species Compendium (2018). Lepidium draba (hoary cress).

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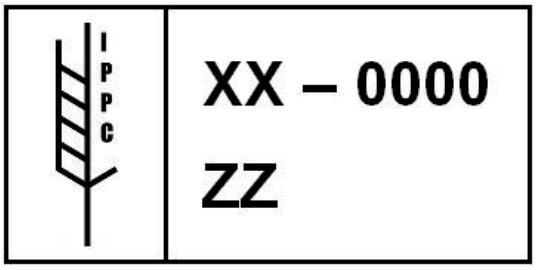
The format of a phytosanitary certificate must be in line with the International Standard for Phytosanitary Measures No. 12 (ISPM-12) guidelines. Please see Appendix III for both a model phytosanitary certificate as per ISPM-12 guidelines, as well as an example of a completed phytosanitary certificate issued by PPQD in Afghanistan.

Because wooden packaging can also introduce pests, phytosanitary certificates also apply to any raw or solid wood that is used to package a consignment (e.g. wooden shipping pallets). Wooden packaging, if used, will need to be debarked, treated and marked in line with ISPM-15 guidelines. This must occur in the country of origin prior to export. Treatments include heat treatments and methyl bromide treatments, although many countries have now banned the latter.

The ISPM 15 mark (Figure 7) is a universally recognizable, non-language-specific logo that displays the International Plant Protection Convention logo, two-letter country code, treatment company code and two-letter treatment code. The mark makes it easy to verify that the wooden packaging meets phytosanitary requirements during inspection at points of exit or entry. In some countries, instead of using the mark, the treatment can be endorsed on the phytosanitary certificate, or it may even be possible to buy pretreated ISPM 15 compliant wooden pallets.

Given the value-to-weight ratio and unique properties of saffron, it is unlikely that the spice would be shipped using wooden packaging such as pallets or crates. Nonetheless, if raw or solid wooden packaging is to be used, please contact PPQD to discuss options.

Figure 7 Generic ISPM-15 mark



Source: Google Images

All plant products and wood packaging materials are subject to quarantine at points of entry in the destination market, where they may be held until an authorized official allows them to be offloaded. This permission is generally granted after the phytosanitary certificate is inspected and the consignment is deemed free from pests, weeds and diseases.

If a phytosanitary certificate does not accompany the consignment, or if pests, weeds or diseases are detected during quarantine inspection, the consignment may be returned, destroyed or in some cases undergo treatment that renders it fit for release.

Product characteristics and performance

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Requirements concerning product characteristics and performance are sometimes outlined within regulations or contained within standards referenced by regulations.

These requirements cover aspects such as product purity, chemical and physical parameters, and sensory and visual characteristics. Specialized laboratories are equipped to test for these characteristics.

Colour, aroma and flavour are vital to saffron quality. The three components that create these distinct qualities are crocin, which gives saffron its deep red colour; picrocrocin, which provides its flavour; and safranal, which gives saffron its distinct aroma. During quality testing, the presence of these important components is carefully measured, usually using spectrophotometric methods. For example, the higher the absorbance of crocin during testing, the higher the colouring strength of the saffron.

It is important to note that buyers may have different quality requirements that go beyond what is legally mandated. Grading the saffron in a laboratory gives buyers certainty that the saffron meets their desired level of quality.

Grades are assigned based on the level of each component, and market prices of saffron are often dictated by grade. The advantage of having recognizable grades for saffron is that consumers have some guarantee of quality without having to buy and taste the saffron first. The most commonly requested standard for saffron and saffron powder worldwide is ISO 3632:2011, which establishes three grades (I, II and III) based on a collection of quality characteristics. Some buyers may go beyond this standard. Read more about testing in Chapter 3.

Packaging

Packaging systems are a vital component of export success. Packaging systems include not only the materials used to package the product, but also all of the packaging-related processes along the supply chain. Packaging machines and equipment, transportation and storage, whether at a production centre, distribution centre or at the point of sale, all influence the success of a packaging system. Moreover, the disposal of packaging material after final use or consumption of the product must also be considered.

In terms of packaging materials, the primary aims are twofold: to ensure the integrity of the product until sale and to entice consumers to purchase the product over other options. Packaging protects its contents from external threats including spoilage, breakage and damage from external environmental conditions until the product reaches the end user. Noncompliance with regulations such as those pertaining to food contact materials can result in outright rejection of goods at the port of entry in the destination market.

Packaging considerations for saffron

There are generally three layers of packaging that need to be considered for most products: primary, secondary and tertiary. Primary packaging is that which comes into immediate contact with the product and is the smallest unit of distribution. Secondary packaging envelops the primary packages and serves as an added layer of protection, such as a case or carton. Tertiary packaging is the third layer of packaging, which is generally used during transportation or shipping, such as a palletized load of secondary packages.

Different packaging materials offer different resistance levels to different elements. Saffron is very hydroscopic – that is, it absorbs moisture easily. If not packed properly using materials with very low permeation to moisture and oxygen, there is a risk of mould growth that can cause mycotoxin contamination or spoilage.

Due to the unique properties of saffron, general bulk packaging guidance offered for other spices may not be ideal. For example, if plastic or polyethylene bags or pouches are used in bulk packaging, there are some potential material weaknesses that need to be considered: they may be porous, which allows saffron aroma to escape; they may allow UV light to reach the saffron, which degrades its quality; and they provide little physical protection for the delicate threads, which are prone to breaking.

Thus, if used, plastic bags or pouches should be of sufficient thickness to protect against punctures. Testing and inspections of barrier properties should be conducted to ensure that the plastic offers the needed protection. To prevent UV light from reaching the saffron, opaque plastic could be used. Often, a secondary layer of packaging is used to help protect against these potential weaknesses, such as aluminium or glass containers with very low permeation to moisture and oxygen. Packaging methods that conserve the aroma and flavour of saffron result in higher quality for the consumer.

For example, the Transport Information Service of Germany emphasizes that saffron is very light-sensitive and therefore must be well-sealed and light-protected during bulk transport. Corrugated cardboard boxes lined with aluminium are sometimes used, as seen in the image below of saffron from Iran.[9] Bulk-packaged saffron is often packed and shipped in 1 kg quantities.

Figure 8 Example of saffron bulk packaging

Source: Transport Information Service – GDV (2018). Saffron.

No matter the type of packaging, it is crucial to have tamper-proof systems, such as a seal, to ensure that the packaging has not been opened and potentially manipulated during transport. Saffron's high value nature lends itself to theft, which can occur along the transport chain. It is important to stress that packaging choice will also depend on the mode of transport as well as the duration and conditions of storage.

Consumer-ready packaged saffron also needs to position, differentiate and sell the product. Packaging should not be viewed as an add-on cost, but as an investment to add value to the product. Common packaging sizes for consumer-ready packaged saffron threads range all the way from 0.1 grams to 5 grams.

Sales of Afghan saffron are hindered by the fact that nonstandard packaging is often used, which decreases appeal in international markets.[10] A centralized packaging supplier using standardized food-grade packaging offers improved consistency and aesthetically pleasing designs, which supports a stronger strategy and brand identity for the Afghan saffron sector.

Figure 9 Examples of consumer-ready packaged saffron

Source: Google Images

[9] Transport Information Service – GDV (2018). Saffron.

[10] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. ITC. Geneva.

Different importers/buyers will have different packaging requirements, depending on their point in the supply chain. For example, if a buyer wants to process the saffron further after receiving the consignment, the buyer would likely prefer saffron shipped in bulk. If dealing with the buyer at the end of the supply chain, then consumer-ready packaging may be preferred.

Problems arise when producers use packaging systems that do not fit demand, making it difficult to enter new markets and become internationally competitive. Double-check with partners in the export market to obtain information on market expectations and requirements before sourcing any packaging materials for retail distribution channels.

Labelling

More frequently than realized, food exports arriving in foreign markets are refused entry because labelling does not comply with international requirements or requirements of the importing country. This can result in outright rejection of a consignment or, at a minimum, delays in entry until corrective action is taken or new labelling is applied. In either case, trade is interrupted and the associated costs result in financial losses. This is especially costly if the storage conditions during the interruption are not ideal and results in spoilage.

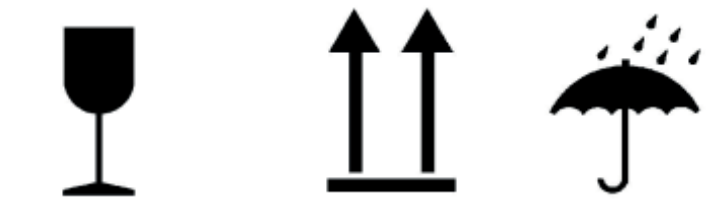
Most countries have laws stipulating food labels and what information labels must contain. It is therefore essential that exporters familiarize themselves with the food labelling requirements of importing countries. Moreover, consumers expect the labelling on food to describe accurately what they are buying. Misleading or fraudulent labelling is an unfair trade practice.

The CAC has deemed eight key elements as mandatory for consumer-ready packaged foods within Codex Standard 1-1985 (General Standard for the Labelling of Prepackaged Foods).[11] These elements serve as the basis for many national regulations on labelling; however, they are only a starting point, as there are many other factors to consider.

For example, labels will differ for primary, secondary and tertiary packaging. There will also be different barcodes used for primary, secondary and tertiary packaging. Requirements will also vary from one region of the globe to another and will differ depending on if the product is to be sold in bulk or retail format.

When shipping saffron to a destination market, it is useful to include certain marks on the external container to better protect the product during transport. According to Germany's Transport Information Service, certain symbols are used when shipping saffron consignments.

Figure 10 Marking of saffron shipping containers



Source: Transport Information Service – GDV (2018). Saffron.

[11] Codex Alimentarius Commission (2007). General Standard for the Labelling of Prepackaged Foods. Food Labelling 5th ed.

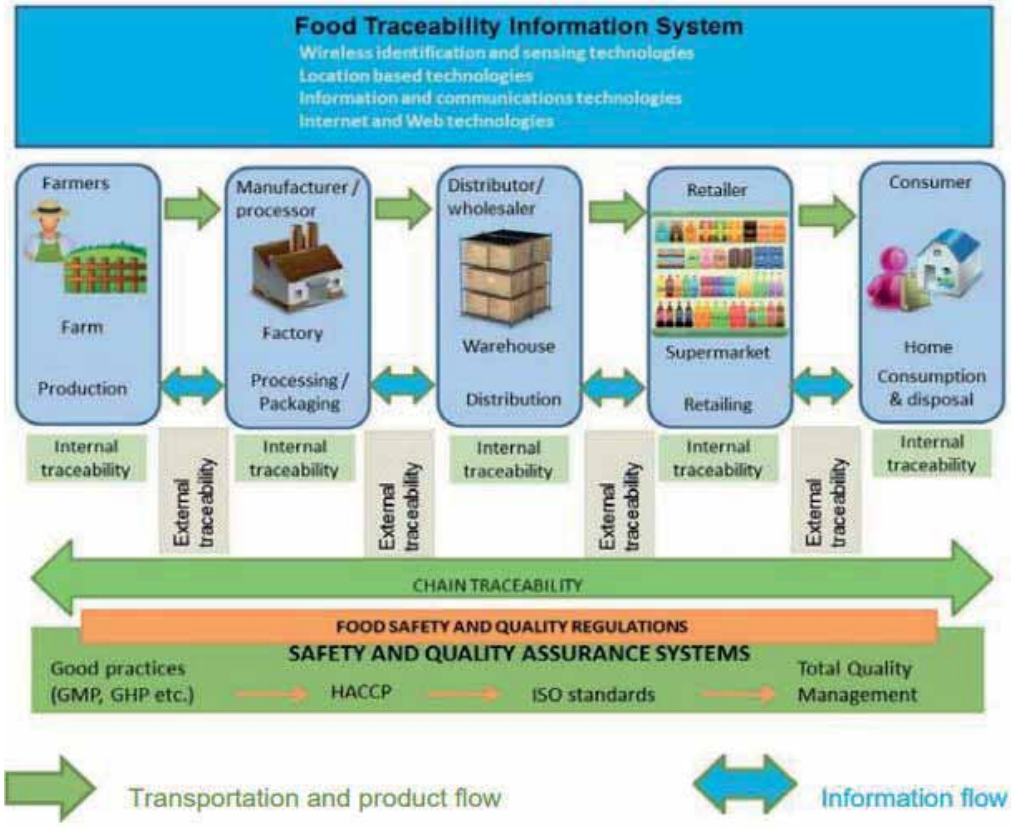
Traceability

The CAC has defined traceability as the ability to follow the movement of a food through specific stages of production, processing and distribution. Traceability is the ability to identify the origin of food and feed ingredients and food sources, particularly when products are found to be faulty. A traceability system allows an organization to document and/or to locate a product through the stages and operations involved in the manufacture, processing, distribution and handling of feed and food, from primary production to consumption.

Effective traceability systems significantly reduce response times when an animal or a plant disease outbreak occurs, by providing more rapid access to relevant and reliable information that helps determine the source of the outbreak as well as the location of implicated products.

In general, a food business should not receive any food or food ingredient unless it can identify the name of the food/ingredient and the name and contact information of the supplier. Traceability systems, already mandatory for food businesses operating in certain developed countries, are becoming increasingly common worldwide and expectations are trending toward knowing the entire value chain.

Figure 11 Conceptual framework of a food traceability system



Source: Aung M.M & Chang Y.S. (2014). Traceability in food supply chain: Safety and quality perspectives. Food Control, 39, 172-184.

Box 1 Additional reading for mandatory requirements

The World Health Organization on pesticide residues in food: http://www.who.int/news-room/fact-sheets/detail/pesticide-residues-in-food

The European Crop Protection Association video on pesticide residues: http://www.ecpa.eu/multimedia-bank/video/pesticide-residues-what-are-mrls-and-my-food-safe

Codex Alimentarius Pesticide Database : http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/en/

Food Safety Authority of Ireland on Mercury, Lead, Cadmium, Tin and Arsenic in Food: https://www.fsai.ie/WorkArea/DownloadAsset.aspx?id=8412

The World Health Organization on Mycotoxins: http://www.who.int/news-room/fact-sheets/detail/mycotoxins

India Ministry of Agriculture AESA-based Integrated Pest Management system for saffron in India: http://farmer.gov.in/imagedefault/ipm/IPM%20package%20for%20Safffron.pdf

International Plant Protection Convention on the regulation of wood packaging material in trade : https://www.ippc.int/static/media/files/publication/en/2016/06/ISPM_15_2013_En_2016-06-07.pdf

Learn more about packaging from the Food and Agriculture Organization of the United Nations: http://www.fao.org/Wairdocs/X5434E/x5434e0g.htm

International Trade Centre publication on Traceability in Food and Agricultural Products : http://www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Exporting_Better/Quality_Management/Redesign/EQM%20Bulletin%2091-2015_Traceability_FINAL%2014Oct15_web.pdf

Voluntary standards: Beyond legislation

By nature, standards are voluntary. They provide rules, guidelines or specifications for activities or their results and may have one or more specific objectives. Standards serve as an essential element of the infrastructure of modern society. There are hundreds of thousands of standards throughout the world, many of which go unnoticed in our everyday lives.

Compliance with standards can offer buyers and consumers across markets assurances that a product will meet or exceed their needs in terms of safety, fitness for purpose, compatibility or interchangeability. In this way, standards are major facilitators of trade. Standards can benefit companies in many ways depending on their use including: increased market opportunities, competitive advantages, improved risk management and cost reduction. Applying standards can help to establish credibility and a good reputation in an industry.

Standards are also used as the basis for technical regulations. For example, when a standard is referenced by or incorporated into a country's food safety law it becomes a technical regulation and is no longer voluntary for that particular market. By making effective use of standards, it is possible to 'stay ahead of the curve' in terms of potential future regulations.

Standards can be public or private, national, regional or international in scope. They can be formulated for reasons such as food safety, social or environmental sustainability, management, or for specific products.

Food safety standards

International food safety standards help to ensure the safety of food supply chains. More and more buyers demand that producers have an operational and well-managed food safety management system (FSMS) in place. Adopting one may open up new markets through improved competitiveness. Before establishing such a system, it is necessary to implement systematic food safety practices and comply with HACCP principles. Read more about HACCP in Appendix II.

Different FSMS standards are available for adoption and implementation, many of which are benchmarked to the Global Food Safety Initiative (GFSI). This initiative was launched in 2000 to unite requirements among different private food safety standards. GFSI brings together key actors in the food industry to continuously improve food safety around the world.

Some of the most recognized GFSI-benchmarked food safety standards are GlobalG.A.P., Safe Quality Food (SQF), FSSC 22000, British Retail Consortium (BRC) and International Featured Standards (IFS). GlobalG.A.P is particularly widespread as it has a truly global focus. SQF targets the United States and Australian markets, BRC is more prevalent in the United Kingdom of Great Britain and Northern Ireland, FSSC 22000 is directed at Europe and IFS is aimed at Germany, France and Italy.[12]

Certification against an FSMS involves third-party verification to determine whether goods, processes and systems meet the requirements outlined by the standard. Successfully obtaining certification against an FSMS standard assures buyers that the organizational processes and systems in place result in safe food that offers consumers added confidence.

Management systems standards

Every organization – whether profit or not-for-profit, large or small – design and implement their processes through a management system. The system may be formal or informal, and it comprises different parts or subsystems that try to address the different needs and expectations of stakeholders including customers, suppliers, shareholders, employees and society. Many organizations use management system standards (MSS) to respond consistently to these needs and to manage specific aspects of their performance such as those related to quality, food safety or the environment. In recent years, there has been an increase in the development and use of MSS in response to stakeholder demands.

Some of the most popular MSS are from the International Organization for Standardization (ISO). According to ISO, its management system standards

"help organizations improve their performance by specifying repeatable steps that organizations consciously implement to achieve their goals and objectives, and to create an organizational culture that reflexively engages in a continuous cycle of self-evaluation, correction and improvement of operations and processes through heightened employee awareness and management leadership and commitment."

There are different types of MSS, including food safety management systems, quality management systems (QMS) and environmental management systems (EMS). The benefits of an effective management system to an organization include more efficient use of resources and improved financial performance; improved risk management and protection of people and the environment; and greater capability to deliver consistent and improved services and products, thereby increasing value to customers and all other stakeholders.

Social and environmental sustainability standards

In 2015, the United Nations launched the Sustainable Development Goals, a set of 17 objectives ranging from responsible production and decent work to climate protection, with an overall aim of creating a more sustainable world. Voluntary sustainability standards (VSS) are critical tools in achieving these goals.

VSS are growing in importance because an increasing number of consumers are concerned about issues such as child labour, environmental protection, fair trade, organic agriculture and genetically modified foods. Higher living standards, especially in developed countries, have resulted in greater sensitivities about social concerns including fair treatment of workers, labour conditions and adequate remuneration from suppliers.

[12] Clarke, Renata (2010). Private Food Safety Standards: Their Role in Food Safety Regulation and their Impact. FAO, Rome.

These considerations have become part of quality in the eyes of many consumers, so buyers may often insist that goods destined for certain markets be produced in a manner that does not violate their social or environmental concerns.

The ITC Sustainability Map provides comprehensive, verified and transparent information on VSS and other similar initiatives covering issues such as food quality, safety and the environment as well as social issues. The main objective of the web platform is to strengthen the capacity of producers, exporters, policymakers and buyers to participate in more sustainable production and trade. Within Sustainability Map, a user can identify relevant standards, quick-scan information about requirements and processes, compare different standards, and perform self-assessments in relation to a specific standard.

Sustainability standards are more prevalent in certain markets than in others. For example, some European consumers give a lot of thought to sustainability issues when making purchasing decisions. Please see Chapter 5 to read more about sustainability trends in different markets.

Product-specific standards

Certain standards are specific to saffron, whether in stigma or powder form. They generally contain detailed requirements that would not apply to goods outside their intended scope. Product-specific standards may cover the areas of food safety, product quality, labelling, packaging, etc., and may be regional, national or international in scope. For example, the international standard ISO 3632, described further below, is specific to saffron and establishes quality requirements and testing methods for both stigmas and powder. An example of a national product-specific standard is the Indian Agricultural Marketing (AGMARK) standard for saffron stigmas and powder.

Many buyers have developed their own unique set of specifications for any saffron that they purchase. Often these requirements are set forth in a 'technical sheet' that describes chemical/physical analysis parameters, sensory characteristics, etc. Sometimes these buyer specifications include quality requirements stricter than those outlined in national or international product-specific standards. Some buyers may value certain product characteristics over others. For example, a buyer may accept lower levels of crocin, picrocrocin and safranal, but would still maintain a near zero tolerance for certain types of foreign matter or adulteration. They may also specify different testing methods for determining the quality parameters.

International standards: ISO standards, Codex Alimentarius

The primary advantage of international standards over private or national standards lies in their near-universal relevancy across the world. For example, ISO brings together experts from every imaginable sector to develop standards under a process of double consensus, that is, among both major market players and experts of particular sectors during the drafting stages, and then among nations during the voting process. There are technical committees devoted to developing standards for particular sectors, like ISO/TC 34/SC 7 on spices, culinary herbs and condiments. ISO standards can be certified against, and one can be assured that certification will be recognized around the world.

The words Codex Alimentarius are Latin, and mean food law or food code. This neatly describes the Codex Alimentarius as it is a collection of food standards developed and presented in a codified manner. The Codex plays a major role in protecting consumer health and removing barriers to trade across the globe. Codex Alimentarius standards are not intended for certification, but are often used as the basis for national food safety regulations and food standards. In addition, the World Trade Organization references Codex standards as benchmark standards used to resolve trade disputes. The Codex Alimentarius also has established sets of general principles and codes of practice that can be used to help control different aspects of food safety.

ISO 3632-1:2011 and ISO 3632-2:2010 Spices – Saffron (Crocus sativus L.) – specification, test methods

ISO 3632 is a product-specific international standard for saffron that has considerable importance on the global market. Its international nature means ISO 3632 is the most widely recognized standard for saffron in the world. Despite this, most Afghan saffron is not ISO certified.

ISO 3632-1:2011 offers specifications for dried saffron in both its stigma and powder form. It covers general characteristics, sensory analysis (flavour, colour and aroma), foreign and extraneous matter, establishes grade classifications (three grades) as well as how to pack and label saffron. Proving compliance with one of the three grades offers buyers added assurance of the quality they will receive when buying saffron, no matter where they are located or from which country the saffron originates. Analysis in a qualified laboratory will determine these parameters and the results will play a major role in the prices that the saffron will be able to fetch on the market.

Many buyers require compliance with these specifications, or use them as the basis for their own private specifications. ISO standards give recognition to high-quality saffron producers and expose those that push adulterated saffron onto the market.

ISO 3632-2:2010 specifies the various test methods and procedures used to determine physical and chemical specifications of dried saffron in both its stigma and powder form outlined in ISO 3632-1:2011. It covers aspects such as sample sizes, microscopic examination, determination of moisture content, floral waste and foreign matter, determination of sensory characteristics (flavour, colour, and aroma) and detection of artificial colouring. It is also used to help interpret the results of these tests and procedures.

Food testing laboratories around the world use the standard to ensure that they are providing accurate and precise results to saffron producers, as well as to offer guarantees to consumers that saffron tested using this standard is authentic and of the quality grade assigned.

While the standards were originally created in 1980, they remains up to date as new versions are often published. The most recent version was published in 2011 and was last reviewed and confirmed in 2017. The detailed parameters of the ISO standards, as subject to copyrights, are not publicly available and must be purchased. Thus, they cannot be reproduced in this guide. ISO Standards have been adopted at the national level in Afghanistan as AS 626 (ISO 1-3632-2011) and AS 627 (ISO 2-3632 – 2010) and are available with the Afghanistan National Standards Authority (ANSA). For more information on the standard, see Box 3.

ISO/TC 34/SC 7 on spices, culinary herbs and condiments is developing the first edition of an international standard on Guidelines for harvesting, transportation, separation of stigma, drying and storage of saffron before packing (ISO/NP 21983).[13]

ISO 22000 – food safety management systems

The ISO 22000 family of standards comprises one of the most well-known series of FSMS standards accepted worldwide. The standards can help any company that ships, packages or sells food to ensure the safety of its products. According to the ISO website, ISO 22000:2018 ‘specifies requirements for a food safety management to enable an organization that is directly or indirectly involved in the food chain:

- to plan, implement, operate, maintain and update an FSMS providing products and services that are safe, in accordance with their intended use;
- to demonstrate compliance with applicable statutory and regulatory food safety requirements;
- to evaluate and assess mutually agreed customer food safety requirements and to demonstrate conformity with them;
- to effectively communicate food safety issues to interested parties within the food chain;
- to ensure that the organization conforms to its stated food safety policy;
- to demonstrate conformity to relevant interested parties;
- to seek certification or registration of its FSMS by an external organization, or make a self-assessment or self-declaration of conformity to this document.[14]

[13] International Organization for Standardization (2018). ISO/NP 21983: Guidelines for harvesting, transportation, separation the stigma, drying and storage of saffron before packing.

[14] International Organization for Standardization (2018). ISO 22000:2018, Food safety management systems – Requirements for any organization in the food chain.

The ISO 22000 family contains the prerequisite programmes such as GAP. GHP, GMP and HACCP. The standards can be used by any organization regardless of its size or position in the food chain, and its implementation can bring benefits such as:

- Greater consumer confidence in the safety of food products;
- New business opportunities as buyers seek out ISO 22000 certified companies for food safety assurances;
- Cost savings as fewer unsafe goods that cannot be sold are produced;
- Improved competence of employees who are trained and aware of their responsibilities when it comes to their position in the FSMS;
- A defined system for obtaining information on food safety hazards and control measures;
- Greater compliance with food safety regulations.

Each year, ISO conducts a survey to help track the number of valid certificates to ISO MSS.[15] The number of valid certificates for ISO 22000:2005 as of 2016 are as follows:

- 32,139 valid certificates worldwide;
- 2,636 valid certificates in Central and South Asia;
- one valid certificate (one site) in Afghanistan;
- 11,083 valid certificates in Europe;
- 2,000 valid certificates in India;
- 11,069 valid certificates in China.

ISO 9001 - quality management systems

ISO 9001 is the most popular MSS in the world and is widely prevalent in all markets as a prerequisite for buyers of all goods and services. ISO 9001 is a quality management system (QMS) standard that enhances an organization's ability to provide products or services that consistently meet customer and regulatory requirements. ISO 9001 specifies 'what' an organization must do but does not indicate 'how' it should be done, thus offering great flexibility. Furthermore, ISO 9001 does not set any particular level of quality, but rather will only help to achieve the level of quality set by the organization.

ISO 9001 can be applied to any sector of industry, from agriculture and manufacturing to service industries. Like all ISO MSS, it can be applied to organizations of all shapes and sizes. Adopting a QMS such as ISO 9001 brings many potential benefits such as:

- Increased ability to provide customers with consistently high-quality products or services while limiting or eliminating defects;
- Increased ability to meet or exceed both customer and regulatory requirements
- Potential to increase customer satisfaction and loyalty
- Better manage risks and opportunities
- Enhanced attention to quality by everyone in the organization, from farmers to top management
- Increased appeal to buyers, because ISO 9001 is widely acknowledged in global markets; those who themselves have implemented ISO 9001 tend to seek partners who have, as well
- Cost savings due to fewer inefficiencies, as well as expensive problems and mistakes.

The number of valid certificates combined for ISO 9001:2008 and ISO 9001:2015 as of 2016 are as follows:[16]

- 1,105,937 valid certificates worldwide;
- 41,370 valid certificates within Central and South Asia;
- 166 valid certificates (373 sites) in Afghanistan;
- 451,415 valid certificates in Europe;
- 37,052 valid certificates in India;
- 350,631 valid certificates in China.

[15] International Organization for Standardization (2018). ISO Survey.

[16] Ibid.

ISO 14001 - environmental management systems

ISO 14001 is the world's most recognizable framework for environmental management systems. An EMS based on ISO 14001 aims to support environmental protection and prevent pollution while taking socio-economic needs into consideration. It provides a framework to help an organization identify business activities that significant affect the environment, to set objectives and targets to minimize those effects, and to develop programmes to achieve targets and implement other operational control measures to ensure compliance with environmental policy.

ISO 14001 does not establish a minimum level of environmental performance. Rather, it compels an organization to achieve the environmental performance goals set by its management. Any type and size of organization can implement ISO 14001. Adopting an EMS based on ISO 14001 can lead to many benefits:

- Greater resource efficiency and reduced waste, leading to lower costs;
- Better public image by providing assurances that environmental impact is being measured;
- More new business opportunities as many customers use ISO 14001 as a criterion for evaluating potential suppliers;
- Safer work environment, which can improve productivity and boost employee morale;
- Increased consumer and stakeholder trust;
- Improved compliance with environmental regulations and better ability to adapt to new regulations;
- Improved overall environmental impact.

The number of valid certificates combined for ISO 14001:2004 and ISO 14001:2015 as of 2015 are as follows: [17]

- 346,147 valid certificates worldwide;
- 8612 valid certificates within Central and South Asia;
- one valid certificate (79 sites) in Afghanistan;
- 120,595 valid certificates in Europe;
- 7,725 valid certificates in India;
- 137,230 valid certificates in China.

Codex Alimentarius standards

Many of the standards within the Codex Alimentarius are known as 'commodity standards'. These set out quality parameters related to product composition such as colour, odour, flavour, moisture content and extraneous matter, as well as information on contaminants, additives, labelling and packaging.

There is no Codex standard for saffron. Until very recently, in fact, there were no Codex standards for any spice. In mid-2017, the CAC approved the development of standards for cumin (CXS 327-2017), dried thyme (CXS 328-2017) and black, white and green peppers (CXS 326-2017).

Some Codex standards can apply to all food products, including saffron. These include general standards on contaminants and toxins, food additives, and packaging and labelling. There are also various codes of practice – sets of written rules that explain production, processing, manufacturing, transport, and storage practices for different foods that ensure the safety and suitability of food.

The Codex standards and codes of practice that are relevant for saffron are listed in Box 2. The full texts can be found on the official website of the Codex Alimentarius under Codex Texts.[18]

[17] International Organization for Standardization (2018). ISO Survey.

[18] Codex Alimentarius Commission (2018). *Codex Texts.*

Box 2 Codex standards and codes of practice applicable to saffron

- Codex Stan 193-1995: General Standard for Contaminants and Toxins in Food and Feed
- Codex Stan 192-1995: General Standard for Food Additives
- Codex Stan 1-1985: General Standard for the Labelling of Pre-packaged Foods
- CAC/RCP 1-1969 : General Principles of Food Hygiene
- CAC/RCP 42-1995 : Code of Hygienic Practice for Spices and Dried Aromatic Herbs
- CAC/RCP 75-2015 Code of Hygienic Practice for Low-Moisture Foods
- CXC 78-2017: Code of Practice for the Prevention and Reduction of Mycotoxins in Spices
- CAC/RCP 56-2004: Code of Practice for the Prevention and Reduction of Lead Contamination in Foods
- CAC/RCP 68-2009: Code of Practice for the Reduction of Contamination of Food with Polycyclic Aromatic Hydrocarbons (PAH) from Smoking and Direct Drying Processes
- CAC/RCP 49-2001: Code of Practice Concerning Source Directed Measures to Reduce Contamination of Food with Chemicals
- CAC/RCP 47-2001: Code of Hygienic Practice for the Transport of Food in Bulk and Semi-Packed Food.

Box 3 Additional reading for voluntary standards

ITC's Sustainability Map: https://sustainabilitymap.org/standard-identify

ISO 3632-1:2011 Spices – Saffron (Crocus sativus L.) – Part 1: Specification

- Read more about this standard: https://www.iso.org/news/2014/02/Ref1819.html
- Preview the standard: https://www.iso.org/obp/ui/#iso:std:iso:3632:-1:ed-2:v1:en

ISO 3632-2:2010 Spices – Saffron (Crocus sativus L.) – Part 2: Test Methods

- Read more about this standard: https://www.iso.org/news/2010/10/Ref1361.html
- Preview the standard: https://www.iso.org/obp/ui/#iso:std:iso:3632:-2:ed-2:v1:en

ISO 22000 – Food Safety Management Systems

- Official Website of the Standard: https://www.iso.org/standard/35466.html
- Preview the standard: https://www.iso.org/obp/ui/#iso:std:iso:22000:ed-1:v1:en
- Self-assessment tool: https://www.iso.org/publication/PUB100024.html
- ISO Handbook - How to use ISO 22000: https://www.iso.org/publication/PUB100340.html

ISO 9001 – Quality Management Systems

- Official Website of the Standard: https://www.iso.org/iso-9001-quality-management.html
- Preview the Standard: https://www.iso.org/obp/ui/#iso:std:iso:9001:ed-5:v1:en
- ISO 9001: How to Use It: https://www.iso.org/publication/PUB100373.html
- ISO 9001 Diagnostic Tool: http://www.intracen.org/ISO-90012008-Diagnostic-tool/

ISO 14001 – Environmental Management Systems

- Official Website of the Standard: https://www.iso.org/iso-14001-environmental-management.html
- Preview the Standard: https://www.iso.org/obp/ui/#iso:std:iso:14001:ed-3:v1:en
- Introduction: https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/introduction_to_iso_14001.pdf
- ISO 14000 family https://www.iso.org/files/live/sites/isoorg/files/archive/pdf/en/theiso14000family_2009.pdf

International Standards – Codex Alimentarius

- Official Website of the Codex Alimentarius: http://www.fao.org/fao-who-codexalimentarius/en/
- Understanding the Codex Alimentarius: http://www.fao.org/3/a-i5667e.pdf

The buyer's perspective

The popular adage is that *customer is king*. This rings very true when it comes to saffron quality. First and foremost, quality means complying with requirements specified by the buyer. Buyers' requirements are normally set by companies that purchase goods either for direct sale to consumers or for further processing. These requirements might be specific to a single purchaser or apply to a group of buyers who serve a large retailer such as a supermarket chain. Buyers' requirements will often go beyond the conditions outlined in regulations. Quality requirements will usually be clearly stated through technical specifications in tender or order documents. Meeting and exceeding the quality specified by a buyer should always be the top priority, and sometimes this will need to be proven before export in the form of a quality certificate of analysis (COA).

Food safety requirements are often not explicitly stated in a buyer's technical sheet. If this is the case, buyers will still expect that a producer/exporter has done due diligence and complies with these conditions. They may even seek guarantees by requiring suppliers to certify against an FSMS standard. Buyers' requirements may also include provisions concerning environmental stewardship or labour protections, or necessitate compliance with specific sustainability standards.

Some requirements might not be explicitly stated by buyers but rather are implied by the market in that they are part of the normal practice of a given industry. For instance, packaging formats might be consistent within a market but vary across markets. Moreover, some voluntary standards can become 'de jure' standards under the right conditions. In the European market, for instance, UNECE standards for fresh fruits and vegetables have become 'de jure' in that they are the basis for specific marketing standards of EU law.

Market trends and consumer preferences may also vary from country to country. The product may be used a certain way in particular parts of the world, or be more prevalent in one market than another. Consumers in one market may value certain qualities of saffron more than consumers in other markets – for example, whether the saffron was produced without pesticides.

On many levels, knowing your buyer and intended market is of paramount importance. Quality requirements can vary substantially depending on the market, the buyer and the intended use of the product. Clear channels of communication with buyers must be established and maintained to ensure that quality corresponds to needs that can change over time. If a supplier cannot or chooses not to fulfil the contractual requirements of a specific buyer, then there will be no sale.

CHAPTER 3 GUARANTEEING QUALITY

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Chapter highlights

- Buyers often demand guarantees of food safety or saffron quality before purchase. These can be offered through a certificate of analysis issued by a competent laboratory. Specialized, well-equipped laboratories can test levels of all the saffron quality characteristics outlined in previous chapters A dedicated laboratory for saffron in Herat province in Afghanistan can perform 19 different tests on the spice.

- One of the biggest issues in saffron quality testing today is adulteration. Saffron adulteration is a global concern that injures all stakeholders in the industry. There are countless ways saffron and saffron powder can be tainted. While some forms of adulteration are easy to spot, others are not. There are well-established and widely used testing methods to detect adulteration, but the development of new technologies that offer greater scrutiny is ongoing.

- Researchers around the world are pushing the boundaries of saffron testing technology for a variety of other purposes, such as determining the geographical origin of saffron, improving methods for determining levels of key chemical compounds and creating faster, non-destructive testing techniques.

Buyers often require laboratory test reports to prove conformity. For greater certainty, buyers may require the analysis of a particular lot before export. They may also request that samples be sent to them for testing.

Testing often takes place in the country of origin. These tests may check for different contaminants in the name of food safety or determine saffron specifications through physical and chemical analysis. Once the analysis is conducted, a certificate of analysis is issued that will accompany the consignment to the destination market. This COA is not a legal document, but is rather part of a contractual agreement between the exporter and the buyer.

The most common product certification that buyers request is certification against ISO 3632. This is the most important product standard for saffron. Part I of the standard outlines the specifications for grades I, II, and III while part II of the standard defines the methods that should be used during testing

All testing samples should be selected according to an established sampling procedure based on random sampling. ISO 3632-2 provides some indications on the size of the sample needed for each test, but buyers usually say how many grams they request.The general rule for spices is to take samples from the number of packages that equal the square root of the total number of packages, but given the high price of saffron, buyers may have stricter rules. Permitting producers or traders to submit handpicked samples for testing defeats the purpose, as handpicked samples make it easier to overstate quality levels. Instead, the samples should be representative of the whole lot. After all, physical checks at points of entry in destination markets may involve the selection of random samples for testing.

Moreover, any discrepancies between a buyer's demanded quality and received quality in terms of product characteristics (sensory, physical and chemical) will jeopardize future business with that buyer. A certificate of quality from a testing laboratory offers assurances that the saffron will meet the desired quality level.

Much in the same way that some saffron can be of a superior quality when compared to different saffron, some laboratories are superior to others. In this context, it is important to determine the competence of laboratories performing the tests. To achieve this guarantee of competence, buyers may insist that tests be carried out by an accredited laboratory (according to ISO/IEC 17025). Accreditation of a laboratory assures buyers that the facility is fully competent and that the results of any test are accurate and can be trusted.

Saffron laboratory, Herat province

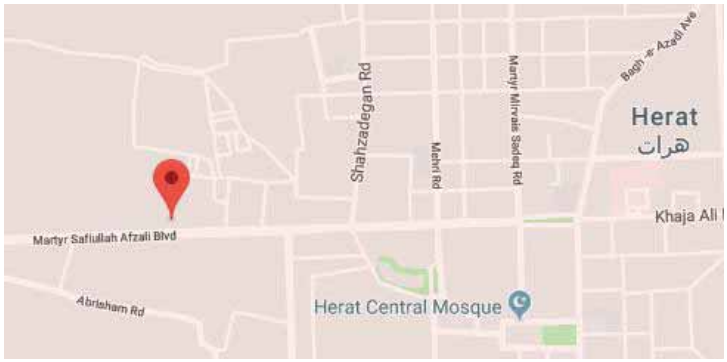
A MAIL laboratory to assess the quality of Afghan saffron was inaugurated in western Herat province in January 2018 with the aim of boosting saffron exports. The specialized laboratory is designed to carry out 19 different tests related to saffron quality, including testing for contaminants and sensory, physical and chemical analysis. Currently, only 13 tests are available at the facility.

- Bitterness (absorbance of Picrocrocin at 257nm)
- Aroma (absorbance of safranal at 330nm)
- Colouring strength (absorbance of Crocin at 440nm)
- Floral waste
- Extraneous matter
- Moisture content and volatile matter
- Total ash content
- Acid-insoluble ash
- Solubility in cold water
- Added colour/aroma *
- Pigments *
- Total nitrogen content *
- Crude fibre content *
- Enterococcus *
- Escherichia coli
- Sulfite-reducing Clostridia *
- Mildew
- PH
- Salinity

*Currently the lab is only equipped for 13 tests. Those marked with an asterisk are not yet tested.

The tests are performed in accordance with the international standard ISO 3632. This laboratory, which tested up to 35 samples for different quality parameters in 2017, is one of the best-equipped and most reliable options for saffron testing in Afghanistan. A manager and three lab experts/technicians staff the facility.

The laboratory intends to achieve accreditation according to ISO 17025 within 3–4 years, so that results are fully recognized by the international community. Besides helping to build trust in the quality of Afghan saffron, the lab will also aid in identifying troublesome pests and diseases in saffron fields. The laboratory is located in Barman village, west of Khajeh Kalleh Square along Martyr Safiullah Afzali Boulevard.



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The global concern of saffron adulteration

The European Spice Association (ESA) defines adulteration as 'the deliberate and intentional inclusion in herbs and spices of substances whose presence is not legally declared, is not permitted or is present in a form which might mislead or confuse the customer, leading to an imitated food and/or a product of reduced value'.[19]

Historically, saffron has been one of the most falsified food commodities. This is a result of its extremely high value and the huge profits that can be made from deceiving buyers. Saffron in stigma form allows consumers to judge the authenticity more easily than saffron powder. Adulteration occurs more often in saffron powder simply because it is easier to disguise the inferior substances. Saffron powder is adulterated with substances ranging from paprika powder, turmeric and the illegal artificial colour tartrazine to metal oxides and brick dust.

Although it is more difficult to fake, there is also a lot of phony saffron stigma on the market. The most prevalent is safflower that is dyed to better match the colour of saffron. Corn silk, marigolds, poppies, fine shreds of red wood and even plastic have also been passed off as saffron stigmas.

[19] European Spice Association (2014). *ESA Adulteration Awareness Document*. 21 Jul.

Many tricks have been used to increase the weight of saffron, such as adding oils, coating stigmas with honey, wax or molasses, or simply drying saffron improperly, so buyers essential pay for added moisture content. Unsuspecting tourists often buy adulterated saffron in local markets. However, fake saffron has also become a serious problem on e-commerce portals, where controls are more difficult than in face-to-face purchases.

Figure 12 Examples of fake saffron

Synthetic saffron

Safflower

The growing prevalence of counterfeit saffron products damages the reputation of the saffron sector. Consumers ultimately receive an inferior product, and this falls back on all growers, processors and exporters – not only those that partake in counterfeiting activities. Counterfeit saffron diverts profits from producers selling the authentic spice. Governments of major saffron-producing countries and standards-developing organizations are working to develop stronger measures to counter this problem.

Several testing methods can expose adulterated saffron for what it truly is: a fraudulent and inferior product. The most common technologies used today to detect artificial colours are thin layer chromatography and high-performance liquid chromatography. Thin layer chromatography costs less, but high-performance liquid chromatography is generally considered superior as it has a more sensitive detection technique.

ISO 3632-2:2010 specifies this method for detecting and identifying artificial dyes, both water-soluble and fat-soluble. However, newer technologies are always evolving, as the list of colours under scrutiny is growing longer and longer. Tartrazine (E102), Quinoline yellow (E104), Sunset yellow (E110), Azorubine (E122), Amaranth (E123), Ponceau 4R (E124), Red 2G (E128) and Allura red (E129), among others have all been used to artificially colour saffron and are detectable by modern tests.

Due to rampant adulteration, some buyers may request that a portion of the yellow style (2.0–3.0 mm) remain attached to the stigma. This helps to ensure against adulterated saffron – if buyers can see part of the style still attached, they know that styles have not been removed, dyed red and mixed in with the stigmas. These buyers prefer to receive such assurances and then to remove the partial styles themselves before selling the pure saffron.

There are also relatively simple methods to detect artificially coloured saffron. Placing saffron threads in a narrow tube of water and watching how the colour diffuses into the liquid is one way. The colour from real saffron will spread very slowly from top to bottom, while colour from dyed saffron will spread much more quickly.

Moreover, the resulting watercolour should be more yellow than orange-red. Real saffron stigmas will retain their red colour and float to the surface, while those treated with artificial colours will lose the colour rapidly. Another way to check for artificial colouring is to look at the actual threads.

Stigmas are trumpet-shaped, and if the threads are unusually long, chances are the style has been included and dyed to look like stigma.

Red stigmas with random streaks of yellow are also a sign of dyeing, and are likely a result of overlapping or sticking threads during the dyeing process.

Companies in the saffron value chain must be vigilant in knowing suppliers and their capabilities. Making sure suppliers adhere to traceability principles can help ensure the authenticity of any saffron received. Moreover, qualified laboratories that can test and certify the authenticity of saffron offer additional assurances to buyers. For more information on adulteration in spices, please read the American Spice Trade Association document 'Identification and Prevention of Adulteration'.[20]

Advances in testing

Safranal detection using gas chromatography

A 2014 study by Bononi, Milella and Tateo[21] attempted to show that gas chromatography is a superior method to test for the presence of safranal when grading saffron. The gas chromotography method was compared to the commercially accepted spectrophotometric method outlined in the international standard for saffron ISO 3632, which specifies the same range of 20-50 for all three saffron quality grades.

A lack of correlation between the testing results derived from the two methods shows that additional studies may be useful. As of yet, gas chromatography testing for safranal has not been recognized by international standards; however, some individual buyers may request gas chromatography as a preferred testing method, especially if they are particularly interested in the aroma properties of saffron.

Determining geographical origin of saffron

Gas chromatography was used in a study[22] to determine the geographical origin of saffron from around the world. The researchers looked at the different volatile compounds of saffron samples using gas chromatography and found that it was possible to separate regions – especially Greek, Iranian, Italian and Spanish – from each other. The classifications were correct 96.4% of the time, which illustrates the potential for identifying the true origin of commercially sold saffron.

In 2016, scientists in Spain and the Czech Republic used various testing techniques to identify unique fingerprints of saffron from around the world.[23] Their particular research confirmed suspicions that saffron labelled as Spanish-grown often originates elsewhere. In fact, they proved that more than half of the samples they tested were fraudulent.

Non-destructive, rapid techniques

Many of the techniques to test saffron quality that are readily available are not only expensive, time-consuming and highly technical, but they are also destructive. Thus, some researchers have been investigating quicker, non-destructive techniques such as electronic noses and electronic tongues[24] to detect saffron quality and safety. These technologies have limitations in their current state, however. Research is ongoing into integrated multi-sensor systems that are becoming more intelligent, more compact and faster.

Please see Appendix X for tables outlining other recent applications of spectroscopic and chromatographic methods to saffron quality assessment.

[20] American Spice Trade Association (2016*). Identification and Prevention of Adulteration.*

[21] Bononi M., Milella P. and Tateo F. Gas chromatography of safranal as preferable method for the commercial grading of saffron (Crocus sativus L.). *Food Chemistry, 176*, 17-21

[22] Anastasaki et al. (2009). Geographical differentiation of saffron by GC-MS/FID and chemometrics. *European Food Research and Technology, 229*(6), 899–905.

[23] Science Daily (2016). *Chemical fingerprints confirm the saffron fraud*. 20 January.

[24] Luz, R.M. & Preedy, V.R. (2016). *Electronic Noses and Tongues in Food Science.* Elsevier Science.

CHAPTER 4 NEW AVENUES TO ADD VALUE

Chapter highlights

- The nutraceutical industry is booming in Europe, Ayurvedic medicine is ever-present in India, and traditional Chinese medicine is a giant, accounting for nearly a third of the total value of the pharmaceutical industry in China. Each of these industries sources saffron for its claimed or proven medicinal properties.
- The medicinal applications of saffron are numerous, and buyers of the spice for this intended usage may assign increased importance to the presence of certain chemical compounds in saffron, such as crocin, picrocrocin, crocetin and safranal.
- Saffron is also sourced for use in the cosmetics and perfume industry. Cosmetic and fragrant applications of the product go back thousands of years, and interest in saffron for various usages continues today. Safranal is the key chemical compound associated with saffron aroma, so saffron with high levels of safranal may be targeted by these industries.
- The colouring properties of saffron remain sought after in the textile industry, although this usage is decreasing due to the associated high cost and the fact that less expensive alternatives have been discovered.

Wellness: Nutraceuticals, Ayurveda, traditional Chinese medicine

Although culinary applications of saffron are dominant, saffron has had traditional medicinal applications in many parts of the ancient world for millennia. For example, in Ancient Greece saffron was used as a cure for insomnia as well as for hangovers due to excessive wine drinking. One of the first historical references about the use of saffron comes from Ancient Egypt, where it was known as an incense with sedative qualities.

Today, the biological compounds present in saffron are associated with certain health benefits. Saffron contains high levels of antioxidants such as alpha and beta-carotenes, as well as to contain many other vitamins and minerals. Table 4 shows the USDA National Nutrient Database mineral and vitamin values for saffron.[25]

Table 4 USDA mineral and vitamin values per 100g, saffron

Nutrient	Unit	Value per 100g	Nutrient	Unit	Value per 100g
Minerals			Vitamins		
Calcium, Ca	mg	111	Vitamin C, total ascorbic acid	mg	80.8
Iron, Fe	mg	11.1	Thiamin	mg	0.115
Magnesium, Mg	mg	264	Riboflavin	mg	0.267
Phosphorus, P	mg	252	Niacin	mg	1.46
Potassium, K	mg	1724	Vitamin B-6	mg	1.01
Sodium, Na	mg	148	Folate, DFE	µg	93
Zinc, Zn	mg	1.09	Vitamin A, RAE	µg	27
			Vitamin A, IU	IU	530

Source: United States Department of Agriculture Agricultural Research Service (2018). *National Nutrient Database for Standard Reference Legacy Release – 02037, Spices, Saffron.*

Saffron is known or claimed to possess a broad spectrum of medicinal benefits. Some of the claims regarding the medicinal benefits of saffron include:

Sedative/sleep aid	Digestive aid	Spasm reducer	Pain reliever
Anti-inflammatory	Cholesterol reducer	Antioxidant	Eye health
Anti-hypertension	Cancer prevention	Treatment of asthma	Treatment of anaemia
Fever reducer	Treatment of impotence and infertility	Treatment of respiratory disease	Treatment of neurodegenerative diseases
Anti-anxiety	Anti-depressant	Treatment of arthritis	Treatment of premenstrual syndrome
Heart attack prevention	Ca rdiovascular health	Blood pr essure reducer	Appeti te suppressant

*Some of the above claims are backed by research studies while others are less supported

[25] United States Department of Agriculture Agricultural Research Service (2018). *National Nutrient Database for Standard Reference Legacy Release – 02037, Spices, Saffron.*

Buyers interested in saffron for medical usage would probably look for saffron with the highest levels of safranal or crocin, as these are thought to be the components with the greatest treatment applications. Crocetin, a chemical constituent of saffron that is absent from the ISO 3632 standard, is of great interest to the pharmaceutical industry for its potential applications in treating tumours and depression. Clinical studies and trials measuring the efficacy of saffron constituents for various pharmaceutical usages are ongoing, and many of the health claims remain unproven due to insufficient evidence.

The claimed medicinal benefits of saffron are also of interest to other health product sectors, notably the nutraceutical sector, which is booming in Western markets like the European Union, the popular Ayurvedic medicine industry in India and TCM.

Nutraceuticals

Due to this huge range of health claims, saffron is widely used in the nutraceutical industry as consumers seek natural means to good health. Nutraceuticals is essentially a term coined to describe foods that possess medicinal benefits, and they are used more to treat ailments than to cure them. They comprise elements of both the food and pharmaceutical industries, and are significantly less expensive and less regulated than pharmaceuticals. In fact, there is a lack of direct regulation in most markets.

There are three different product categories within nutraceuticals: functional beverages (such as vitamin-infused drinks), functional food and supplements.

Growth of saffron use in the nutraceutical sector continues to have a positive impact on the industry. Awareness of nutraceuticals is still growing in Europe and other Western markets. France in particular is one of the key markets for nutraceuticals in Europe. Some of the major players in the European nutraceuticals market include Cargill Incorporated, Archer Daniels Midland (United States.), BASF SE (Germany), DuPont (United States) and Royal DSM (the Netherlands).[26] The marketing activities of large companies in the nutraceuticals sector have contributed to the growing awareness of the benefits of saffron, which has a snowball effect on the number of new consumers.

One can find numerous nutraceutical products being sold by major online retailers that contain saffron extract as an active ingredient. The most prevalent saffron-containing nutraceutical products found in a search are appetite suppressants; however, some other products found include:

- Daily memory brain supplement containing pure saffron extract and red Korean Ginseng
- Appetite suppressant capsules containing 88.5 mg saffron extract per capsule (0.10%)
- Ocular support – eye health supplement containing saffron extract
- Mood and energy level enhancer containing 100% saffron extract.

Many countries have regulations limiting health claims on product labels. For example, in the European Union, health claims on food must be clear, accurate and based on scientific evidence. Food bearing claims that could mislead consumers are prohibited on the European market. These rules are enforced within Regulation (EC) No 1924/2006.

Ayurveda

Ayurveda has been practiced for thousands of years in India as a traditional method of medical treatment. It emphasizes the prevention of disease, rejuvenation of bodily systems and extension of life span. It is based on the concept that the human body has three systems: the nervous system, the venous system and the arterial system, which when out of balance results in many forms of illness.

Modern Indian society recognizes Ayurveda as a legitimate medical system. Those who want to practice Ayurvedic medicine receive training and licensing, and around two-thirds of the rural population in India use Ayurveda as part of their primary healthcare needs. A big part of Ayurvedic-based treatment is the prescription of medicinal herbs and spices. Saffron is revered in Ayurveda because it is considered a

[26] Markets Insider (2017). *Europe Nutraceuticals Market by Applications; by Types; by Country – Analysis and Forecast*. 3 Oct.

'tridoshic' substance, that is, it helps to balance all three body systems. It also is considered to have positive effects on the mind.

The number of well-controlled clinical trials and research reviews undertaken on Ayurveda is relatively small, and thus mainstream acceptance of its safety and benefits in Western medical research is limited. Nonetheless, there is still growing popularity among some segments of the population turning to alternative medicine.

Saffron in Ayurvedic medicine is usually consumed in stigma or powder form. For example, placing a few stigma threads in milk for soaking before drinking is common. Saffron is often infused into a popular Ayurveda product called Chyawanprash, which is a jam composed of a mix of fruits, herbs and other foods. Saffron destined for the Indian market may ultimately be used in Ayurvedic medicinal substances. For India, rules concerning foods used for medical purposes are found within Food Safety and Standards (Food or Health Supplements, Nutraceuticals, Foods for Special Dietary Uses, Foods for Special Medical Purpose, Functional Foods and Novel Food) Regulations, 2016.

Traditional Chinese medicine

Saffron has been used in China for centuries as part of the dietetics pillar of TCM. The TCM approach is all about balance, harmony and energy. Similar to Ayurveda, TCM is more about treatment than curing. Saffron plays an important role in TCM as having sweet taste and cold properties, which are associated with the heart and liver meridians. The applications of saffron in Chinese medicine are numerous, including: promoting blood circulation, detoxification, pain relief, cardiovascular, liver and kidney disease prevention, as well as neurological and nervous system disease prevention. TCM is a multibillion-dollar industry that in 2015 accounted for almost 29% of the total value of the Chinese pharmaceutical industry.[27]

In TCM, saffron is often consumed as plant-based medicine in the form of herbal drinks, saffron tea or infusions. Saffron is also cooked into food for medicinal benefits. One of most prevalent non-culinary uses of saffron in China is the foot bath or foot soak. Foot care is an important part of TCM, and saffron is widely used in herb blends to promote blood circulation.

The drying process of saffron is important in TCM. Proper drying results in increased levels of antioxidants present in saffron, which is a major feature of herbs and spices used in TCM.

The CFDA has been cracking down on markets of TCM ingredients due to widespread instances of counterfeit ingredients, artificial dying and adulteration, and dangerously high traces of pesticides and fertilizers. Action was taken in 2017, when the certifications of 81 manufacturers of TCM products were revoked after the authorities detected irregularities in production and quality control due to a lack of GMP.

There is progress towards developing a national system of standardization for TCM by 2020. As of December 2016, nearly 650 standards had been created. For more information, please read the White Paper on *Traditional Chinese Medicine in China*.[28] The TCM sector will be a major growth driver of saffron imports in China, especially if national production fails to live up to demand both in terms of quantity and quality. TCM products are also a major export for China and are a focus of the Chinese Government's 'going global' strategy.[29]

[27] Xinhuanet (2016). *China issues first white paper on traditional Chinese medicine*. Dec 6.

[28] The State Council of the People's Republic of China (2016). *Full text: Traditional Chinese Medicine in China.* 6 Dec.

[29] Wen, Wang (2015). *TCM products find their niche overseas.* 20 Oct. China Daily USA.

Cosmetics, perfume and textiles

In addition to culinary and medicinal applications, saffron is used in the production of cosmetics and perfume. This has been the case for thousands of years. Alexander the Great was known to use saffron as a shampoo, and Cleopatra was known to bathe with the spice. Today, saffron still has a wide variety of homemade cosmetic applications such as:

- Mixing saffron with milk and sandalwood powder to make a mask for skin radiance treatment
- Creating a paste of saffron and fresh basil leaves to treat acne and blemishes
- Blending saffron and lemon juice to treat dry skin

There is growing awareness in the retail cosmetics sector of the wide-arrayed utility of saffron including the production of skin creams, anti-blemish lotions and cleansers. Increased use of saffron for these applications, especially in the Asia Pacific market, could help fuel the market over the next several years.[30]

Liquid saffron extracts have been used to prepare perfume in the Middle East for millennia, and they are now becoming more common in Western markets. While not yet a significant market segment, the perfume industry recognizes the attractive qualities of saffron aroma. An Internet search brings numerous hits of online retailers selling saffron-laced perfume and cologne. Fragrances featuring saffron will almost always be a blend of a variety of scents, which makes the aroma last longer.

The blending of a homemade artisanal saffron perfume is relatively simple, only requiring saffron, essential oils such as sandalwood or rose, and pure grain alcohol. The blending of retail-ready perfume takes a significant level of expertise and processing capabilities. Given that safranal is the chemical component responsible for saffron aroma, it is sometimes a key product factor for buyers interested in buying saffron for fragrance production.

Although much more common in the past, saffron is still used today as a textile dye. The popularity stems from the saffron colour being a status symbol. This practice is more prevalent in Asian countries such as China or India, although it has become less cost-effective due because the colours lack stability and the spice is expensive. The primary dye component of saffron, crocin, has been found in the less expensive gardenia fruit, which has been developed as an alternative source for dyeing purposes.

Subsequenlty, gardenia fruit has become an adulterant of saffron and other spices like paprika. The colouring properties of saffron are more widely used in the food industry as consumers shift away from synthetic chemical dyes to natural ones. Buyers who intend to use saffron for its colouring properties would likely be most interested in crocin levels than a typical buyer.

Saffron has also been sold more in liquid form in recent years. Liquid saffron can be made at home by adding powdered saffron to hot or iced water and essentially creating a strong infusion. Liquid saffron extract is usually prepared through treatment with aqueous alcohol, followed by careful concentration.

Approximately 140,000 stigmas are required to produce one kilogram of extract.[31] This liquid can then be bottled and used for a variety of purposes. In cooking, liquid saffron is enjoyed by many due to its convenient measurement and use as well as increased shelf life. Liquid saffron extracts are used as a colouring agent in foods, beverages, liquors, perfume and fabrics, and as health supplements.

[30] Grand View Research (2015). *Saffron Market Analysis by Application, by Region and Segment Forecasts, 2018-2025*. May.

[31] Food and Agriculture Organization of the United Nations (1995). Chapter 6. *Natural colourants and dyestuffs.*

CHAPTER 5 KEY MARKETS: EUROPE, INDIA, CHINA

Chapter highlights

- Quality requirements for saffron in Europe, India and China share commonalities in terms of criteria outlined in legislation, but often diverge in terms of strictness of requirements. Key standards in different markets vary, in addition to preferences among consumers and buyers.
- Major re-exporters of saffron in Spain, France and Italy dominate distribution channels in Europe. Among European retailers, high quality is the make-or-break parameter. Grade one specifications according to ISO 3632 are a common baseline for many European buyers. Some have even moved beyond this standard and developed their own specifications and quality protocols. EU legislation is quite strict for food safety, and European buyers require that suppliers be certified against a food safety management system standard based on HACCP principles. Strong buyer relationships based on trust and built over time are a critical success factor. Sustainability issues and transparency are valued more by European consumers than elsewhere, signalling opportunities for niche market branding.
- India is the largest market for Afghan saffron. It will continue to rely on imported saffron despite significant domestic production in the Kashmir region. India has experienced major issues with food safety, and a major concern for saffron buyers and consumers alike is compliance with food safety regulations set forth by the Food Safety and Standards Authority of India. Because most saffron exported to India is used to meet domestic demand, complying with the specifications outlined in national standards such as the AGMARK grading and marking rules for saffron is advised.
- Business ties between Afghanistan and China are on the upswing. This means real opportunities for the Afghan saffron sector in this dynamic market. Food safety laws in China are revised constantly and there is an ongoing effort to better align with international standards. Navigating food safety legislation in China, outlined primarily in a series of ‘Guobiao’ national standards, can be a tricky endeavour, especially when considering the language barriers to overcome. Like in India, food safety scandals have left a strong imprint in the minds of consumers. Moreover, the Chinese market is flooded with adulterated or fake saffron. Consequently, buyers will want guarantees that the saffron is pure and authentic, and that it is harvested and handled in a safe and proper manner.

Europe: Consistent high quality

Saffron from Afghanistan has attracted increasing attention in the high-end European market over the last several years, due to its unique taste and great potential for high quality. The region experienced annual growth in saffron imports of 7% between 2012 and 2016.

Europe is a major market for re-exports of saffron as some member countries have large competitive advantages in terms of processing, packaging and branding capabilities.

The value-added profits generated from re-exports are significant, so these importers are always looking to source larger quantities of high-quality saffron. It remains a challenge to find a niche in the European market that is independent of the existing distribution channels controlled by dominant re-exporters.

Today, only a small portion of European saffron imports are sourced from Afghanistan. This signals opportunity for considerable growth, provided Afghan saffron can develop and maintain a reputation of consistent high quality through the implementation of quality control measures. The beginnings of a strong reputation are already in place: since 2013, the International Taste and Quality Institute in Brussels has consistently rated saffron from Afghanistan among the best in the world.

For major European retailers, quality is the make-or-break parameter. It is extremely important for exporters to build strong relationships with importers and develop a brand identity based on high quality. This includes compliance with food safety measures, and adherence to international quality standards such as ISO 3632 and beyond.[32]

Box 4 Key regulations and product standards in the European market

- Regulation (EC) No 178/2002 on general principles and requirements of food law
- Regulation (EC) No 852/2004 on the hygiene of foodstuffs
- Regulation (EC) No 396/2005 on maximum residue levels of pesticides in or on food and feed of plant and animal origin (and amendment No 178/2006)
- Regulation (EC) 1881/2006 on setting maximum levels for certain contaminants in foodstuffs
- Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs
- Regulation (EC) No 1333/2008 on food additives
- Council Directive 2000/29/EC on protective measures against the introduction into the Community of organisms harmful to plants or plant products and against their spread within the Community
- Regulation (EU) 543/2011 General Marketing Standard (saffron is exempted from this standard)
- Regulation (EC) No 1935/2004 on materials and articles intended to come into contact with food
- Commission Directive 2004/102/EC on phytosanitary measures on wood packaging material
- Regulation (EU) No 1169/2011 on the provision of food information to consumers
- Regulation (EC) No 1924/2006 on nutrition and health claims made on foods
- Regulation (EC) No 882/2004 on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules
- Council Regulation (EC) no 834/2007 on organic production and labelling of organic products
- European Spice Association – Quality Minima Document – Rev. 5

Mandatory requirements in Europe

Food safety

The European Commission defines contaminants as substances that have not been intentionally added to food, and instead may be present as a result of the various stages of its production, packaging, transport or holding, or environmental contamination. To ensure high levels of public health, the EU sets maximum levels for certain contaminants in food. If a consignment of saffron is found not to meet the food safety requirements outlined below, it may be refused entry or taken off the market.

Use of an FSMS based on the principles of HACCP is mandatory for food processors, and is recommended for farmers involved in primary production. Buyers of spices in the European Union will avoid buying saffron from producers not following the principles of HACCP within their operations, and may even demand compliance with standards that are more comprehensive. Please read more about HACCP in Appendix II.

Pesticide residues

The regulations regarding maximum residue limits for different pesticides are set within Regulation (EC) No 396/2005. Products containing pesticide residues exceeding the established limit or containing banned pesticides are not allowed on the European market.

The specific limits for pesticides that might be used while cultivating saffron can be found in the EU Pesticides database.[33] For saffron entering the EU, 483 potential substances are subject to MRLs. A comprehensive list of these substances and their limits can be found by browsing the EU Pesticide database and performing

[32] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva

[33] European Commission (2018). *EU – Pesticides database.*

a search for the product saffron (code number 0860010). Producers should not use any pesticide that is not on this list. One can then search for a specific pesticide residue within the list using the search field at the top-right of the page. Please see Appendix IV for a screenshot of the database.

European buyers can sometimes struggle to find spice suppliers that consistently deliver products which comply with strict European MRLs, and training on proper pesticide use is a widespread need. It is important to note that some European countries and buyers have established MRLs that are stricter than those in EU regulations. Thus, it is always important to check with buyers to ensure their requirements are being met.

Metal contaminants

Limits on metal contaminants are set within Regulation (EC) 1881/2006. No limits have been established specifically for saffron or for food categories in which saffron would belong. Nonetheless, European Union General Food law mandates that all food products entering the EU market must be deemed safe. The presence of metal contaminants such as tin, lead, cadmium, arsenic and mercury at excessive levels renders food unsafe for the European market.

Naturally occurring toxic substances

Limits on naturally occurring toxic substances are set within Regulation (EC) 1881/2006 and amendments. No limits have been established specifically for saffron or for food categories in which saffron would belong. However, the EU has set limits on aflatoxins and ochratoxin A for cayenne, paprika, nutmeg, ginger and turmeric. These are all spices for which contamination occurrence is higher. In practice, limits will be the same for any spice, including saffron. Please be sure to discuss these parameters with buyers in the EU.

Table 5 Maximum levels for mycotoxins, spices – European Union

Food stuff	Maximum Levels of Aflatoxins (µg/kg) ppb	
Spices: Capsicum spp. (dried fruits thereof, whole or ground, including chillies, chilli powder, cayenne and paprika)* Piper spp. (fruits thereof, including white and black pepper) Myristica fragrans (nutmeg) Zingiber officinale (ginger) Curcuma longa (turmeric) Mixtures of spices containing one or more of the abovementioned spices	**B1**	**Total (Sum of B1, B2, G1, G2)**
	5.0	10.0
	Maximum Level of Ochratoxin A (µg/kg) ppb	
	15.0	

Note: ppb: parts per billion.
Source: Regulation (EC) 1881/2006, * The maximum limit for ochratoxin A in Capsicum spp. has recently been increased to 20 µg/kg.

Microbiological contaminants

Limits on microbiological contaminants are set within Regulation (EC) No 2073/2005. EU law contains no specific requirements regarding microbiological criteria for saffron or for the food category ‘spices’. However, according to European Union General Food law, all food products entering the EU market must be deemed safe. The presence of microbiological contaminants such as salmonella at any level renders food unsafe.

Food safety authorities are diligent about preventing food products contaminated with microbiological contaminants such as e-coli or salmonella from entering the EU market. Furthermore, once on the market, food business operators are known to test spices for the presence of microbiological contaminants and notify food safety authorities in the event of a positive test. Some buyers in the European Union will request a laboratory analysis of saffron before entering into a purchase agreement.

Risks of microbiological contamination in spices can be mitigated largely through good food hygiene practices. Regulation (EC) No 852/2004 on the hygiene of foodstuffs sets out applicable hygiene requirements on imported food. Read more about Good Hygiene Practices in Appendix II.

Other contaminants

The European Union introduced new legislation in 2015 regarding limits on polycyclic aromatic hydrocarbons for spices, which are chemicals that can contaminate spices such as saffron during the drying process. For example, poor drying practices that rely on the burning of fossil fuels, coal or garbage result in contaminated smoke becoming mixed in with the dried product. Limits on PAHs in foodstuffs are set out in Regulation (EC) 1881/2006. Traces of PAHs shall not exceed the levels stated in Table 6.

Table 6 Limits on other contaminants, spices – European Union

Name of the contaminant	Food	Maximum level (µg/kg) ppb	
		Benzo(a)pyrene	Sum of benzo(a)pyrene, benz(a)anthracene, benzo(b)fluoranthene and chrysene
Polycyclic Aromatic Hydrocarbons	Dried Spices with the exception of cardamom and smoked Capsicum spp.	10.0	50.0

Note: ppb: parts per billion.
Source: Regulation (EC) 1881/2006.

Food additives

Regulation (EC) No 1333/2008 contains a list of food additives permitted for use in the European Union at certain levels and on certain foods. Food adulteration is a big concern in the EU and one that buyers take very seriously. Given the nature of the product, saffron and saffron powder should never contain any food additives such as added colours. Adding inferior substances, whether natural or synthetic, would render the product adulterated from its pure form and unfit in terms of quality. Read more about saffron adulteration in Chapter 3.

Irradiation

While allowed on spices like saffron, irradiation should only be considered through mutual agreement with the buyer, as consumers in the European Union are largely apprehensive about irradiation of food. EU regulations permit irradiation only in specific circumstances, such as 1) there is a reasonable technological need; 2) it poses no health hazard; 3) it benefits consumers; and 4) it does not replace hygiene, health or good manufacturing or agricultural practice.[34] Additionally, food irradiation can only take place in irradiation plants approved by the European Union.

Controls at the point of entry

According to Regulation (EC) No 882/2004, food imported into the European Union is subject to potential controls at points of entry. These are performed to ensure that all food introduced into the EU market is safe and complies with regulations. There are different types of official controls: 1) documentary checks or an examination of documents accompanying a consignment; 2) identity checks to ensure that the accompanying documents match the consignment; and 3) physical checks that may include inspections of packaging or sampling the product for laboratory analysis. This may happen at EU borders or even once on the market, but most frequently these checks occur at the point of entry.

Due to repeated noncompliance, some foods are subject to stricter controls at designated points of entry in the EU as per Commission Regulation (EC) No 669/2009. Although saffron from Afghanistan is not subject to increased controls at present, this could change, so all efforts should be made to comply with food safety requirements. See Appendix V for examples of border alerts and rejections for saffron via the Rapid Alert System for Food and Feed of the EU.

[34] European Commission (2018). *Food Irradiation*.

Plant health

According to Council Directive 2000/29/EC, all imports into the European Union containing plants, plant products or other material capable of harbouring plant pests, including wooden packaging material such as wooden pallets, must be accompanied by a phytosanitary certificate assuring their absence from the consignment. EU requirements for wooden packaging material are based on the ISPM 15 standard. Because saffron has an extremely high value-weight ratio and is generally shipped in smaller quantities, wooden packaging material is less likely to be used. If present, however, it must be debarked, heat-treated and officially marked in line with ISPM 15 procedures.

An authorized official in the country of origin must issue the phytosanitary certificate. Generally, this authorized body will be the plant quarantine department of the National Plant Protection Organization (NPPO). Upon arrival at the point of entry in the EU, consignments are subject to official controls to ensure that phytosanitary requirements have been met. See the section 'Plant Health' in Chapter 2 for more information on obtaining phytosanitary certificates in Afghanistan and ISPM-15.

Product characteristics and performance

Many products, primarily fresh fruits and vegetables, entering the EU must meet requirements set forth within EU Marketing Standards. However, saffron is explicitly listed as a product that is *exempted* from the general marketing standard.[35]

However, the ESA has created a Quality Minima Document that has become a set of de facto standard guidelines for dried herbs and spices in the European Union. The document describes the minimum quality for dried herbs and spices that buyers should demand when purchasing for further processing within the European Union (business to business' transactions). The requirements do not extend to spices for direct sale to consumers.[36]

Table 7 outlines the Quality Minima set for product characteristics of both saffron and saffron powder, as measured through laboratory analysis. The document also includes many references to EU regulations covered elsewhere in this chapter (e.g. contaminants, traceability, packaging and labelling). The Quality Minima Document does not cover sensory properties related to the presence of picrocrocin, crocin and safranal.

Table 7 European Spice Association, Quality Minima – saffron whole, saffron powder

Parameter	S affron whole	Powder
Extraneous matter	Not more than 1.0% by weight	Not more than 1.0% by weight
Moisture content	Not more than 12.0% by weight	Not more than 10.0% by weight
Volatile oil	No value given	No value given
Ash content	Not more than 8.0% by weight	Not more than 8.0% by weight
Acid-insoluble ash	Not more than 1.0% by weight	Not more than 1.5% by weight
Water activity (Aw)	Not more than 0.65	Not more than 65%

Source: European Spice Association (2018). *Quality Minima Document.*

It is important to note that quality requirements can vary by EU member state and by individual buyer. In this sense, it is necessary to communicate with buyers for specific quality requirements.

Packaging

General packaging requirements – Food contact materials

Regulation (EC) No 1935/2004 lays out rules regarding materials that come into contact with food products. As the packaging will undoubtedly make physical contact with the saffron, it is important that only materials

[35] European Commission (2018). *Fruits and vegetables: Marketing standards.*

[36] European Spice Association (2018). *Quality Minima Document.*

which are suitable for contact with food are used and will not endanger human health, cause an unacceptable change in the composition of the saffron, or cause deterioration in the sensory characteristics of the saffron.

The packaging must be free from substances that could damage the saffron, fungal contamination, insect infestation and undesirable or bad odours. Regulations on different food contact materials are quite extensive. For more information and a list of EU legislation on specific food contact materials, please visit the European Commission webpage on legislation for food contact materials.[37]

Specific packaging requirements

No specific packaging format requirement exists for saffron within European Union regulations. Different importers/buyers will have different requirements regarding what they expect in terms of packaging. For example, the type and size of the package is often customer choice. There is a major difference in packaging requirements for the EU market depending on whether saffron is exported in bulk or in consumer-ready packaging. Consumer-ready packaging must conform to Directive 94/62/EC on packaging and packaging waste. Be sure to discuss packaging requirements with buyers to make sure specific requirements are met. The 'buyers' requirements' section found further below contains more information on what buyers may expect in the European market, and Chapter 2 contains practical guidance for packaging saffron.

Labelling

Correct labelling is very important to buyers in the EU and can be a major point of frustration if done incorrectly. EU regulations on labelling such as those found in Regulation (EU) No. 1169/2011 primarily apply to pre-packaged food intended for sale directly to consumers.

Labelling information should be written in a language that is understood by the consumers of the destination country: for the EU, English is often used for this purpose. Importantly, English should always be used for transportation labels when shipping internationally. In addition, when applied to primary packaging, labels or any direct printing must not contain any toxic ink or glue.

Found below is a series of labelling elements found in EU regulations on labelling pre-packaged food. It is important to note that these are merely regulatory labelling aspects and the lists may not be exhaustive.

- Full name of the product and country of origin
- Full name and address of the manufacturer
- Name and address of the importer
- Net weight expressed in metric units (grams)
- Date of manufacture
- Date of expiration
- Lot number/batch number/bar code
- Product grade (if graded)
- Nutritional information
- Instructions or special conditions for storage or use
- Allergen information (e.g. if processed in facility that also processes nuts)
- Any treatments the food may have undergone (e.g. irradiated food must be labelled "irradiated" or "treated with ionising radiation")
- Certification logos (if applicable) and/or retailer logos (e.g. if the product is to be marketed under a private label).

Effective labelling goes far beyond these labelling elements and serves to differentiate a product and appeal to the customer. Its success depends on many other factors such as materials, design elements, different bar codes and QR codes that provide additional information to the consumer. Simply including the elements in this list is not sufficient for successful selling in a market. Labelling requirements of buyers often go beyond these elements and depend on expectations in the market. Please double check with buyers to ensure expectations are met (see Appendix VI for retail saffron labelling examples).

[37] European Commission (2018). *Food Contact Materials: Legislation*.

Traceability

Food products must be traceable within the European market as per Regulation (EC) No 178/2002, Article 18. Traceability is of paramount importance in the European Union market, as it is an indispensable tool for confronting the challenges of food safety. While exporters in trading partner countries cannot be legally required to fulfil traceability requirements imposed within the European Union, the requirement extends to the European importer, who must be able to identify from whom the product was exported in the third country. At a minimum, records should be kept of:

- Names and business addresses of anyone that supplies saffron;
- Names and business addresses of anyone to whom saffron is sold.

This is known as the 'one step back, one step forward' traceability approach. Saffron should not be received or sold unless the name and business address of the supplier/buyer has been identified and recorded. Each lot/batch of saffron supplied should be associated with its supplier, and records should indicate/track this.

A system should be in place whereby this information can be provided to authorities in the event it is requested. It is common practice for European Union buyers to ask trading partners to meet the traceability requirements even beyond the one step back-one step forward principle. However, these requests are part of contractual arrangements and are not legally required. [38]

Box 5 Additional reading for mandatory requirements in the European market

EU Factsheet on Food Contaminants:
https://ec.europa.eu/food/sites/food/files/safety/docs/cs_contaminants_factsheet_en.pdf

EU Factsheet on New rules on pesticide residues in food:
https://ec.europa.eu/food/sites/food/files/plant/docs/pesticides_mrl_legis_factsheet_en.pdf

EU Factsheet on Food Traceability:
https://ec.europa.eu/food/sites/food/files/safety/docs/gfl_req_factsheet_traceability_2007_en.pdf

EU guidance document: Key questions related to import requirements and the new rules on food hygiene and official food controls: https://ec.europa.eu/food/sites/food/files/safety/docs/ia_ic_guidance_import-requirements.pdf

European Spice Association Quality Minima document: https://www.esa-spices.org/download/esa-qmd-rev-5-update-as-per-esa-tc-26-03-18.pdf

European Spice Association Adulteration Awareness Document, July 2014: https://www.esa-spices.org/download/esa-adulteration-awareness-document2

CBI Product factsheet: Consumer packed spices and herbs:
https://www.cbi.eu/sites/default/files/market_information/researches/product-factsheet-consumer-packed-spices-herbs-europe-spices-herbs-2013.pdf

Key standards in Europe

A number of the following summaries of standards are sourced from the standards module of ITC's Sustainability Map website, which provides users with detailed information on hundreds of sustainability standards in terms of requirements, scope and certification processes in addition to offering self-assessments against standards. Please visit Sustainabilitymap.org to read more and to take advantage of these useful features.

[38] European Commission (2010). *Guidance on the Implementation of Articles 11, 12, 14, 17, 18, 19 and 20 of Regulation (EC) N° 178/2002 on General Food Law.*

Food safety standards

Many European buyers require adherence to HACCP as a guarantee of food safety. One way to ensure compliance with requirements related to HACCP is obtaining certification against an FSMS standard based on HACCP principles, such as ISO 22000. Read more about HACCP in Appendix II.

Some of the most popular private FSMS standards in the European market are FSSC 22000, IFS, SQF and BRC. All of the standards contain general management provisions covering GMP, GHP, GAP and HACCP systems and are benchmarked to the GFSI. Most buyers will have a preference for one system over the others, so make sure to discuss this with potential buyers before implementation. Certification against these standards can be sought from an accredited certification body. In Afghanistan, Société Générale de Surveillance (SGS) or DNV GL actively provide certification services.

IFS Food

IFS Food is a standard for auditing food product suppliers/manufacturers and therefore only concerns food-processing companies or companies that pack loose food products. IFS Food is to be used when a product is 'processed' or when there is a hazard for product contamination during the primary packing. IFS Food includes requirements concerning:

- Senior management responsibility
- Quality and food safety management systems
- Resource management
- Production processes
- Measurements/analysis /improvements
- Food defence.

The requirements give every company the chance to develop solutions that fit its own processes and needs. The objectives of IFS Food are: 1) to establish a common standard with a uniform evaluation system; 2) to work with accredited certification bodies and qualified IFS-approved auditors; 3) to ensure comparability and transparency throughout the entire supply chain; and 4) to reduce costs and time for both manufacturers and retailers.

Around 11,000 manufacturers use IFS Food and audits are conducted in 96 countries. For more information, please visit SustainabilityMap.org or visit the official website of the standard:
https://www.ifs-certification.com/index.php/en/standards/251-ifs-food-en

BRC Global Standard for Food Safety

British Retail Consortium (BRC) Global Standards is a leading safety and quality certification programme, used by more than 20,000 certificated suppliers in 90 countries, with certification issued through a worldwide network of accredited certification bodies.

The BRC Global Standard for Food Safety can be applied to any food-processing or packing operation where food is handled, processed or packed. This may range from primary products facilities such as fresh produce packhouses and slaughterhouses through to processed foods, canneries and high-risk ready-to-eat products.

The standard is divided into 7 chapters:

- Senior Management Commitment and Continual Improvement
- The Food Safety Plan (HACCP)
- Food Safety and Quality Management System
- Site Standards
- Product Control

- Process Control
- Personnel.

The BRC Global Standard for Food Safety is particularly relevant for the United Kingdom market, but is largely recognised everywhere. For more information, please visit SustainabilityMap.org or visit the official website of the standard: brcglobalstandards.com

Safe Quality Food Programme – SQF

The mission statement of SQF is to deliver consistent, globally recognized food safety and quality certification programmes based on sound scientific principles, consistently applied across all industry sectors, and valued by all stakeholders.

The most recent version of the SQF Code (edition 8) is intended for use by all sectors of the food industry from primary production to storage and distribution. The SQF Code is both a product and process certification standard the uses HACCP as its foundation. A key feature of the SQF Code is its emphasis on the systematic application of HACCP to identify, monitor and control food quality threats in the process. The SQF programme links primary production certification to food manufacturing, distribution and agent/broker management certification. Edition 8 is broken down into seven different standards:

- SQF Food Safety Fundamentals (not GFSI benchmarked)
- SQF Food Safety Code for Primary Production
- SQF Food Safety Code for Manufacturing
- SQF Food Safety Code for Storage and Distribution
- SQF Food Safety Code for Manufacture of Food Packaging
- SQF Food Safety Code for Food Retail
- SQF Quality Code (not GFSI benchmarked).

For more information, please visit SustainabilityMap.org or visit the official website of the standard: sqfi.com.

FSSC 22000

FSSC 22000 is based on the food safety management standard ISO 22000:2005. It covers the food safety systems of manufacturers that process or produce animal goods, perishable vegetal products, goods with a long shelf life, food ingredients including additives, vitamins and bio-cultures, and food packaging.

The FSSC 22000 scheme specifies detailed requirements for the food safety system of the organizations to be certified, the certification system of the certification bodies and the system of accreditation by the accreditation bodies.

One of the features of FSSC is that manufacturers that are already certified against ISO 22000 only need an additional review against the applicable technical specifications for sector-specific prerequisite programmes to fulfil FSSC 22000 certification criteria. The FSSC 22000 certification scheme was the first standard accepted by the European Cooperation for Accreditation.

FSSC 22000 includes provisions for transportation and onsite storage for all food manufacturers, regardless of size and complexity, profit-making or not, public or private. For more information, please visit SustainabilityMap.org or visit the official website of the standard: fssc22000.com/.

GLOBALG.A.P.

GLOBALG.A.P. is a non-profit organization whose mission is to work on the continuous improvement of GAP at farm level to ensure confidence in the safe and sustainable production of food for the benefit of consumers. GLOBALG.A.P. is a pre-farm-gate standard, which means that the certificate covers the process from farm inputs like feed or seedlings and all the farming activities until the product leaves the farm.

It is more than simply a food safety standard in that it aims to minimize the harmful environmental impacts of farming operations, reducing the use of chemical inputs and ensuring a responsible approach to worker health and safety. In this respect, it could also be thought of as a sustainability standard.

GLOBALG.A.P. is recognized in more than 100 countries and has more than 111,000 certified producers worldwide. GLOBALG.A.P. works with more than 142 independent and accredited certification bodies around the world to carry out certification. Some of the largest retailers in the world are members of GLOBALG.A.P.

GLOBALG.A.P. includes annual inspections of the producers and additional unannounced inspections by independent accredited certification bodies. Certifications can either be done on an individual farmer level or in farmer groups. It is a business-to-business standard, so no GLOBALG.A.P. logos or labels appear on certified products. For more information, please visit SustainabilityMap.org or visit the official website of the standard: globalgap.org.

Social and environmental sustainability standards

Sustainability issues may have once been a concern of niche markets within the European Union, but they are at the forefront of the food sector today. While following the sustainability practices outlined by buyers is often sufficient, some buyers may also require certification against a sustainability standard. Below are a few of the key sustainability standards in the European market.

EU Organic

Organic agriculture is a holistic production management system that respects natural life cycles and minimized human impact on the environment. For a product to be considered organic, the entire supply chain from growing to distribution and retailing has a role to play. The European Union has established rules on organic production, processing, distribution, labelling and controls.[39]

Regulation (EC) No. 834/2007 lays down principles, aims and overarching rules of organic production, and defines how organic products should be labelled. Some of the key requirements of organic production and processing relevant for saffron are:

- Minimized use of non-renewable energy and off-farm inputs
- Recycling of wastes and saffron by-products
- Corms used as inputs in organic production should themselves be organically produced.
- Tillage and cultivation practices that maintain and increase long-term soil health (e.g. periodic crop rotation)
- Minimize contamination of the environment
- Prevention of damage caused by pests, diseases and weeds shall rely primarily on protection by natural enemies, crop varieties, rotation, cultivation techniques and thermal processes
- General prohibition of synthetic chemicals on saffron crops, such as synthetic pesticides and fertilizers*
- Prohibition on mineral nitrogen fertilizers, instead using nitrogen fixing plants
- Prohibition on the use of genetically modified organisms (GMOs)

[39] European Commission Agriculture and Rural Development (2018). *Producing Organic*.

- Prohibition on the use of irradiation
- Prohibition of food additives
- Processing of saffron with care and without chemical methods
- Processing of organic saffron shall be separated in time and space from non-organic saffron.

* Some synthetic products are allowed in organic production, but only when there are no suitable alternatives. These products are placed on an approved list that can be found in the annexes of the implementing regulation, Regulation (EC) No. 889/2008.

Figure 13 Example of EU Organic logo with labels

AF-BIO-007
Non-EU Agriculture

Labelling
Foods can only be labelled organic if at least 95% of their agricultural ingredients meet the necessary standards. The list of ingredients shall indicate which ingredients are organic. Producers of packaged organic food have been required to use the EU Organic logo; however, this is not a binding requirement for organic foods from outside the European Union. Organic products imported from third countries may display the logo, but are not legally obliged. If used, European Union legal provisions must be respected. Also, the code number of the certification body must be placed in the same visual field as the EU Organic logo, and 'non-EU Agriculture' should appear directly below the code number.

Code numbers have the format AB-CDE-999, where 'AB' is the ISO two-character code for the country where the certification takes place. 'CDE' is a term establishing a link with organic production (e.g. BIO, ECO or ORG) and '999' is the attributed reference number composed of one to three digits. Also, national and private labels may be displayed next to the EU Organic label. All other labelling requirements must be in line with European Union regulations for labelling.

Storage and transport
Storage areas for organic products need to be managed in a way that ensures identification of lots and avoids mixing with non-organic products. Organic goods must only be transported to other operators or units in appropriate packaging or containers closed in such a manner the organic content cannot be substituted without manipulation or damage of a seal.

Certification
Organic products from countries outside the European Union can only be distributed in Europe if they are produced and inspected under conditions that are equivalent to those applying to organic producers in the European Union. Certification bodies outside the European Union are directly authorized and monitored by the European Commission and European Union countries.

This allows the European Commission to supervise the import of organic goods and the checks carried out on organic guarantees. An electronic certificate of inspection issued by authorized certification body must accompany imported consignments from countries outside of the European Union. Authorities at the point of entry will verify the validity of the certificate before the goods go to customs for final clearance.

Entry into a fully certified organic system can take years. For example, all production rules are to be applied during a conversion period of at least three years before the first harvest of organic products. However, price premiums associated with organic foods can range from 10%–35%. The market for organic products is less congested and can result in higher brand loyalty from consumers.

New rules

From 1 January 2021, new rules will be enforced regarding organic production and the labelling of organic products. The changes are made to 'equip a fast-growing sector with clear and stable rules, and to allow organic producers to compete fairly, independently whether they produce in the EU or in a third country.'[40] For more information on organic foods and organic saffron:

CAC's *Guidelines for the production, processing, labelling and marketing of organically produced foods:* http://www.fao.org/docs/eims/upload/230124/CXg_032e.pdf

ABAC Holland Training Manual for Organic Saffron: http://abacholland.com/wp-content/uploads/2012/09/Handout-Saffron-compleet-1.pdf

Fairtrade International

Fairtrade provides producers with access to a fast-growing market segment that is highly recognized by consumers in the global North. Fairtrade standards are designed to tackle poverty and empower producers in the poorest countries in the world. The standards apply to both producers and traders. Fairtrade standards are developed through a collaborative and voluntary process by members, farmers, industry, scientists and advisers from the private and public sectors.

Fairtrade focuses on bettering the lives of those who produce Fairtrade-certified products. One of the principles of Fairtrade is a guaranteed minimum price paid to producers as well as a premium. This helps to ensure a decent living for smallholders and to develop farming communities. Minimum prices and premiums for different products can be viewed on the Fairtrade website.

Fairtrade has different standards depending on the position in the supply chain. Firstly, there is the Fairtrade Small Producer Standard for Herbs, Herbal Teas and Spices for smallholder farmers. Then, there is the Fairtrade Standard for Hired Labour, which applies to organizations that employ hired labour to supply Fairtrade-certified products. Alternatively, there is the Fairtrade Trader Standard, which applies to traders who buy and sell Fairtrade products or who handle the Fairtrade price and premium. For more information, please visit SustainabilityMap.org or visit the official website of the standard: fairtrade.net

Sustainable Spices Initiative

The stated mission of the Sustainable Spices Initiative is to sustainably transform the mainstream spices sector, thereby securing future sourcing and stimulating economic growth in producing countries. Rather than create a new standard, the initiative chose to create a 'basket' of existing standards that can be considered 'gold standards' for business-to-business and business-to-consumer trade. The standards are judged on their content, credibility and effectiveness.

The Sustainable Spices Initiative has partnered with ITC to offer a customized tool that provides information on the selected standards and codes of conducts addressing sustainability issues in the spice supply chain. This tool can be accessed at standardsmap.org/ssi/.

Product-specific standards

Buyers will likely be the most important source for requirements related to saffron-specifications. Most buyers have established quality parameters that are communicated in the form of a technical specification sheet. Detailed specifications should be requested from buyers.

[40] http://www.consilium.europa.eu/en/press/press-releases/2018/05/22/organic-farming-new-eu-rules-adopted/pdf

The Quality Minima Document published by the ESA, while not a standard in the traditional sense, is a leading document for national spice associations in Europe and thus for most buyers in European markets. It serves as the basis for many buyers' requirements. Read more about the Quality Minima Document earlier in this chapter or at the ESA website: esa-spices.org

ISO standards for saffron and saffron powder, such as ISO 3632-1:2011 and ISO 3632-2:2010, are widely used in the European market, whether alone or as the basis for individual buyer specifications. Many saffron buyers have developed their own standards that go beyond those of the ISO standards, either in terms of saffron specifications, advanced testing methods, or both. Read more about ISO 3632 in Chapter 2.

Market preferences, trends and buyers' requirements in Europe

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Trends and preferences

Health

European consumers are becoming increasingly averse to the use of chemicals or pesticides on the food they eat. Many studies have drawn a correlation between lifetime exposure to pesticides and health. Even though the European Union sets regulations on MRLs in a way that has lifetime exposure in mind, many consumers want to avoid them altogether.

Organic foods are produced without the use of synthetic chemicals or fertilizers and are thus seen as more appealing to a significant percentage of European consumers. The European organic market has grown at an impressive and steady rate, and no end seems to be in sight. The value of the market and per capita consumer spending on organic food more than doubled from 2007–16. European countries account for the highest share of organic food sales as a percentage of their respective food markets.[41] The EU Organic standard is the key standard in the European market.

Many European consumers are also shifting away from synthetic flavourings or colourings in favour of natural ones. Saffron offers many benefits as a natural ingredient for colour or flavouring. Gluten allergies are also a growing problem in Western markets, and gluten-free labelling offers assurance to consumers that consuming saffron will not affect their well-being. Moreover, alternative uses of saffron are on the rise in the European market. While most saffron is consumed in stigma or powder form, a growing proportion is used in medical and cosmetic industries, as the health benefits of saffron become more widely known. Chapter 4 contains more information on alternative uses of saffron.

Sustainability

Given the unique and high-value nature of saffron, it makes a lot of sense to position the spice in the high end of the market. One of the major trends in the high-end food market is sustainability, whether relating to

[41] The Research Institute of Organic Agriculture, FiBL (2018). *European organic market grew by double digits and organic area reached 13.5 million hectares in 2016.* News archive. 14 Feb.

environmentally friendly production processes, sound labour practices, health and safety, or community development. In fact, sustainability issues are so important to some consumers that they outweigh other saffron quality factors such as colour, taste or aroma.

Sustainable practices adopted along the supply chain can go a long way to differentiating a product from others and opening new market opportunities. Many buyers actually value sustainability to such a degree that it has become a key factor or even prerequisite in purchasing decisions.[42] Several voluntary sustainability standards are common for spices in European markets, such as Fairtrade, GlobalG.A.P. and the Sustainable Spices Initiative basket of standards.

Transparency
European consumers generally like to know the source of the food they eat, how it is produced and where it has been. Traceability technologies are making it easier for companies to provide this information to consumers. 'Farm to fork' schemes make it possible for consumers to track the food they eat all the way back to the farm where it was produced, in some cases to the very plot of land or individual tree that bore the fruit.

Quick response (QR) codes are often present on food product labels that allow a consumer to scan the code with a smart phone and find more information about the origin or ingredients of the food on a linked website. QR codes are a good way to tell a story about the product or the people who produce it to the consumer, which can help build brand identity and customer loyalty and serve to differentiate a product from the competition. Moreover, given the small size of saffron packaging, QR codes are a good way to communicate more information that simply cannot fit on the label.

Convenience
As Europeans live increasingly busy lives they have less time to cook. Some consumers may prefer to cook with spices that are more convenient to use. Powdered saffron or even liquid saffron tend to be easier to cook with, as they can be accurately measured and added to food with ease. Packaging also plays a large role in the convenience of a product. Easy-to-use packaging, such as that with built-in measuring or dispensing mechanisms, may be desirable for some consumers.

To read more on trends and preferences in the European spice market, please read the Centre for the Promotion of Imports from developing countries (CBI) market information reports on exporting spices and herbs to Europe: https://www.cbi.eu/market-information/spices-herbs/

Buyers' requirements

The European saffron market is not easy to enter, largely because of strict buyer requirements. European buyers, especially those in the retail sector, expect very high-quality saffron. Many have moved beyond the ISO-3632 standard; either in terms of the product specifications they require or in terms of the advanced testing methods they use to determine these parameters. The ISO standard remains very important as a baseline standard. Quality is the key to the European market. Buyers are willing to pay premium prices for top-quality saffron; however, accessing these buyers hinges on a very strong reputation and trust that can take time to develop

Food safety
In terms of food safety, this means an extremely low tolerance of the contaminants outlined in food safety regulations, such as pesticide residues, aflatoxin, heavy metals and microbiology. Some buyers may have zero tolerance for metal contaminants. For microbiology, buyers will generally test for salmonella, coliforms such as E-coli and moulds/yeasts, and they also have a limit established for a total viable count (a sum of all colony-forming bacteria).

Saffron is expected to be entirely free of GMOs and allergens and without the use of irradiation. Steam sterilization should not be used in lieu of irradiation, as it is detrimental to saffron quality. There is no need

[42] Centre for the Promotion of Imports from developing countries, CBI (2018). *Exporting spices and herbs to Europe.* Market Information.

for irradiation or steam sterilization treatments when good agricultural, manufacturing and hygiene practices are followed along the supply chain.

Certification against an FSMS standard based on the principles of HACCP can be a good option to provide assurances to buyers that requirements concerning contaminants will be met. This is a general requirement of European Union buyers who do not like to take chances with food safety risks. Several HACCP-compliant FSMS standards can be adopted and implemented, but an organization can also choose to use/develop its own unique HACCP-compliant FSMS.

Food adulteration remains a top concern for European buyers, as evidenced by the resources invested to developing superior detection methods. There should be a complete absence of additives such as artificial colourings or fillers. Buyers' quality departments tend to assert that any trace of colour is a sign of cheating, and will reject a consignment where it has been detected. This is important, because colours can sometimes transfer to saffron not through intentional deception, but rather through physical contact with the spice. For example, workers wearing coloured gloves can transfer dye from their gloves to the delicate saffron. Therefore, colour fabrics should not be used at any point in the supply chain. Read more about saffron adulteration in Chapter 3.

Product characteristics and performance
Given the tendency of European buyers to go beyond the ISO standard, product characteristics should at least be in line with ISO standard grade I. Major saffron companies such as the Italian-based company Aromatica SRL, has established its own process of quality control through research collaboration with the Faculty of Agriculture of the University of Milan. Staff perform advanced controls, more detailed than those described in the ISO standard. This new testing protocol along with the intensive research and monitoring of quality control activities has resulted in Aromatica achieving the product certification 'Process Control' under the supervision of the certification body SGS (see Appendix VII for the saffron technical sheet of Aromatica SRL, which outlines the specifications that they require).

High-quality saffron for the European market should contain crocin absorbance levels exceeding 220nm, picrocrocin absorbance levels exceeding 80nm, and safranal levels should always be within the 20nm–50nm range. Generally speaking, the presence of styles is an unwelcome inclusion unless requested by buyers, and they should not be present if processing stigma into powdered saffron. Because they contain no sensory value, their inclusion brings down the crocin, picrocrocin and safranal values obtained during chemical and physical analysis.

It is almost impossible to guarantee a complete absence of extraneous matter in saffron. Nonetheless, levels of extraneous matter present should be extremely low, around 0.1%. There is generally no tolerance for certain extraneous matter such as hair, glass and metal. Hair must be carefully controlled for in a human labour-intensive product like saffron. Very strict hygiene procedures in both harvest and processing activities need to be followed. Read more about the characteristics of top quality saffron in Chapter 1.

Packaging
Buyers' requirements for packaging will differ substantially depending on whether saffron is exported in bulk or as pre-packaged saffron for direct to consumer sale (consumer-ready packaged saffron). Entry into the consumer-ready packaged saffron market requires significant investment in processing and packing facilities. Usually, buyers will communicate what they expect in terms of packaging format.

The CBI Product Factsheet on consumer-packed spices and herbs in the European Union offers examples of common packaging for spices and herbs[43].

These include but are not limited to:

- Glass bottles with metal or plastic caps with inbuilt features of tamper evidence, dispensing, etc. (popular in high-end markets)
- Printed plastic flexible pouches, polyester and biaxially oriented polypropylene-based laminates are especially popular

[43] Centre for the Promotion of Imports from developing countries, CBI (2014). *CBI Product Factsheet: Consumer-packed spices & herbs in the EU.*

- Printed tinplate containers with or without dispensing systems
- Plastic and composite containers with plugs and caps with dispensing and tamper evidence features
- Lined cartons.

Well-designed, professional packaging is extremely important for consumer-ready packaged saffron. The look and feel of packaging is important in a very competitive market. Packaging should be convenient in design and easy to use. Consumers are highly influenced by the attractiveness of packaging and often make purchasing decisions based on packaging that stands out from the crowd. If the choice is made to export consumer-ready packaged spices, communicating with potential buyers on what they expect is critical. Many saffron buyers in the European Union prefer to use European packers, so saffron is often exported to the European Union in bulk packages. See Chapter 2 for more information on common bulk packaging.

Labelling
Aside from communicating key information to the consumer, labels are also an important factor in attractive packaging. Establishing a consistent look and feel to labels for different packaging sizes is necessary to develop an identity as a company. Buyers may request that certain certifications (if obtained) are stipulated on the label, as well as other aspects such as directions for use or cooking guidelines. Traceability codes are commonplace while QR codes that allow consumers to view more information online about the product are increasingly prevalent.

It is also very important that buyers have all the information that they need about saffron they intend to purchase. Comprehensive product specifications must be provided quickly to potential buyers when requested, including full descriptions of available products, results of laboratory analysis, grades or certifications obtained.

Traceability
Many European buyers will expect full traceability for any saffron that they buy. 'Farm-to-fork' traceability is becoming more prevalent in the European Union as consumers want to know from where the food they consume originates. One way to achieve full traceability is by using a coding system for individual lots or batches that is traceable back to the origin location. For example, a processor that receives saffron from multiple growers can help facilitate traceability by packing one grower's saffron at a time. This way, one batch of saffron will run through the packing process accompanied by a receipt that connects it to the grower. A unique bar code is placed on the package at the end of the line, so that the saffron has official identification tracing back to that particular grower as it travels to different locations.

Building relationships
European Union buyers prefer to form long-term relationships with suppliers. These relationships can only develop if suppliers are consistently able to provide the quantity and quality of product desired. It is very likely that buyers will already have established relationships with their existing suppliers, so it will require a lot of effort to convince them to change.

Guarantees in the form of certifications to FSMS standards, ISO 9001, or grade I quality certifications according to ISO-3632 can go a long way to make buyers comfortable with a new supplier. Niche markets such as organic certifications, Fairtrade or other sustainability standard certifications can shrink the competitive landscape in terms of sheer numbers, and perhaps can facilitate inroads with premium spice retailers.

Niche markets can also be less demanding in terms of volume requirements, making them more fitting for smaller producers. Price premiums can be gained in niche markets, as buyers know that customers will pay for peace of mind. There are a number of trade shows throughout Europe where participants can showcase their products to potential buyers.

Box 6 Trade shows in the European market

Anuga 10 Trade Shows in One in Cologne, Germany - http://www.anuga.com/anuga/index-2.php

SIAL Food Innovation Exhibition in Paris, France - https://www.sialparis.com/

Natural & Organic Products Europe in London, England - https://www.naturalproducts.co.uk/

Biofach Trade Fair for Organic Food in Nuremberg, Germany - https://www.biofach.de/

Fi (Food Ingredients Global) brings together the world's buyers and sellers of food ingredients at numerous events around the world: https://www.figlobal.com/

EventsEye is a database of over 10,000 trade shows happening around the world. Events can be separated by theme, date or location for increased relevancy: https://www.eventseye.com/fairs/trade-shows-by-theme.html

Meet the re-exporters: Spain, Italy, France

It is important to realize the extent to which large importers and resellers in Spain, Italy and France control global distribution of saffron. These re-exporters capture nearly all of the added value due to their advantages in packaging, branding and distribution. Afghanistan should not only look to build relationships with buyers in these three countries through proven consistent supply of high-quality saffron, but also view their success as testament to the advantages of upgrading packaging capacity and strong branding.

Spain

Spain and saffron share a rich history. Spain has long been an important producer of saffron, and even though most saffron exported from Spain is actually grown elsewhere, its reputation as a high-quality source of the spice remains very strong. A significant majority of saffron produced in Spain is grown in the provinces of the Castilla-La Mancha region – a large plateau not far from Madrid that has a reputation for producing some of the best saffron in the world. Saffron from the La Mancha region is a protected name of origin.

Saffron is consumed in Spain primarily in stigma form. Saffron is the key ingredient in many Spanish recipes, including the most widely known dish, paella (although nowadays food colouring is frequently used in its place). In the La Mancha region, saffron is used in everything from Spanish-style tortilla omelettes and meat dishes to raisin cakes. Another regional product, Manchego cheese, is also flavoured with saffron.

Spain is the second-largest exporter of saffron behind the Islamic Republic of Iran. However, most of this is not actually production, but rather Iranian saffron processed, packaged and branded in Spain that is counted as Spanish exports. In fact, saffron production in Spain is actually declining due to rising wages and the labour-intensive nature of saffron farming.

The strength in the sector belongs to Spanish companies that are known to have very advanced grading, processing and packaging capabilities. Significant value is added during these stages, all of which goes to these Spanish companies. This is added value that could be gained by the Afghan saffron sector if the necessary improvements to processing capabilities were made.

Afghan saffron exports to Spain peaked in 2013 at $611,000 and have steadily declined since. This is partly due to the easing of sanctions on the Islamic Republic of Iran, which led to the gradual substitution of Iranian saffron imports for Afghan ones due to a greater knowledge of regulatory requirements of the European market. There were also instances of salmonella and E-coli contamination in some saffron consignments from Afghanistan.[44] Given Spain's current dependence on Iranian saffron, any political developments that end in reinstated or new sanctions on Iran could mean significant diversification of supply, and opportunities for Afghan saffron to fill the void.

In the recent past, Spain used its own grading system, established decades ago. The Order of 30 June 1988 on Quality Standards for Foreign Trade of Saffron established the general technical and quality conditions

[44] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

that saffron must meet for foreign trade. While not officially used today due to the organization of a common market for European Union agricultural products as well as the increasing preference for international standards, the terminology is still used occasionally on the Spanish market.

The standard sets forth requirements for five grades of saffron plus powdered saffron. The grade 'select' was originally called 'Mancha'. However, to distinguish saffron that comes from the La Mancha region from a commercial grade, the title was removed and replaced with the more general term 'select'. Table 8 outlines these Spanish saffron grades.

Table 8 Saffron grades according to Spanish quality standards

Grade	Visual Characteristics	Colouring Strength	Floral Matter (max)	Moisture and Volatile Matter (max)	Total Ash % (max)	Acid-Insoluble Ash% (max)	Ethereal Extract % (max)
Coupé	Stigmas only, no styles present. Presents a characteristic red colour	≥ 190 nm		15%	8%	2%	14.5%
Select	Stigmas are longer than styles, presenting an intense red colour	≥ 180 nm	≤ 4%	15%	8%	2%	14.5%
Rio	Stigmas and styles have similar length, presenting a red colour	≥ 150 nm	≤ 7%	15%	8%	2%	14.5%
Sierra	Stigmas are shorter than styles, presenting a reddish-yellow colour	≥ 110 nm	≤ 10%	15%	8%	2%	14.5%
Standard	Saffron composed of a mixture of Select, Rio and Sierra grades	≥ 130 nm	≤ 7%	15%	8%	2%	14.5%
Molido	Powdered saffron resulting from grounding one of the other grades. Must be labelled as requisite grade.	Match grade	Match grade	8%	Match grade	Match grade	Match grade

Source: Agencia Estatal Boletin Oficial del Estado. *Orden de 30 de junio de 1988 sobre Normas de Calidad del Comercio Exterior del Azafrán.*

Italy

After Spain, Italy is the second-largest European exporter of saffron. It also has a rich history of saffron production driven by high demand for the spice in Italian cuisine. Italy is the second-biggest European importer of saffron as well. Over the years, Italy has become a major re-exporter of saffron, although it is not known just how much of the saffron it imports ends up being processed, rebranded and re-exported. Italy mainly re-exports the spice to Switzerland, Germany and the United States.[45]

Saffron is also grown in Italy; however, the proportion of domestically grown saffron to total volume is quite small. Similar to other European countries, domestic production is decreasing due to rising wages and the labour-intensive nature of saffron harvesting. Some of the highest-quality saffron comes from the Abruzzo region in Italy. Like saffron from the La Mancha region of Spain, Abruzzo saffron is a protected name of origin. However, the area of domestic cultivation in the Abruzzo region is limited to eight hectares of land, which is very small compared to the 430 hectares devoted to saffron cultivation at the turn of the last century.[46]

Afghan saffron exports to Italy were increasing rapidly until 2012, when they began to drop precipitously due to sanitary and phytosanitary issues with the products, as well as concerns about quality levels and

[45] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

[46] Delicious Italy (2010). *Story of Saffron Production in Abruzzo.* 9 Sep.

traceability. Efforts should be made to overcome these concerns by developing strong relationships with Italian buyers and providing consistently high-quality saffron, as Italy is a very desirable market due to its wide trade network and high saffron demand in Italian cuisine.[47]

One of the most famous Italian dishes using saffron is Milanese saffron risotto. The spice is also used to produce strong aromatic liquors that are popular in some parts of Italy. A popular product and consumer packaging format for saffron in Italy is saffron powder in paper sachets. These individual sachets of saffron look a lot like sugar packets that one would use for morning coffee. Each sachet is around 5 x 7 centimetres in size and contains around 0.1 g of saffron powder. Please see Appendix VII to view a major Italian buyer's technical sheet, which outlines bulk-packaging requirements.

France

France is also a re-exporter of saffron, although not to the same degree as Spain. In 2016, 72% of the saffron imported into France was consumed domestically, while re-exports went to Portugal, Belgium and Saudi Arabia. Growth of saffron imports averaged 5% from 2012–16. Afghan exports to France increased at a much higher average annual rate of 116% over the five-year period, reaching a total value of $1.2 million in 2016.[48]

Saffron corms were originally introduced in France during the Middle Ages, but production only experienced a renaissance in the 1980s. In 1987, a group of saffron farmers in Gâtinais purchased 50,000 corms from the Kashmir region in India. Much of the saffron grown today around Gâtinais originates from this initial influx of Kashmir corms.[49] Saffron is grown in many other regions across France, such as the Normandy region and the former province of Quercy. Yet, domestic production is very limited and is mostly dedicated to tourist sales and select e-commerce sales. France continues to rely on imports to meet domestic demand.

Saffron is used as a key ingredient in a number of French dishes including the famous French bouillabaisse, a fish stew that uses saffron as a key ingredient. High-quality saffron has become an experimental ingredient for many top French chefs, who tend to recommend the use of whole saffron stigma and not saffron powder. When cooking, they generally recommend soaking the stigmas for at least four hours in hot water or stock and then adding them to the dish not long before serving, as simmering diminishes the flavour of the saffron.

Similarly to other European countries, grading and testing in a qualified laboratory are important for saffron destined for the French market. The use of ISO 3632 (Parts I & II) as a baseline standard is widespread for determining saffron quality, and buyers will also expect use of an FSMS based on HACCP principles.

[47] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

[48] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

[49] France Agroalimentaire (2017). *French saffron – the spice earning its rightful place in our foods.* 19 Jan.

India: Afghanistan's largest market

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Saffron truly is part of India's cultural identity. After all, the national flag features the colour saffron, which indicates strength and courage. India is the second-largest producer of saffron in the world behind the Islamic Republic of Iran, although most of this is consumed domestically, as its exports are only ranked 12th. Although most of the saffron grown in India is consumed there, production levels are still insufficient to meet demand.

In 2016, India imported $14.9 million in saffron, making it the world's fourth-biggest importer. Explosive economic growth has made saffron accessible to more consumers from middle and high-income household. Indian saffron demand averaged annual growth of 23% from 2012–16.

Afghanistan has had remarkable success penetrating the Indian saffron market: of the $14.9 million imported in 2016, $14 million came from Afghanistan. This is very different from 2012, when India was not even among the top 10 importers of Afghan saffron.

Going forward, the Indian market will be a strategic market for Afghan saffron. To better cater to the market, production volumes should be increased to allow for consistent and stable bulk shipments. Business relationships should be strengthened to minimize the occurrence of tariff-avoiding illegal smuggling. Focus should also be directed towards improving packaging methods and branding to improve opportunities in the wholesale and retail sectors.[50]

Box 7 Key regulations and product standards in the Indian market

- Food Safety and Standards Act, 2006
- Food Safety and Standards Rules, 2011
- Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011
- Food Safety and Standards (Food Product Standards and Food Additives) Regulation, 2011
- Food Safety and Standards (Packaging and Labelling) Regulation, 2011
- Food Safety and Standards (Laboratory Sampling and Analysis) Regulation, 2011
- Food Safety and Standards (Food Recall Procedure) Regulation, 2017
- Legal Metrology (Packaged Commodities) Rules, 2011
- Plant Quarantine (Regulation of Import into India) Order, 2003
- Prevention of Food Adulteration Act, 1954
- Food Safety and Standards (Organic Foods) Regulations, 2017
- Food Safety and Standards (Food or Health Supplements, Nutraceuticals, Foods for Special Dietary Uses, Foods for Special Medical Purpose, Functional Foods and Novel Food) Regulations, 2016.
- AGMARK Saffron Grading and Marking Rules, 2012
- Bureau of Indian Standards: IS 5453-1: Saffron, Part 1: Specification
- Bureau of Indian Standards: IS 5453-2: Saffron, Part 2: Methods of Test.

Mandatory requirements in India

Food safety

The Food Safety and Standards Authority of India (FSSAI) sets maximum limits on different contaminants to ensure food safety in India. As per FSSAI regulations, a 'crop contaminant' is any substance that is not intentionally added to food, but rather is inadvertently added during production, manufacturing, processing,

[50] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

preparation, treatment, packaging, transport or storage as a result of environmental contamination. These contaminants include potentially harmful substances such as pesticides/insecticides residues, heavy metals, naturally occurring toxic substances such as mycotoxins and microbiological organisms.

Pesticide residues

MRLs are set within Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011. The limits are set for specific foods or food categories. No limits are established specifically for saffron; however, the following limits are set for the food category 'spices' into which saffron would fall. Saffron exported to India shall not contain pesticide residues in excess of the quantities stated in Table 9.

Table 9 Pesticide MRLs, spices - India

Name of Pesticide	Food	Tolerance Limit (mg/kg or ppm)
Inorganic bromide*	Spices	400.0

Source: Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011.
* determined and expressed as total bromide from all sources.

In the absence of an established MRL, authorities from the Ministry of Health and Family Welfare generally refer to MRLs established within the Codex Alimentarius, as long as the pesticide in question has not been banned by India. The Codex Alimentarius has established the MRLs seen in Table 10 for the food category 'spices' (HS 0093).[51]

Table 10 Codex Alimentarius MRLs, spices

Pesticide	MRL	Year of Adoption
Acephate	0.2 mg/kg	2005
Azinphos-methyl *	0.5 mg/kg	2005
Bromide Ion	400 mg/kg	
Dichlorvos	0.1 mg/kg	2005
Disulfoton *	0.05 mg/kg	2005
Hydrogen phosphide	0.01 mg/kg	
Methamidophos	0.1 mg/kg	2005
Permethrin	0.05 mg/kg	2005
Vinclozolin	0.05 mg/kg	2005

Source: Codex Alimentarius Commission (2018*). Pesticide Database, HS 0093 Spices*
* Denotes a pesticide that has been refused registration in India, but is not yet on the list of banned substances. For a list of pesticides that are banned, refused registration and restricted in use within India, please visit the Central Insecticides Board and Registration Committee website at http://ppqs.gov.in/divisions/cib-rc

Metal contaminants

Limits on metal contaminants are set within Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011. No limits are established specifically for saffron; however, there are limits set for the food category 'spices' as well as the categories 'foods not specified', 'other foods', and 'all foods' into which saffron would fall. Thus, saffron exported to India shall not contain quantities of metal in excess of those shown in Table 11.

[51] Codex Alimentarius Commission (2018*). Pesticide Database, HS 0093 Spices*.

Table 11 Metal contaminant limits, relevant food categories – India

Contaminant	Article of food	Parts per million (ppm) by weight
Lead	Tea, dehydrated onions, dried herbs and *spices*, flavourings, alginic acid, alignates, agar, carrageen and similar products derived from seaweed	10.0 on the dry matter
Copper	Foods not specified	30.0
Arsenic	Dried herbs, finings and clearing agents, solid pectin all grades, *spices*	1.1
Tin	Foods not specified	250.0
Cadmium	Other foods	1.5
Mercury	Other foods	1.0
Methyl mercury	All foods	0.25

Source: Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011

Naturally occurring toxic substances

Limits on naturally occurring toxic substances are set within Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011. No limits are established specifically for saffron; however, there are limits set for the food category 'spices' into which saffron would fall. For saffron, aflatoxin is a harmful mycotoxin that is controlled for, and levels present must not exceed that listed in Table 12.

Table 12 Mycotoxin limits, spices - India

Name of contaminant	Article of food	Limit – micrograms/kg (ppb)
Aflatoxin	Spices	30.0

Note: ppb: parts per billion.
Source: Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011.

Microbiological contaminants

The microbiological parameters for different spices are found in Food Safety and Standards (Food Product Standards and Food Additives) Regulation, 2011. For saffron, there is a stated requirement for the absence of salmonella bacteria, which is found in Table 13.

Table 13 Microbiological parameters, saffron – India

Contaminant	Article of Food	Parameter
Salmonella	Saffron	Absent in 25g*

Source: Food Safety and Standards (Food Product Standards and Food Additives) Regulation, 2011.
* When testing for salmonella, the following methods are used by authorities: IS 5887-3 and ISO 6579-1.

Other contaminants

Limits on other contaminants are set within Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011. No limits are established specifically for saffron; however, there is a limit set for the food category 'other foods' into which saffron would fall. In this case, the contaminant is melamine, a nitrogen-based compound sometimes found in food contact materials made from plastic. Traces of the substance shall not exceed the level stated in Table 14.

Table 14 Other contaminant limits, relevant food categories, India

Name of the contaminant	Food	Maximum level (mg/kg)
Melamine	Other foods	2.5

Source: Food Safety and Standards (Contaminants, Toxins and Residues) Regulation, 2011.

Food additives

Saffron and saffron powder should not contain any food additives. For example, added colouring matter, dyes or preservatives, or substitution of an inferior substance, would render the product adulterated from its pure form and unfit in terms of quality.

Irradiation

Under the Atomic Energy (Radiation Processing of Food and Allied Products) Rules, 2012. no facility can irradiate food without the approval of the Department of Atomic Energy in India. Thus, any irradiation of products would only occur after arrival in India, and at the behest of the buyer. That said, spices are one of the foods approved for irradiation (see the dosage limits in Table 15).

Table 15 Approved dosage of radiation for spices – India

Food Product	Dose Limits of Radiation – kGy (kilogray)			
Dry vegetables, seasonings, spices, condiments, dry herbs and their products, tea, coffee, cocoa and plant products	For microbial de-contamination		For insect disinfestation	
	Minimum dose	Maximum dose	Minimum dose	Maximum dose
	6.0	14.0	0.3	1.0

Source: Atomic Energy (Radiation Processing of Food and Allied Products) Rules, 2012.

Controls at the point of entry

According to Food Safety and Standards (Laboratory and Sampling Analysis) Regulation, 2011, once a consignment arrives in India, it may be selected for sampling and testing by customs authorities working with FSSAI officials to ensure that the food complies with Food Safety Standards Regulations. If selected for sampling and testing, two separate samples may be drawn from the consignment and sent to a food analyst at a notified laboratory.

If the sample is shown to comply with regulations, customs authorities can proceed with clearing the consignment for entry into India. However, if the first sample drawn from the consignment reveals the presence of contaminants that can pose a serious hazard to the safety and health of the consumer, the food analyst will inform an authorized official, who may refer the second sample to a referral laboratory for retesting to confirm the findings of the notified laboratory. If the second sample is also found to be hazardous, both the samples as well as all of the imported articles of food related to the sample will be refused entry into India (i.e. either destroyed or re-exported to the country of origin by the food importer).

According to Food Safety and Standards (Import) Regulations 2017, a general visual inspection will be made at the port of entry. Inspectors will determine whether the articles of food were stored in clean and hygienic conditions and were free of living/dead/fragments of insects, rodent contamination, moulds, unwanted odour taint or mustiness, or any other substance that can influence the safety of the food. For saffron, the size of the two samples that may be drawn and sent to a laboratory are seen in Table 16.

Table 16 Standard sample size drawn from consignment at port of entry, saffron – India

Article of Food	Approximate quantity to be supplied
Saffron	20g

Source: Food Safety and Standards (Laboratory and Sampling Analysis) Regulation, 2011.

Plant health

India has legislation in place to prevent the introduction and spread of harmful organisms. According to the Plant Quarantine Order, 2003: 'No consignment shall be permitted import unless accompanied by an original phytosanitary certificate issued by an authorized officer at the country of origin.' Thus, for a consignment to be accepted at the port of entry in India, it must be accompanied by a phytosanitary certificate guaranteeing that the consignment is not capable of introducing pests, weeds or diseases that could harm humans, plants or animals in the importing country.

The phytosanitary certificate must be issued by an authorized official in the country of origin. Generally, the authorizing body will be the plant quarantine department of the NPPO (see Chapter 2 for phytosanitary certificates in Afghanistan).

Upon arrival at the port of entry in India, consignments may undergo a physical inspection. According to the Plant Quarantine Order, no consignment of plant products that is found to be infested or infected with a quarantine pest or contaminated with noxious weed species will be approved for import. If found free from quarantine pests and noxious weed species, offloading of the consignment will be permitted. If pests are detected during an inspection, the importer must arrange for fumigation or disinfestation of the consignment.

Product characteristics and performance

Food Safety and Standards (Food Product Standards and Food Additives) Regulation, 2011, lays down the minimum requirements that saffron and saffron powder must meet in terms of product definition, extraneous matter, floral waste, moisture, volatile matter, ash content, solubility, flavour, aroma, colour, nitrogen and crude fibre content. Any saffron or saffron powder must satisfy these minimum requirements even to be considered for purchase by Indian buyers.

Ultimately, buyers in the Indian market will decide whether the quality characteristics of saffron should meet or exceed the parameters listed in Table 17. Thus, it is vital to determine buyers' requirements (see Table 2 for descriptions of these characteristics).

Table 17 Minimum requirements – Product characteristics and performance, saffron – India

Saffron stigma means the dried stigmas or tops of styles of Crocus Sativus Linnaeus. Saffron powder means the powder obtained by crushing dried stigmas of Crocus Sativus Linnaeus. It shall be dark red in colour with a slightly bitter and pungent flavour, free from foreign odour and mustiness. It shall be free from mould, living and dead insects, insect fragments, rodent contamination. The product shall be free from added colouring matter. It shall conform to the following standards:		
Characteristic	**Stigma**	**Powder**
Extraneous matter	Not more than 1.0% by weight	No value given
Floral waste	Not more than 10.0% by weight	No value given
Moisture and volatile matter at 103±°C	Not more than 12.0% by weight	Not more than 10.0% by weight
Total ash on dry basis	Not more than 8.0% by weight	Not more than 8.0% by weight
Acid-insoluble ash on dry basis	Not more than 1.5% by weight	Not more than 1.5% by weight
Solubility in cold water on dry weight basis	Not more than 65%	Not more than 65%
Bitterness expressed as direct reading of absorbance of picrocrocin at 257nm on dry matter basis	Not less than 30	Not less than 30
Safranal expressed as direct reading of absorbance at 330nm on dry matter basis	Not less than 20 and not more than 50	Not less than 20 and not more than 50
Colouring strength expressed as direct reading of absorbance of crocin at 440 nm on dry matter basis	Not less than 80	Not less than 80

Total nitrogen on dry basis	Not more than 2.0% by weight	Not more than 3.0% by weight
Crude fibre on dry basis	Not more than 6.0% by weight	Not more than 6.0% by weig ht

Source: Food Safety and Standards (Food Product Standards and Food Additives) Regulation, 2011.

Packaging

General packaging requirements – Food contact materials

These requirements pertain to restrictions on food contact materials that may jeopardize the safety of food. No consignment of food shall be stored in a manner that enables articles in one consignment to be exposed to other food articles. A container made of the following materials, when used to prepare, package and store of food, shall be deemed to render it unfit for human consumption:

- containers that are rusty
- enamelled containers that have become chipped and rusty
- copper or brass containers that are not properly tinned
- containers made of aluminium that do not conform to Indian standards IS:20 or IS:21.

Containers made of plastic should conform to the following Indian Standards (IS) if they used as receptacles for packing or storing food articles:

- IS:10146 (Specification for Polyethylene in contact with foodstuffs)
- IS:10142 (Specification for Styrene Polymers in contact with foodstuffs)
- IS:10151 (Specification for Polyvinyl Chloride (PVC), in contact with foodstuffs)
- IS:10910 (Specification for Polypropylene in contact with foodstuffs)
- IS:11434 (Specification for Ionomer Resins in contact with foodstuffs)
- IS:12252 (Specification for Polyalkylene Terephthalate (PET)).

Specific packaging requirements – saffron

Within Indian Food Safety and Standards (Packaging and Labelling) Regulation, 2011, there are no product specific packaging requirements related to saffron or saffron powder. Importers/buyers will have different requirements regarding what they expect in terms of packaging. For example, the type and size of the package is often customer choice. Please double-check with these parties in the import market to ensure you are meeting expectations. Please see Chapter 2 for some practical guidance on packaging.

Note that within Legal Metrology (Packaged Commodities) Rules, 2011, there are maximum permissible errors on packaged net quantities declared by weight or by volume, as seen in Table 18. It is very important that accuracy is maintained when weighing packaged saffron. Many buyers will expect much more accurate values than those stated here.

Table 18 Maximum permissible errors on packaged net quantities, all food products – India

Declared Quantity (g or ml)	Maximum permissible error in excess or in deficiency*	
	As a percentage of declared quantity	As expressed as g or ml
up to 50	9.0	
50 to 100		4.5
100 to 200	4.5	
200 to 300		9
300 to 500	3.0	
500 to 1000		15
1000 to 100000	1.5	
10000 to 15000		150
More than 15000	1.0	

Source: Food Safety and Standards (Packaging and Labelling) Regulation, 2011.
* The maximum permissible error specified as percentage shall be rounded off to the nearest one-tenth of a g or ml, for a declared quantity less than or equal to 1,000 g or ml and to the next whole g or ml for declared quantities above 1,000 g or ml

Other packaging considerations

According to Food Safety and Standards (Import) Regulations, 2017, every consignment of food to be imported into India should be packed in containers in a way that facilitates the inspection and collection of samples from the consignment. This is somewhat of a dilemma when it comes to saffron, as its high value nature lends itself to theft, which can even occur during inspection activities. Easy sampling can result in easy stealing. For this reason, tamper proof seals are often used when shipping saffron, which would by definition, be incompatible with this aspect of this regulation.

Even though there are no product-specific packaging regulations for saffron or spices within Food Safety and Standards regulations, there is general guidance offered within the AGMARK standard Saffron Grading and Marking Rules, 2012. Please read the section *Key standards in India* for more information.

Labelling

Food Safety and Standards (Packaging and Labelling) Regulation, 2011, outlines labelling requirements for food products imported into India. The minimum labelling requirements for saffron exported to India are listed below. There are general labelling requirements for pre-packaged food as well as sector-specific labelling requirements for spices. Note that specific labelling requirements differ depending on whether the saffron is imported in bulk packages or in consumer-ready packages.

According to Food Safety and Standards (Import) Regulations, 2017, any consignment that is found at the port of entry not to comply with packaging and labelling regulations will be rejected outright and not permitted entry into India until corrected.

It is important to note that these are merely regulatory labelling aspects and the lists may not be exhaustive. Effective labelling goes far beyond these labelling elements and serves to differentiate a product and appeal to the customer. Its success depends on many other factors such as materials, design elements, different bar codes and QR codes that provide additional information to the consumer. Simply including the elements in this list is not sufficient for successful selling in a market.

General labelling requirements

- The information to be specified on the label shall be in English or Hindi in the Devnagri script.
- Food shall not be labelled with any information that is false, misleading or deceptive.
- The label shall be applied in way that ensures it will not become separated from the container.
- Contents on the label shall be clear, prominent, indelible and readily legible by the consumer. All information should be grouped together and given in one place.
- If the container is covered by a wrapper, the wrapper should contain the necessary information or the label on the container should be visible and readable through the outer wrapper.

Specific labelling requirements

The following information should be included on the label for saffron shipped in bulk packages (wholesale):

- Name of food
- Name and complete address of manufacturer/packer
- Net weight in metric values
- Batch number/lot number/code number
- Name and complete address of the importer

The following information should be included on the label for consumer-ready packaged saffron:

- Name of food
- Name and complete address of the manufacturer/packer
- Date of manufacturing/packing (day/month/tyear)*
- Country of origin
- Net weight in metric values
- Batch number/lot number/code number

- 'Best before' date or 'use by' date or date of expiry (day/month/tyear or best before XX months from date of packing)*
- Declaration regarding vegetarian or non-vegetarian (vegetarian food must have a symbol consisting of a green-filled circle inside a green square outline, prominently displayed on the package in close proximity to the name of the food)
- FSSAI logo and licence number (the importer can apply this upon arrival at the port of entry in India as a rectifiable label, so depending on the agreement with the importer, this information may not be necessary)
- Name and address of the importer

*As per FSS regulations, all imported food products must have a valid shelf life of no less than 60% of their original shelf life. Remaining shelf life will be calculated based on the values given for date of manufacturing/packing and the date of expiry.

Figure 14 Logo for vegetarian food, India

Source: Food Safety and Standards (Packaging and Labelling) Regulation, 2011

Labelling requirements of buyers often go beyond minimum requirements and depend on the expectations of different importers/buyers. Please double-check with these parties in the import market to ensure you are meeting their expectations. Please see Appendix VI for retail saffron labelling examples.

Traceability

While there is no explicitly stated regulation within Indian law citing traceability system requirements for those exporting food to India, Food Safety and Standards (Food Recall Procedure) Regulation, 2017, dictates that food business operators in India (including importers) must have an up-to-date food recall plan in place. This means that importers must have procedures in place to identify the food businesses they have supplied. They also should keep records of food business from which they have bought food.

In general, traceability is of growing importance in the global marketplace. It is increasingly expected that, at a minimum, an exporter knows

- Names and business addresses of anyone that supplies it with saffron
- Names and business addresses of anyone to whom it sold saffron

This is known as the 'one step back, one step forward' traceability approach. It is important to note that if you are exporting saffron in pre-packaged form then use of batch numbers/lot number/code numbers is a mandatory labelling requirement. These numbers serve as identification marks, which allow for the food to be traced back through the supply chain in the event that a food product recall/withdrawal is necessary. Read more about traceability in Chapter 2.

Box 8 Additional reading for mandatory requirements in the Indian market

Food Safety Helpline is a useful resource for the Indian market that considers itself a 'one-stop shop' for all things related to compliance with FSSAI regulations. The website includes a search feature, which allows users to view all published articles related to a specific topic: https://foodsafetyhelpline.com/

Spices Board India: http://www.indianspices.com/

Key standards in India

Product-specific standards

AGMARK Grading and Marking Rules

The AGMARK certification scheme is a very popular agricultural product-grading scheme in India that defines grade designations based on different quality parameters. AGMARK is a certification mark assigned to goods that conform to a set of standards approved by the Directorate of Marketing and Inspection within the Ministry of Agriculture & Farmers Welfare.

AGMARK standards cover quality guidelines for more than 200 different commodities ranging from spices, food grains and cereals to oils, fruit, vegetables and processed products. AGMARK certification is widely used in India. More recently, AGMARK certification is used as a quality assurance mechanism for exports of Indian agricultural products.

Because grading takes place in regional AGMARK-approved laboratories in India, Afghan exporters would generally not seek AGMARK certification prior to export. However, buyers in India who intend to have their saffron graded according to the AGMARK standard may seek a level of quality that corresponds to these grade designations from Afghanistan producers.

The AGMARK grading designations for saffron and saffron powder are set forth in Saffron Grading and Marking Rules, 2012. Grades are based on characteristics such flavour, colour and aroma, as well as detailed specifications such as limits on moisture content, floral waste and extraneous matter, ash content and solubility.

Three separate grades can be assigned depending on the testing results of the saffron or saffron powder: General, Standard and Special. Grade designations help saffron producers fetch prices on the market that correlate to the quality produced, while at the same time helping consumers to identify their desired quality.

Table 19 AGMARK criteria for grade designation, saffron stigma and powder

Characteristic	Grade Designations					
	Stigma			Powder		
	Special	Standard	General	Special	Standard	General
Floral waste, percent by mass on dry basis (max.)	0.5	4	6	n/a	n/a	n/a
Extraneous matter, percent by mass on dry basis – Organic / Inorganic (max.)	0.10 / NIL	0.40 / 0.10	0.75/ 0.25	n/a	n/a	n/a
Moisture and volatile matter percent by mass (max.)	10.0	11.0	12.0	9.0	10.0	10.0
Total ash percent by mass on dry basis (max.)	6.0	7.0	8.0	6.0	7.0	8.0
Acid-insoluble ash percent by mass on dry basis (max.)	1.00	1.25	1.50	1.00	1.25	1.50
Solubility in cold-water percent by mass on dry basis (max.)	65	65	65	65	65	65
Crude fibre percent by mass on dry basis (max.)	5.0	6.0	6.0	5.0	6.0	6.0
Bitterness expressed as direct reading of the absorbance of picrocrocin at 257 nm on dry basis (min.)	70	55	40	70	55	40
Safranal (aroma) expressed as direct reading of the absorbance of safranal at 330 nm on dry basis (min.-max.)	20-50	20-50	20-50	20-50	20-50	20-50

Colouring strength expressed as direct reading of the absorbance of crocin at 440 nm on dry basis (min.)	200	170	120	200	170	120
Total nitrogen percent by mass on dry basis (max.)	2.00	2.00	2.00	3.00	3.00	3.00

Source: AGMARK Saffron Grading and Marking Rules, 2012.

Packaging and labelling of saffron and saffron powder according to AGMARK

Method of packing

- Saffron and saffron powder shall be packed in new and clean tins, glass containers, plastic containers, polythene bags of food-grade quality or any other packing material of food-grade quality as approved by the agricultural marketing adviser or any officer authorized on behalf of the adviser.
- The packing material shall be free from insect or fungal infestation and should not impart any toxic substance or undesirable odour or flavour to the product.
- Saffron and saffron powder shall be packed in pack sizes as per the provisions of the Legal Metrology (Packaged Commodities) Rules, 2011, or as per the instructions issued from time to time by the agricultural marketing adviser.*
- Graded material of small pack sizes of the same lot or batch and grade shall be packed in a master container displaying complete details along with grade designation mark.
- Each package shall contain saffron and saffron powder of the same type and of the same grade designation.
- Each package shall be properly and securely closed and sealed.

* As of this writing, there are no standard packaging quantities set forth within the Legal Metrology (Packaged Commodities) Rules, 2011, for saffron or the food category 'spices'.

Method of marking

The grade designation mark shall be securely affixed to or printed on each package in a manner approved by the agricultural marketing adviser, or an officer authorized on behalf of the adviser, in accordance with the provisions of rule 11 of the General Grading and Marking Rules, 1988. In addition, the following particulars shall be clearly and indelibly marked on each package, namely:

- name of the commodity
- country of origin
- grade
- variety or trade name (optional)
- lot or batch number
- date of packing
- crop year
- net weight
- best before _____ month ____ year
- maximum retail price (inclusive of all taxes)
- name and address of the authorized packer
- any other particulars as may be specified under the Legal Metrology (Packaged Commodities) Rules, 2011, the Food Safety and Standards Act, 2006, (34 of 2006) any other relevant Act or instructions issued by the agricultural marketing adviser or any officer authorized by the adviser.
- The ink used for marking on packages shall not contaminate the saffron and saffron powder.

Read the full AGMARK standard for saffron and saffron powder: http://dmi.gov.in/Documents/saffron.pdf

Read more about the AGMARK certification scheme:
http://dmi.gov.in/Documents/Final%20Text%20Matter%20related%20to%20QC%20Section.pdf

BIS standards for saffron

The Bureau of Indian Standards (BIS) was created in 1947 as the Indian Standards Institution and has operated as the national standards body of India since 1986. One of the roles of BIS is to formulate and promote national standards throughout most sectors of the Indian economy. Standards tend to be reviewed regularly and an effort is made to remain aligned with requisite international standards.

IS 5453 – Saffron, Part 1 – Specification prescribes requirements for saffron in both stigma and powder form. In fact, IS 5453 is the referenced standard used in Indian food safety regulations. However, the requirements incorporated into regulations were only for grades 3 and 4 (the lowest grades). There are also required quality levels for grades 1 and 2 present within the standard, as well as information on packing and labelling.

Importantly, the latest revisions of this IS 5453 have been made to align with the latest version of the international standard, ISO 3632-1: 2011 'Spices – Saffron (Crocus sativus L.) – Part 1: Specification' issued by ISO. The technical content of the latest BIS revisions is not available online, but those interested are advised to refer to the corresponding ISO standard. The most current, publicly available version of the standard can be viewed online at: https://archive.org/details/gov.law.is.5453.1.1996

Social and environmental sustainability standards

Jaivik Bharat – Organic Food

In late 2017, FSSAI operationalized the Food Safety and Standards (Organic Food) Regulation, 2017. This was an important step in creating a viable organic food sector in India, as it was the first time a unified regulation on organic foods was operationalized, bringing together two existing systems: the National Programme for Organic Production (NPOP) and the Department of Commerce and Participatory Guarantee System for India (PGS-India).

A common logo with the tagline 'Jaivik Bharat' was launched in parallel for use on products and will coexist alongside the two existing logos. This will allow for easier identification of organic food and help build consumer confidence.

Any foods offered or promoted for sale as organic must comply with all of the requirements of NPOP[52] or PGS-India.[53] NPOP was modelled after European Union regulations as well as the Codex Alimentarius. The detailed requirements for each of these systems are contained with operational manuals found on the respective website.

In addition, organic foods should comply with all requirements set forth in Indian food safety regulations. As organic foods do not use synthetic inputs, the limit of pesticide residue shall be 5% of the maximum limits prescribed for non-organic foods or the level of quantification (whichever is higher). The labelling on organic food packages shall convey full and accurate information on the organic status of the product, such as the certification mark of the one the systems mentioned, in addition to the Jaivik Bharat logo.

The accredited certification bodies of NPOP or the regional councils of PGS-India certify organic food products in India. However, for imports of organic food, re-certification of products is not necessary as long as there is a bilateral or multilateral agreement based on equivalence of organic standards.

If India and Afghanistan were to establish a bilateral or multilateral agreement based on equivalence, then consignments of organic saffron would only need to be accompanied by a transaction certificate issued by an accredited certification body.

[52] Agricultural & Processed Food Products Export Development Authority (2014). *National Programme for Organic Production*.
[53] National Centre of Organic Farming (2015). *Participatory Guarantee System for India – PGS India.*

Fairtrade International

Indian consumers are becoming more aware of ethical concerns in food supply chains. Fairtrade is an increasingly recognizable mark that consumers associate with sound labour practices and compensation. For more information on Fairtrade International, please see the section *Key Standards in Europe.*

Food safety standards

Certification to an HACCP-based FSMS is a common requirement among major buyers in the Indian market. ISO 22000 and FSSC 22000 are two of the more popular FSMS standards within India. Read more about ISO 22000 in Chapter 2 and FSSC 22000 in the section *Key Standards in Europe.*

Market preferences, trends and buyers' requirements in India

Trends and preferences

Saffron consumption should continue to grow along with the economic development and urbanization of India. Given its high price, the spice tends to be consumed by high-income households, but demand among middle-income households is rising. Younger and affluent Indian consumers are changing their outlooks toward food and beginning to demand qualities such as purity, authenticity and transparency.

Food additives are becoming less acceptable and expectations of higher production standards such as organic production are increasingly common. India is unable to meet the growing demand with domestically grown saffron even though it is second in the world in land area used for saffron cultivation. Saffron imports should continue to rise going forward, and Afghan saffron can fulfil a significant portion of this demand.

Organic
It may be useful to look at the trends in Western countries to get an idea of where things are headed in India, given its economic growth and larger disposable incomes. While the Indian organic food market is not nearly as developed as it is in Europe, major inroads are being made with the operationalization of new organic regulations in 2017.

India is a major exporter of organic foods, but historically many countries avoided exporting organic products to India because of perceived small demand and market size for organic products domestically. This perception is now changing as the organic foods market shows signs of growth. Health-conscious Indian consumers have shown a willingness to pay a premium for organic products, but have been held back by lack of availability or irregularity of supply.

Product labels
Within the Indian market, health claims on food labels such as 'no preservatives/additives' are very popular. Gluten-free labelling is also growing in popularity. These are all inherent characteristics of pure, quality saffron and are examples of product labelling that surpass the mandatory requirements. Including additional information such as this on a retail saffron label might remind consumers that a product is fit for their consumption and help to make it stand out from the crowd.

Regarding health concerns, public acceptance of GMOs is still very low in India. While GMOs can be produced, sold and imported in India, this is only permitted with the consent of the Genetic Engineering Approval Committee. Non-GMO is another element that could easily be included on a retail saffron label.

Market segments
Retail stores tend to charge more for saffron than wholesalers, given the larger number of middlemen involved in retail sales as well as the greater overhead costs. Nonetheless, there is a growing tendency among higher income individuals in India to buy saffron from supermarkets rather than traditional grocery retailers or 'kiranas'. This may suggest that customers want the higher hygiene standards and quality assurances that come with branded, retail saffron.

FSMS standards are growing in popularity across the country. Moreover, the younger and brand-savvy population of India is grabbing a bigger share of disposable income relative to the rest of the population.

Younger, wealthier Indians are key sales drivers of premium and value-added products that tend to be found mostly in supermarkets.

Ethical consumer
The market for ethical consumers is growing in India. More and more Indian consumers are becoming aware of ethical trade practices and the need for economic, social and environmental sustainability. On a global level, corporate social responsibility is becoming a core requirement for many of the world's most important buyers.

If socially conscious buyers believe that a part of the value chain partakes in environmentally unfriendly practices, they may look elsewhere to find more socially responsible suppliers. Sustainability standards are becoming increasingly important to gain an advantage in the marketplace and differentiate products from others in a positive way.

Superfoods
Superfood powders are increasing in popularity in India. Many consumers mix these powders into shakes, smoothies or other food items for the perceived health benefits. Given the perceived health benefits of saffron within Ayurvedic medicine, exports of saffron powder to India as a superfood powder could benefit from this trend. Chapter 4 contains more information on the medicinal qualities of saffron.

Buyers' requirements

On average, buyers in the Indian market are less strict about saffron quality than those found in the European market. Given the current inability of India to meet saffron demand with domestic production, Indian buyers primarily import saffron for domestic consumption and not for re-export, like their European counterparts. The primary demand comes from households, restaurants and hotel chains. Afghan exporters have been able to capitalize on geographical proximity and growing market size in developing strong relationships with wholesalers and retailers.

These relationships should continue to grow in the near to medium term, given the rapid growth of the Indian market. Thus, India offers a lot of potential for further market penetration and export opportunities. Recent developments regarding the air corridor between India and Afghanistan bode well for export logistics. [54]

Food safety and adulteration
India experienced major issues with food safety in the recent past, so FSMSs based on HACCP principles are becoming commonplace among buyer requirements. Certification against an HACCP-based FSMS standard like ISO 22000 is a good way to offer guarantees to Indian buyers that there will be minimal food safety risks associated with a consignment of saffron.

The Indian market is not immune from the problems associated with adulterated saffron, so saffron will be expected to be 100% pure without any traces of added colour or inferior substances. Powdered saffron is especially susceptible to use of inferior substances, so buyers will be particularly cautious with saffron shipped in this form.

National standards
The fact that most saffron exported to India is used to meet domestic demand means that national product standard specifications such as the AGMARK standard may be equally important to those with a more international scope. Many buyers still accept medium-quality saffron, which makes the Indian market more accessible than the European market. However, to establish a reputation for Afghan saffron as very high-quality, exports of medium-quality saffron are not the long-term strategy. Instead, exports of high-quality saffron to the Indian market should be maximized.

Saffron characteristics that are in line with the 'Special' designation of the AGMARK standard would generally be considered top quality in India. This means that crocin and picrocrocin absorbance should be at least 200 and 70, respectively. Safranal levels should always be in the 20–50 range. Extraneous matter needs to be below the 0.1% level and floral waste should be maximum 0.5%. As within Europe, there is a low tolerance

[54] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

for certain types of extraneous matter such as hair, metal and glass. The highest quality saffron should be 100% stigmas without any portion of styles present; however, there is room for lower grades, so inclusion of styles may be a market decision between producers and buyers.

Packaging and labelling
Buyer requirements for packaging and labelling of consumer-ready packaged saffron are more stringent than those for saffron packed and shipped in bulk. Just as in Europe, the look and feel of packaging is of critical importance.

Labels often contain extra information regarding directions for use and ideal storage conditions as well as certification marks and statements on the nature of the product such as 'no preservatives/additives', 'GMO-free' or 'Gluten-free'. All of these elements should be arranged with buyers, who will often stipulate detailed packaging and labelling requirements for consumer-ready packaged saffron.

Medicinal applications
Some Indian buyers may be interested in purchasing saffron for non-culinary applications such as those used in Ayurvedic medicine. These buyers would probably be more interested in certain characteristics of the saffron, such as crocin levels. See Chapter 4 on alternative uses of saffron for more information.

Box 9 Trade shows in the Indian market

Food Ingredients (Fi) India in New Delhi brings together the world's buyers and sellers of food ingredients: https://www.figlobal.com/

Biofach India Trade Fair for Organic Food in New Delhi: http://www.biofach-india.com/

Annapoorna World of Food India in Mumbai: http://www.worldoffoodindia.com/

EventsEye is a database of over 10,000 trade shows happening around the world. Events can be separated by theme, date or location for increased relevancy: https://www.eventseye.com/fairs/trade-shows-by-theme.html

China: Demand fuelled by traditional Chinese medicine

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China's geographical proximity to Afghanistan, along with its large population, make this market an export destination with considerable potential for the Afghan saffron sector. China imports most of its saffron from the Islamic Republic of Iran, but buyers will likely want to diversify their supply, given the fact that saffron demand has grown by 49% annually since 2012.

Building on historical Silk Road ties between the two countries, saffron from Afghanistan offers new opportunities to increase business and strengthen ties with China. In 2016 alone, Afghanistan signed six agreements and memorandums of understanding with China aiming to boost business and diplomatic relationships, one of which related to saffron.

These agreements mean Afghanistan has a real opportunity to benefit from China's growing appetite for saffron, especially in the traditional Chinese medicine (TCM) sector. Some Afghan saffron companies have already received a degree of exposure in the Chinese market after participating in the International Food Exhibition & Imported Food Exhibition in Guangzhou, one the most prominent food and beverage exhibitions in China. The Afghan saffron sector should build on existing momentum and make a concerted effort to establish itself as a consistent supplier of high-quality saffron to the Chinese market.[55]

[55] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

Box 10 Key regulations and product standards in the Chinese market

- Food Safety Law of the People's Republic of China, 2015
- The Law of the People's Republic of China on Quality and Safety of Agricultural Products, 2006
- GB 2763-2016 Maximum Residue Limits for Pesticides in Foods
- GB 2761-2017 Maximum Levels of Mycotoxins in Food
- GB 2762-2017 Maximum Levels of Contaminants in Food
- GB 29921-2013 Maximum Levels of Pathogens in Foods
- GB 2760-2014 Uses of Food Additives
- People's Republic of China Entry and Exit Animal and Plant Quarantine Act
- People's Republic of China Quality and Safety Act
- GB 4806.1-2016 General Safety Requirements of Food Contact Materials and Articles
- GB 7718-2011 General Rules for the Labelling of Pre-packaged Food
- GB 28050-2011 General rules for nutrition labelling of pre-packaged food
- GB 29924-2013 General rules for labelling of food additives
- GB 14881-2013 General Hygienic Regulation for Food Production
- AQSIQ Notice 27 Administrative regulation on the inspection and supervision of labelling of imported and exported pre-packaged food
- Law of the People's Republic of China on Import and Export Commodity Inspection
- AQSIQ Decree No. 62 on Genetically Modified Products
- GB/T 19630-2011 National Standard of Organic Products (Parts I,II,III & IV)
- GB/T 22324.1 – 2017 Saffron—Part 1: Specification

Mandatory requirements in China

Food safety

Food safety regulations in China are set forth in the Food Safety Law of the People's Republic of China (2015). The law states that imported food must comply with the relevant mandatory Chinese national standards or '*Guobiao*' (GB) related to pesticide MRLs, mycotoxins, metal and microbiological contaminants, food additives, etc.

Chinese food safety regulations and procedures are frequently revised. In 2015, the Food Safety Law was upgraded in an attempt to strengthen the regulation of food and increase oversight of food supply chains. Mandatory standards have since been altered to reflect these revisions. Changes to regulations on different contaminants are ongoing and an effort is being made to align food safety standards with counterpart international standards. Appendix VIII contains web links to food safety laws and national standards of China.

There are also certain grey areas in legislation that can overlap or contradict each other. Given the dynamic nature of Chinese food safety laws, producers should discuss requirements thoroughly with buyers before exporting goods to the Chinese market to ensure that products are in compliance.

Pesticide residues

Chinese national standard GB 2763-2016 establishes MRLs for pesticides in foods. The standard outlines 4,140 MRLs for 433 different pesticides. No MRLs are given specifically for saffron within the standard. Foods are grouped into categories within the standard, and saffron would belong to the food category 'condiments'. GB standards state that when a cap is applied to a certain food category, all types of foods in the food category are subject to the limit unless otherwise specified. These limits are seen in Table 20.

The Chinese Ministry of Agriculture has pledged to establish 10,000 MRLs by 2020. There is also an effort to defer to MRLs established by the Codex Alimentarius. Given the frequent revisions to laws related to MRLs, producers should make sure to communicate with buyers to ascertain which pesticides they are allowed to use, if any. No goods containing traces of a pesticide that is prohibited by the state can be sold on the Chinese market. The banned pesticides can be found at the website of the Chemical Inspection and Regulation Service.[56] China also maintains an MRL database for certain products and product categories.[57]

Table 20 Pesticide MRLs for the food category 'condiments' – China

Pesticide	Food Category/Name	Maximum residue limit (mg/kg)
Azinphos-methyl	Condiments (with the exception of dried chili)	0.5
Hydrogen phosphide	Condiments	0.01
Permethrin	Condiments (with the exception of dried chili, horseradish)	0.05
Vinclozolin	Condiments	0.05
Acephate	Condiments (with the exception of dried chili)	0.2

Source: Chinese national standard GB 2763-2016.

Metal contaminants

Chinese national standard GB 2762-2017 sets limits for metals such as lead, cadmium, mercury, arsenic, tin, etc., that can harm human health due to their toxicity. While no limits are set for saffron specifically, there are some established for the food category 'condiment (spices)' and others to which saffron would belong, as seen in Table 21. The lack of a limit for a certain metal contaminant does not mean the presence of the contaminant is not dangerous. Traces of toxic metals should always be minimized, no matter the product in question.

Table 21 Maximum levels for metal contaminants, 'condiments' and 'foods (packed in tin)' – China

Metal contaminant	Food Category (name)	Limit mg/kg
Lead	Condiment (spices)	3.0
Cadmium	Not established	
Mercury	Not established	
Arsenic	Condiment	Total arsenic: 0.5 Inorganic: n/a
Tin	Foods (packed in tin)	250
Nickel	Not established	
Chromium	Not established	

Source: Chinese national standard GB 2762-2017.

Naturally occurring toxic substances

Chinese national standard GB 2761-2017 sets forth requirements regarding maximum levels of mycotoxins in food. While no limits have been established specifically for saffron, there is a limit on aflatoxin B1 levels for the food category 'condiments', within which saffron would belong, as seen in Table 22. Regardless of the existence of the mycotoxin limits, producers and processors should take all measures to keep levels to a minimum.

[56] Chemical Inspection and Regulation Service (2017). *List of Banned and Restricted Pesticide Products in China*.

[57] Institute for the Control of Agrochemicals, Ministry of Agriculture (2012). *Maximum Residue Limits Database of China.*

Table 22 Established mycotoxin limits for the food category 'condiments' – China

Substance	Food Category (name)	Limit µg /kg (micrograms/kg)
Aflatoxin B1	Condiment	5.0

Source: Chinese national standard GB 2761-2017.

Microbiological contaminants

Chinese national standard GB 29921-2013 on maximum levels of pathogens in food specifies limits and testing methods for five types of pathogens for 11 categories of food. The caps for the food category 'ready-to-eat condiments' to which saffron would belong are found in Table 23.

Table 23 Maximum levels of pathogens for the food category 'ready to eat condiments' – China

Food Category (name)	Pathogen	Sampling Plan and Limit (unit used is 25g or 25ml, unless otherwise specified)				Testing Method
		n	c	m	M	
Ready-to-eat condiments	Salmonella	5	0	0	-	GB 4789.4
	Listeria monocytogenes	5	2	100 CFU/g (mL)	1,000 CFU/g (mL)	GB 4789.10 (2nd Method)

Source: Chinese national standard GB 29921-2013
n=number of sample units drawn from the lot; c=maximum number of samples exceeding the value 'm'; m=limit value acceptable for pathogen specified; M=maximum safe limit value of pathogen specified.

Expressed in words, salmonella and listeria monocytogenes are two pathogenic bacteria that are relevant for the food category 'ready-to-eat condiments'. For salmonella, when the referenced test method is performed on five random samples, no sample should have the presence of the bacteria. For Listeria monocytogenes, only two samples of the five random samples may exceed the level of 100 colony-forming units (CFU) per gram, while none can exceed 1,000 CFU per gram.

Other contaminants

Chinese national standard GB 2762-2017 also sets limits for other contaminants such as nitrite and benzo(a)pyrene, among others. The current version of the standard includes no limits for food categories to which saffron would belong. The contaminants are nonetheless important and should be minimized. For instance, benzo(a)pyrene is a PAH, meaning it can contaminate spices like saffron through improper drying practices, such as the burning of fossil fuels or coal. Given the dynamic nature of food safety laws in China, the requirements related to other contaminants mentioned in this regulation are likely to change and will eventually include categories covering spices like saffron.

Food additives

The use of food additives is common in China. However, only food additives listed within a 'positive list' found in GB 2760-2014 National Food Safety Standard for Uses of Food Additives may be used, and only in the food categories specified in the list. Furthermore, maximum residual levels are established that cannot be exceeded. Despite this, given the nature of pure saffron, the intentional addition of any foreign substance, whether natural or synthetic, would dramatically affect the product's quality, and would render it adulterated. Thus, no food additives should be used in saffron or saffron powder.

Irradiation

Irradiated of food is allowed in China, and one of the common applications of this technology is the decontamination of spices. Irradiation for spices is outlined in the recommended national standard GB/T 18526.4-2001: Code of good irradiation practice for the control for pathogens and other microflora in spice and seasoning. However, food irradiation must take place in irradiation facilities that comply with Chinese national standards. Also, food irradiation is not a substitute for good manufacturing and sanitary practices in

food production and processing. If irradiation is performed on a food product, the labels and instructions of the food must indicate 'irradiated foods' and the irradiated ingredients must be indicated in the list of ingredients.

Controls at the point of entry

According the Food Safety Law of the People's Republic of China, 2015, imported food must comply with national food safety standards. To ensure this, the Entry-Exit Inspection and Quarantine Bureau (CIQ) shall inspect imported food at the port of entry. Food that is found to not meet national food safety standards will not be allowed into country. This also applies to compliance with phytosanitary, packaging and labelling requirements.

Plant health

According to the *Protocol of Phytosanitary Requirements for Exports of Saffron Stigma from Afghanistan to China*, signed in May 2016 (valid for three years), exported saffron must meet the plant quarantine laws and regulations of both Afghanistan and China. The saffron should not contain soil, weeds, pests or other animal and plant residues, and must be free from diseases and other harmful organisms.

Planning, processing, packing, storage and shipping of Afghan saffron shall be carried out under the supervision of officials from the Plant Protection and Quarantine Directorate (PPQD) of Afghanistan or authorized personnel. PPQD will carry out a quarantine inspection of each consignment of saffron meant for export to China.

For each consignment that has passed this inspection, PPQD will issue a phytosanitary certificate certifying that the saffron meets Chinese phytosanitary requirements. The information it bears, such as names and addresses of producers, processors and exporters, should be written in English. The certificate should also bear the additional statement 'This consignment of saffron meets the requirements of the Protocol of Phytosanitary Requirements for Exports of Saffron Stigma from Afghanistan to China.'

Once the saffron consignment arrives at the port of entry in China, CIQ will quarantine it. CIQ personnel will check the phytosanitary certificate, related documents and marks, and carry out a quarantine inspection. If any living pest or any pest that is not notified by Afghanistan to China is detected, the consignment shall be returned or subjected to quarantine treatment. If the saffron is deemed free from pests, weeds and diseases and the phytosanitary certificate is in order, permission to offload the saffron consignment will be given, and the saffron can enter the market. Read more about phytosanitary certificates and the ISPM 15 standard in Chapter 2.

Product characteristics and performance

While mandatory Chinese national standards are prefixed with 'GB', recommended standards are prefixed 'GB/T'. There is no mandatory product standard for saffron; however, the relevant recommended product standard is GB/T 22324.1-2017 Saffron – Part 1: Specification. Read more about this standard in the section *Key standards in China.*

Packaging

General packaging requirements – food contact materials

National Standard GB 4806.1-2016 on General Safety Requirements for Food-Contact Material and Articles outlines basic requirements regarding packaging materials that are intended for contact with food. For more information on food contact materials, see Chapter 2.

- Under recommended conditions of use, levels of substances present on food contact materials that end up migrating into foods should not cause harm to human health.
- Under recommended conditions of use, food contact materials when in contact with food should not result in changes of food composition, structure or properties such as colour, smell or taste and should not have any technical effect that is not intended on the foods.

- The quantity of substances used in food contact materials should be minimized on the premise that the desired results can be achieved.
- The substances used in food-contact materials and articles should comply with appropriate quality specifications.*
- Producers of food contact materials should control non-intentionally added substances in products to ensure that the migrating quantity complies with the first two provisions.
- Producers of food contact materials that contain an effective resistant/proofing layer between substances and food should carry out safety assessments and control measures to ensure that the substance does not migrate to the food at a level exceeding 0.01 mg/kg.

* Note that there are hundreds of standards for food-packaging containers that set forth specific safety requirements on food contact materials. Please discuss with buyers to determine the appropriate standard for their chosen packaging method.

Specific packaging requirements – saffron

Within Chinese food safety laws and national standards, no product-specific packaging requirements are related to saffron or saffron powder. Instead, the type and size of the package is often customer choice. Always double-check with these parties in the import market to ensure you are meeting expectations. Please see Chapter 2 for practical guidance on packaging and storing saffron.

Labelling

Proper labelling of products is very important when it comes to customs inspection and clearance at the port of entry in China. CIQ will inspect labelling requirements when goods arrive at ports of entry. Of all types of noncompliance, incorrect product labelling is the most frequent problem that CIQ encounters. As an example, from March 2012–October 2013, 567 (14.3%) of the 3,966 rejections at customs, were due to noncompliant labelling.[58] Make certain labelling is done properly and be sure to ask buyers if they have additional requirements.

Labels and instructions on food shall be clear, visible and easy to read. In addition, labels, instructions and packaging of food may not contain false or exaggerated information, nor may they make statements about disease prevention and treatment functions. Food that is inconsistent with the information contained on the label and instructions will not be marketed.

Labels should not become separated from the food packaging. According to *the Protocol of Phytosanitary Requirements for Exports of Saffron Stigma from Afghanistan to China*, the packing box of each consignment of saffron shall be clearly marked with 输往中华人民共和国 in Chinese characters (translates as *export to China*), while other information regarding name of the product, names and addresses of saffron producers, processors, exporters and other information should be written in English.

Specific labelling for pre-packaged food for direct-to-consumer sale

The Food Safety Law of the People's Republic of China, 2015, and national standard GB 7718-2011 set out general rules for label content of pre-packaged food meant for direct-to-consumer sale. Pre-packaged food shall be provided with labels and instructions using standard Chinese characters. Pre-packaged food without labels or instructions in Chinese or labels/instructions that do not comply with the law shall not be imported. Foreign languages can be used, but only when corresponding to Chinese characters on the label (with the exception of trademarks, names/addresses/contact information of agents, importers or distributors, and webpage addresses).

Any foreign language must be in a smaller font than the Chinese characters. Chinese and foreign language variants of the label need to be registered with CIQ (this will happen during company registration with the General Administration of Quality Supervision, Inspection and Quarantine, AQSIQ.) It is possible to have the importer attach labels after arrival at the port of entry, but this must be discussed in detail with buyers.

The lists below are merely regulatory labelling aspects as per Chinese law and may not be exhaustive. Effective labelling goes far beyond these labelling elements and serves to differentiate a product and appeal

[58] Chemical Inspection & Regulation Service (2014). *Labelling requirements on pre-packaged foods imported into China.* Jan.

to the customer. Its success depends on many other factors such as materials, design elements, different bar codes and QR codes that provide additional information to the consumer. Simply including the elements in this list is not sufficient for successful selling in a market.

The following items must be present on the label:

- Food name
- List of ingredients
- Net content (expressed as g or kg)
- Country of origin
- Name, address and contact information of the agent, importer and/or distributer that are properly registered in China
- Date of production as YYYY.MM.DD format (e.g. 2018.09.15 or 2018/09/15 or 20180915)
- Shelf life or expiration date expressed as 'The expiration date is YYYY.MM.DD'
- Storage conditions if needed (e.g. store in a dry and cool place)
- Food production licence number (required for all those engaged in food production activities in China)
- If a single pre-packaged food contains multiple individual pre-packaged food products of the same product category, then this needs to be described on the label (e.g. 4 g x 2 g)
- If irradiated, then label should read 'irradiated foods' in proximity to the product name
- If the product has been graded according to a product standard with clearly defined grades, then the grade of the product should be indicated on the label.

The following items are recommended for food labels:

- Batch number/lot number
- Consumption method(s) – helpful instructions to open the product, how to use the product
- Allergen information – if the food has been processed in a facility that processes other foods that commonly cause allergic reactions (e.g. nuts).

Labelling requirements of buyers often go beyond minimum requirements and depend on the expectations of different importers/buyers. Please double-check with these parties in the import market to ensure you are meeting their expectations. Please see Appendix VI for retail saffron labelling examples.

Traceability

China intends to complete a product quality traceability system by 2020.[59] This system will use technology to target key products such as agricultural goods and will provide important information about sources, destinations and accountable parties in order to reinforce product safety and quality.

Meanwhile, the Food Safety Law of the People's Republic of China, 2015, emphasizes traceability and food recall throughout many of its articles. For example, Article 98 reads that food importers in China shall establish a system of recordkeeping to track imports of food. They shall keep information on every party that sells them food, such as names and contact information, quantities, production dates, batch numbers, etc. This is the 'step backward' of basic traceability (i.e. keeping records of those who supply you with products). This way, if a food safety hazard is identified, the origin of the problem can be tracked and food can be recalled.

In general, traceability is of growing importance in the global marketplace. It is increasingly expected that exporters know, at a minimum

- Names and business addresses of anyone that supplies them with saffron
- Names and business addresses of anyone to whom they sell their saffron

This is known as the 'one step back, one step forward' traceability approach.

[59] Ministry of Agriculture and Rural Affairs of the People's Republic of China (2017). *China to complete product quality traceability system by 2020. 25 Oct.*

Key standards in China

Product-specific standards

GB/T 22324.1-2017 Saffron – Part 1: Specification

The standard *GB/T 22324.1-2017 Saffron – Part 1: Specification* sets out specifications for saffron in terms of physical and chemical characteristics. It covers general characteristics, sensory analysis (flavour, colour and aroma) and grade classifications. The standard adopts the international standard ISO 3632-1: 2011 (for a fee).

The standard can be purchased from the official website of China's national standards body, gbstandards.org.

The counterpart standard to this product standard is GB/T 22324.2 – 2017 Saffron – Part 2: Test Methods, which describes the various test methods and procedures used to determine physical and chemical specifications of dried saffron. It also adopts an international standard ISO 3632-2: 2010, and thus is not publicly available free of charge. The standard can be purchased from the official website of the national standards body.

These standards are of rising importance in the Chinese market and exporters of saffron to China should take into account the specifications outlined in the first part of the standard, as determined by the testing methods outlined in the second part. For more information on both parts of the adopted ISO standard, see Chapter 2.

Social and environmental sustainability standards

China Organic

The series of food safety scares in China in the recent past has resulted in a greater tendency among consumers to look for food safety assurances in the form of organically certified products. Growing disposable incomes in China have meant that imported organic foods are an increasingly accessible option for Chinese consumers. The organic food market in China has tripled over the last decade to more than 1% of total food consumption, with a lot of room to grow.[60]

China Organic standards are similar in scope to those of the European Union and the United States Department of Agriculture (USDA), and even have stricter requirements on some provisions. Despite this trend, significant barriers remain in the form of an unstable and often restricted certification process.[61]

The specific regulations and standards for organic certification first took effect in 2005 and were updated in 2011. They are based on international norms with added emphasis on contamination by pollutants and prohibited materials and quality management system, especially recordkeeping and traceability. There are four standards in the set, concerning production, processing, labelling and marketing and management systems. These cover imports as well as domestic production.

Production

Chinese national standard GB/T 19630.1-2011 sets forth production requirements for organic products. According to the general principles of this standard, organic production shall be free of pesticides, fertilizers and growth regulators, and make zero use of GMOs or chemical-based food additives. Organic products shall follow the natural law and ecology principle and harmonize the balance of the planting industry by adopting techniques of sustainable agricultural production.

No irradiation is allowed on organic products. All land used for organic farming must undergo a conversion period of 24–36 months. Only plant products planted and harvested after this conversion period may be sold as organic products. There should be a buffer zone in terms of time and/or space that minimizes the chances

[60] China Business Review (2015). *Going Organic: Investing in China's Growing Health Foods Market*. 30 June.

[61] Sina Finance (2015). *Organic food certification still faces a certain amount of operational space for crisis certification*. 29 Sep.

that non-organic production inputs do not contaminate organic production areas. More details on production requirements for Chinese organic certification can be found in the full standard.

Processing
Chinese national standard GB/T 19630.2-2011 sets forth processing requirements for organic products. According to the general principles of this standard, all ingredients of the product shall be obtained mainly following the organic agricultural system described in GB/T 19630.1 and the amount of non-organic ingredients, if used, must be reduced as far as possible. The content of organic ingredients must be at least 95% in terms of mass or volume. The nutritional ingredients and original nature of the products shall be retained in the course of processing as far as possible.

The processing and subsequent procedures of organic products shall be separated from those of non-organic products in terms of time and space. The processing of organic goods shall comply with all applicable food safety laws and regulations. The processing of organic products shall cause no negative impact, or minimal negative impact, on the environment. More details on processing requirements for Chinese organic certification can be found in the full standard.

Labelling and marketing
Chinese national standard GB/T 19630.3-2011 sets forth labelling and marketing requirements for organic products. According to the general principles of this standard, organic products shall follow all general food labelling requirements of Chinese regulations and standards. The term 'organic' or other characters, designs or symbols that imply organic products may only be used on labels of products produced and processed according to the GB/T 19630 set of standards.

Labels shall not mislead consumers to consider conventional products as organic products. The characters, designs and symbols present on the label shall be clear and conspicuous. The colour of the background and colours of text shall be contrasting. The certification label on organic retail packages contains: the China Organic product logo, the name or logo of the certification body, and a unique organic code consisting of the code of the certification body, the year of production and a random number. More details on labelling and marketing requirements for Chinese organic certification can be found in the full standard.

Figure 15 Example of China Organic certification label

Management system
Chinese national standard GB/T 19630.4-2011 sets forth management system requirements for organic products. According to the general principles of this standard, organic producers, processors or handlers shall develop and maintain a management system for the production, processing and handling of organic products in accordance with the requirements set forth in the GB/T 19630 set of standards.

Certification
According to requirements, products to be sold as organic in China (whether produced domestically or internationally) must obtain Chinese organic certification and this certification must be done by an accredited certification body in China. Organic product regulation and certification are governed and supervised by the Certification and Accreditation Administration (CNCA) of the People's Republic of China.

The two major Chinese certifying organizations are China Organic Food Certification Center and Organic Food Development Center. There are also selected private international certification bodies that are approved to certify organic products. Private certifiers include ECOCERT (France), BCS (Germany), IMO (Switzerland) JONA and OMIC (Japan). A complete list of CNCA-accredited certification bodies can be found in Appendix IX.

CNCA has drafted rules that would allow mutual recognition between CNCA and regulatory bodies in exporting countries so that organic products certified outside of China would be accepted into the country. However, to this day there remains a significant lack of equivalence agreements between China and third countries covering organic standards and certification procedures.

This means that even a widely recognized organic certification scheme, such as USDA organic products, would still need Chinese certification. This could involve extra expenses to become certified, such as paying for an accredited certifier to travel to the producing country, and payment of the certification fee. Chinese organic certification is valid for one year and applicants must annually renew, which involves follow-up in-country visits from Chinese inspectors.[62]

In late 2016, China signed its first mutual recognition agreement with New Zealand, meaning that goods exported from New Zealand to China are now exempt from Chinese certification requirements. Afghanistan and China do not yet have such an agreement.

Food safety standards

The number of food safety scandals that have occurred in China over the years has fuelled demand for products that can offer additional food safety assurances. Certification against an FSMS standard based on HACCP principles such as ISO 22000 can provide these assurances. According to the 2016 ISO survey, there were more valid certificates for ISO 22000 in China than there were in Europe. Please read Chapter 2 for more information on ISO 22000 and Chapter 5 (Europe) for more on FSMS standards. Learn more about HACCP in Appendix II.

Market preferences, trends and buyers' requirements in China

Trends and preferences

China continues to evolve on several levels: socially, economically and environmentally. The middle class is growing at an impressive rate and can buy more food in terms of variety at a higher quality. Some consumers are slowly moving away from the traditional Chinese diet and are consuming a more varied international diet. Demand for food outpaces the capabilities of domestic production, in large part due to increased food safety controls and the significant amount of farmland that is now considered unsuitable for food production.[63]

Food safety
According to a 2016 McKinsey study, 72% of Chinese consumers worry that the food they eat is harmful to their health, an increase of 12% from 2012. There is still general distrust among consumers toward government oversight of food safety. The growing Chinese middle class is increasingly purchasing foods with foreign certifications as they have a reputation for being safer than domestically produced foods. Certification to an FSMS based on HACCP principles is a key way of offering additional guarantees of food safety to Chinese consumers. Seeing that a product originates from a company certified to ISO 22000 or one of the other private FSMS standards will give peace of mind to consumers who are wary of the hazards of food production processes.

'Clean' food
The McKinsey study also found that about half of consumers focus on eating healthy and nutritious foods, with 38% identifying 'organic or green food' as among their top three criteria for food safety.[64] This is despite the fact that there is a lack of credible organic certification schemes in China. Price premiums in China are significant for organically certified food, ranging anywhere from 3–10 times higher. Consumers of organic products primarily purchase them from specialized shops or major supermarket chains. Read more about China Organic certification in the section *Key standards in China*.

[62] USDA GAIN Report (2010). *Organics Report – People's Republic of China*. 26 Oct.

[63] Price Waterhouse Cooper (2015). *Changing Chinese diet brings China into era of food interdependence.* 5 Oct.

[64] McKinsey & Company (2016). *The Modernization of the Chinese Consumer*. March.

Overall, 'clean' food certifications such as non-GMO, organic and no artificial ingredients are gaining traction in China, with 80% of consumers saying they have started eating healthier diets, according to a Credit Suisse survey.[65] Given the intrinsic purity properties of saffron along with its association with health benefits, it is no surprise that Chinese demand for saffron has grown a 49% a year since 2012.[66] Emphasizing these qualities of saffron when exporting to the Chinese market could lead to better outcomes.

E-commerce
China is the world's largest e-commerce market. E-payment methods have gained countrywide popularity in the past few years and the added convenience of this gave an additional boost to e-commerce platforms.[67] From a regulatory perspective, cross-border controls for e-commerce remain more unpredictable than those for regular food businesses.

Selling in bulk remains a very common way to sell saffron in China, and a lot of this is being sold in Chinese e-commerce. That said, even e-commerce customers are looking for more proof of authenticity when purchasing products via e-commerce platforms, regardless of whether goods are being produced domestically or imported.[68] Exploring Chinese e-commerce platforms and viewing numerous instances of unrealistic pricing for large quantities of saffron provides evidence of the widespread problem of fake or adulterated saffron on e-commerce platforms. Thus, certification to saffron standards such as ISO 3632 or the equivalent national standard GB/T 22324.1-2017 is important even for e-commerce sales.

Premium goods
Chinese consumers are spending more money on premium products. The growth of premium product segments in China is greater than that of both the 'mass' and the 'value' segments. Foreign brands hold a general leadership position in the 'premium' segment, while local brands are winning market share over foreign brands in the 'mass' segment. These facts may suggest that targeting the premium pre-packaged spice sector with very high-quality, highly priced saffron is a valid market entry strategy.

Brand loyalty
As per the McKinsey report, brand loyalty in China increased by 10% in the 'food and beverages' sector from 2011–15 and by 11% for the 'personal care' sector. This signals that fewer Chinese consumers are open to trying new brands, which means that new brand entrants in the saffron market in China (whether for culinary purposes or medicinal) may face tough competition with established brands.

Buyers' requirements

Overcoming language barriers
The fact that many of the most recent versions of Chinese national food safety standards are only available in Mandarin means that it is important to develop strong cooperative relationships with Chinese business partners to overcome language barriers and facilitate market access.

Saffron adulteration
The Chinese market is flush with sellers of fake saffron that has zero medicinal value and can even be hazardous to consumer health. The authenticity of saffron exported to Chinese buyers will need to demonstrated in one form or another. Otherwise, buyers will hesitate to purchase saffron from a new supplier. Read more about adulterated saffron in Chapter 3. Like the Indian market, the Chinese market is less strict about saffron quality than the European market. The primary interest of buyers is authenticity and safety. This is true for saffron for both culinary applications as well as for use in TCM, an industry that has undergone some changes in the recent past.

Traditional Chinese medicine and safety
In 2013, the China Food and Drug Administration (CFDA) began regulating the markets of TCM ingredients due to widespread instances of counterfeit ingredients, artificial dying and adulteration, and dangerously high traces of pesticides and fertilizers. Further action was taken in 2017, when the CFDA revoked the certifications of 81 manufacturers of TCM products after detecting irregularities in production and quality

[65] Credit Suisse (2017). *The Chinese Consumer in 2017: The Lifestyle Upgrade.* 17 May.

[66] International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

[67] Agroberichten Buitenland (2018). *China Food Safety Law – Practical Procedures, trends and opportunities for Dutch companies*. 7 Mar.

[68] Kooy, Steve (2017). *The Growth of Green Product Certification in China*. SCS Global Services. 20 Jun.

control. It was determined that an absence of GMP in these operations led to these irregularities. There is progress towards developing a national system of standardization for TCM, which includes basic standards and technical standards as well as management standards.

By the end of 2016, 649 standards had been created, and the development plan continues until 2020. The trend of increased regulation in the TCM industry in China means that food safety controls in the form of GHP, GAP and GMP will be of growing importance for suppliers of saffron to Chinese buyers. Please read Appendix II for more on these practices.

Evidence of investment

There is great interest within China to source saffron from Afghanistan to meet growing demand, and investments are being made. Evidence of the investment of the Chinese medicine industry in the Afghan saffron sector can be found in western Herat province.

Chinese businessman Xiang Wei Jie introduced the practice of indoor growing of saffron in western Herat province and the Kabul area. A veteran of the Chinese medicine industry, he has been working with local farmers to grow high-quality blooms indoors and to introduce saffron grown indoors to international markets. Indoor growing can help to control pest exposure and can result in a more controlled process that leads to higher-quality saffron.[69]

Box 11 Trade shows in the Chinese market

The International Food Exhibition & Imported Food Exhibition in Guangzhou is a leading business-to-business trading platform covering the whole value chain of the food industry:
http://www.chinaexhibition.com/Official_Site/11-9409-IFE_2018_-_The_18th_China_(Guangzhou)_International_Food_Exhibition_and_Import_Food_Exhibition_2018.html

China International Organic & Green Food Industry Expo in Beijing:
http://www.chinaexhibition.com/Official_Site/11-9076-The_22nd_China_International_Organic_and_Green_Food_Industry_Expo_(Beijing)_2018.html

Shanghai International Condiments & Food Ingredients Exhibition:
http://www.chinaexhibition.com/Official_Site/11-9086-CFIE_2017_-_Shanghai_International_Condiments_and_Food_Ingredients_Exhibition_2017.html

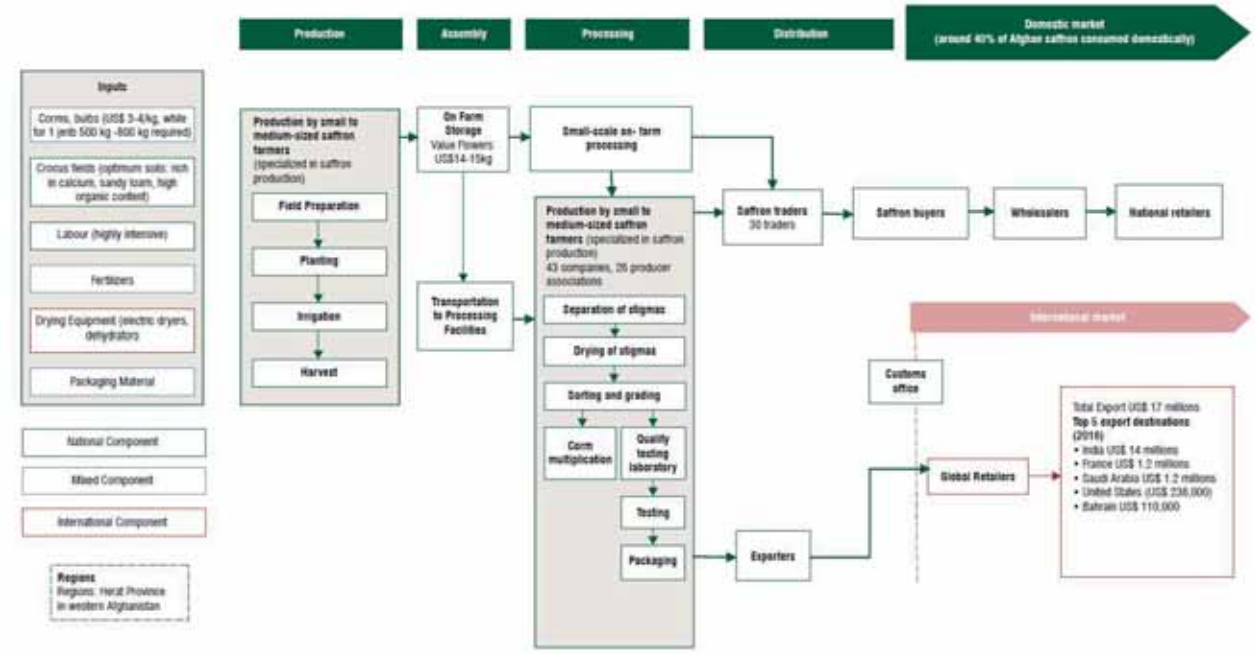
Healthplex Expo 2018 Natural & Nutraceutical Products China: http://www.chinaexhibition.com/Official_Site/11-9404-HNC_Expo_2018_-_Healthplex_and_Nutraceutical_Products_China_2018.html

China Exhibition serves as a directory of trade shows in China which can be filtered by date, industry, or location. http://www.chinaexhibition.com/

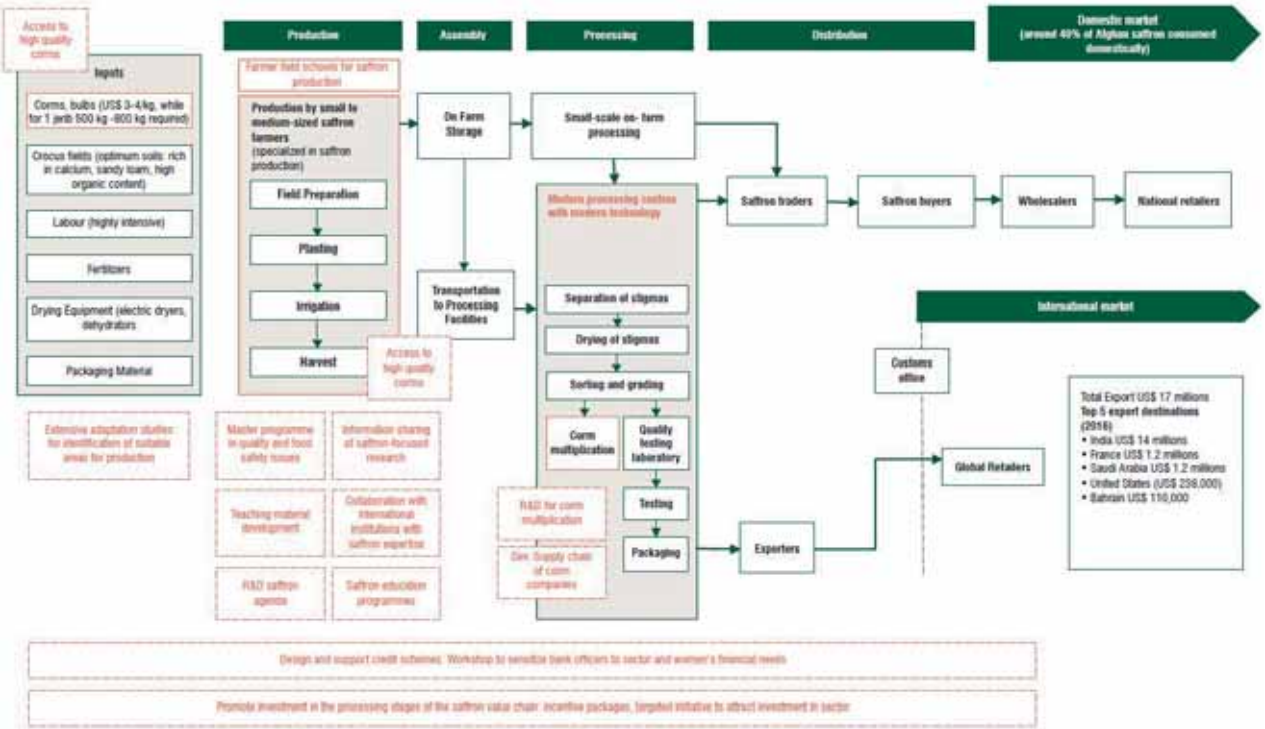
69 China News 7 (2017). *This is a taste of traditional Chinese medicine, to bring hope to this war-torn country*. 28 Nov.

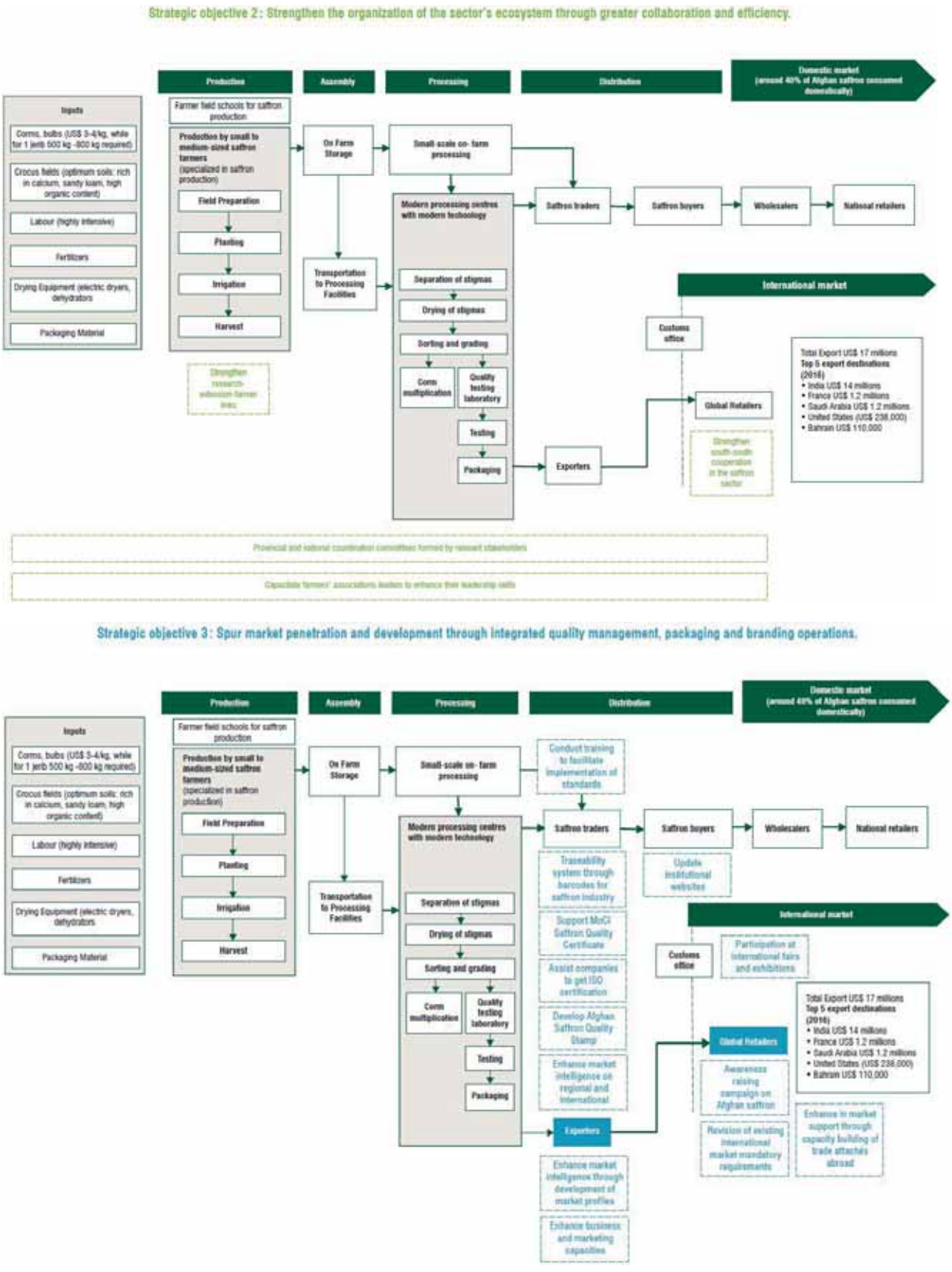
APPENDICES

Appendix I – Afghanistan saffron value chain, current and future



Strategic objective 1: Increase production and productivity through improved supply-side conditions.





Source: International Trade Centre (2018). Afghanistan's National Export Strategy 2018-2022, Saffron Sector. Geneva.

Appendix II – Quality management systems to reduce risk: GHP, GAP, GMP, HACCP

Saffron can be contaminated at any stage from cultivation to final consumption. It may seem logical, then, to evaluate saffron as close to the point of final consumption as possible to ensure safety. However, this approach is outdated due to its inefficiency. This reactive approach allows for work to continue until problems are detected during inspection. The problem is that contamination could have occurred at a very early stage, which means that all work and effort that followed were wasted on a product that was ultimately rejected.

As an example, imagine that saffron becomes contaminated because polluted water was used on particular plot of land during cultivation. If this saffron is harvested without any regard for controls or checks, then it may end up being mixed with other perfectly good saffron, which then also becomes contaminated. Without a focus on prevention, the problem is only discovered when the product is sent for testing. This results in significant losses both in terms of time and money, especially with a high-value product like saffron. Instead, a systems approach to food safety is needed to ensure that contamination risks along the food chain are minimized.

Given the limitations associated with over-reliance on final inspection and testing, present-day approaches to food safety focus on *preventing* risks throughout the food chain. A systems approach manages quality at all stages in an integrated manner, which allows for early detection of a problem. When a problem occurs it can be contained to minimize further damage. Corrective action is then taken to resolve the problem and measures are put in place to prevent it from occurring in the future.

Some of the most basic pre-requisites to food safety management systems include GAP, GHP and GMP. These systems serve as the foundation of the systematic preventative approach to food safety known as HACCP. All four systems work together to build safety and quality into foods at each stage of production, and each will be discussed in more detail below.

Good Hygiene Practices (GHP)

Consumers have the right to expect the food they eat to be safe. Among the most dangerous food safety hazards are foodborne illnesses, which can result from poor hygiene practices throughout the stages of production of a food product. Not only can such practices result in serious illness or even fatalities, but they can seriously disrupt international trade. Outbreaks have drastic consequences on trade that are multiplied as the world increasingly becomes a global village.

Practicing good hygiene from food production to consumption is of paramount importance to minimize the human health and economic risks associated with foodborne illness and injury. The CAC document on the General Principles of Food Hygiene (CAC/RCP 1-1969) lays a foundation for ensuring food hygiene from primary production through consumption, and highlights key hygiene controls at each stage.[70] These controls are recognized at the international level and can be used by governments, industry and consumers alike. Use of an HACCP system is promoted within the document, as a means to enhance food safety.

The General Principles of Food Hygiene apply to both GAP and GMP through the implementation of GHP throughout the food chain (including primary production through to the final consumer), to ensure that food is safe and suitable for human consumption.

The General Principles of Food Hygiene set objectives for eight focus areas: 1) primary production, 2) design and facilities, 3) control of operation, 4) maintenance and sanitation, 5) personal hygiene, 6) transportation, 7) product information and consumer awareness, and 8) training. Table 24 outlines these objectives, as well as the reasoning behind them. Both GAP and GMP incorporate GHP. Please read subsequent sections on GAP and GMP for more detailed GHP applicable to saffron cultivation and manufacturing.

[70] Codex Alimentarius Commission (1969). *General Principles of Food Hygiene (CAC/RCP 1-1969)*.

Table 24 General Principles of Food Hygiene

Focus Area	Objectives	Rationale
Primary production	Primary production should be managed in a way that ensures that food is safe and suitable for its intended use. Where necessary, this will include: • avoiding the use of areas where the environment poses a threat to the safety of food • controlling contaminants, pests and diseases of animals and plant in such a way as to not pose a threat to food safety • adopting practices and measures to ensure food is produced under appropriately hygienic conditions	To reduce the likelihood of introducing a hazard that may adversely affect the safety of food, or its suitability for consumption, at later stages of the food chain.
Design and facilities	Depending on the nature of the operations, and the risks associated with them, premises, equipment and facilities should be located, designed and built to ensure that: • contamination is minimized • design and layout permit appropriate maintenance, cleaning and disinfections and minimize air-borne contamination • surfaces and materials, in particular those in contact with food, are non-toxic in intended use and, where necessary, suitably durable and easy to maintain and clean • where appropriate, suitable facilities are available for temperature, humidity and other controls • there is effective protection against pest access and harbourage	Attention to good hygienic design and construction, appropriate location, and the provision of adequate facilities, is necessary to enable hazards to be effectively controlled.
Control of operation	To produce food that is safe and suitable for human consumption by: • formulating design requirements with respect to raw materials, composition, processing, distribution, and consumer use to be met in the manufacture and handling of specific food items • designing, implementing, monitoring and reviewing effective control systems	To reduce the risk of unsafe food by taking preventative measures to ensure the safety and suitability of food at an appropriate stage in the operation by controlling food hazards.

Focus Area	Objectives	Rationale
Maintenance and sanitation	To establish effective systems to: • ensure adequate and appropriate maintenance and cleaning • control pests • manage waste • monitor effectiveness of maintenance and sanitation procedures	To facilitate the continuing effective control of food hazards, pests and other agents likely to contaminate food.
Personal Hygiene	To ensure that those who come directly or indirectly into contact with food are not likely to contaminate food by: • maintaining an appropriate degree of personal cleanliness • behaving and operating in an appropriate manner	People who do not maintain an appropriate degree of personal cleanliness, who have certain illnesses or conditions or who behave inappropriately, can contaminate food and transmit illness to consumers.
Transportation	Measures should be taken where necessary to: • protect food from potential sources of contamination • protect food from damage likely to render the food unsuitable for consumption • provide an environment that effectively controls the growth of pathogenic or spoilage micro-organisms and the production of toxins in food	Food may become contaminated, or may not reach its destination in a suitable condition for consumption, unless effective control measures are taken during transport, even where adequate hygiene control measures have been taken earlier in the food chain.
Product Information and Consumer Awareness	Products should bear appropriate information to ensure that: • adequate and accessible information is available to the next person in the food chain to enable them to handle, store, process, prepare and display the product safely and correctly • the lot or batch can be easily identified and recalled if necessary Consumers should have enough knowledge of food hygiene to enable them to: • understand the importance of product information • make informed choices appropriate to the individual • prevent contamination and growth or survival of foodborne pathogens by	Insufficient product information, and/or inadequate knowledge of general food hygiene, can lead to products being mishandled at later stages in the food chain. Such mishandling can result in illness or products becoming unsuitable for consumption, even where adequate hygiene control measures have been taken earlier in the food chain.

Focus Area	Objectives	Rationale
	storing, preparing and using it correctly Information for industry or trade users should be clearly distinguishable from consumer information, particularly on food labels.	
Training	Those engaged in food operations who come directly or indirectly into contact with food should be trained, and/or instructed in food hygiene to a level appropriate to the operations they are to perform.	Training is fundamentally important to any food hygiene system. Inadequate hygiene training, and/or instruction and supervision of *everyone* involved in food related activities poses a potential threat to the safety of food and its suitability for consumption.

Source: Codex Alimentarius Commission (1969). *General Principles of Food Hygiene (CAC/RCP 1-1969)*.

Good Agricultural Practices (GAP)

In saffron production, some hazards are very difficult to recondition or eliminate through post-harvest processing. Thus, it is very important to prevent them in the first place. Contaminants such as mycotoxins, pesticide residues, heavy metals and microbiological contaminants are most effectively controlled by using good practices during growing, harvest, transport and storage. According to the FAO, Good Agricultural Practices are practices that need to be applied on farms to ensure food safety during pre-production, production, harvest and post-harvest. To apply good practices throughout the food chain, GAP should be complemented by GHP throughout all stages of production and GMP during post-harvest stages.

GAP implementation relies on the identification of potential hazards to food through different forms of contamination, and defines appropriate measures for their prevention or control. Key GAP for controlling food safety hazards are found below in Table 25. These practices can help to prevent contamination, or at least ensure a level of presence that is acceptable and will meet food safety standards. The controlling of food safety hazards is only one part of GAP, albeit an important one. GAP also addresses environmental, social and economic considerations in a sustainable manner.

More comprehensive GAP have been developed that institute controls at different stages of production. One of the common ones is the GLOBALG.A.P. standard, which covers soil management, production substrates, pre-harvest controls for plant protection application, organic fertilizer application, pre-harvest check, harvesting, final produce packing at point of harvest, sanitary facilities, packing and storage areas, pest control and post-harvest treatment. Read more about the GLOBALG.A.P. standard in Chapter 5 (Europe).

Table 25 Summary of Good Agricultural Practices for controlling food safety hazards

Source	Recommended practice to prevent a safety hazard
Production site location and environment	• Be informed of the previous and present usage of the crocus flower production area and adjoining sites to identify potential hazards. • Evaluate the location of the production area in terms of its exposure to pests, pesticides, weeds or diseases due to the environment. Be acquainted with types of pests, diseases and weeds in the general area. • Assess the potential for contamination of the production area by leaking, leaching or overflowing manure storage sites, waste disposal or treatment areas, chemical and hazardous waste sites or flooding from polluted surface waters. • To minimize the risk of heavy metal contamination, saffron should not be grown in or near areas that are prone to the presence of heavy metals, such as industrial areas. • Evaluate the slope of the land to determine potential for runoff of contamination from other nearby fields.

Source	Recommended practice to prevent a safety hazard
	• Ensure that the crocus flowers are grown far enough away from other plants that are known to attract high levels of pests or disease. Production areas should be maintained to reduce likelihood of pest attraction, such as minimizing the presence of standing water, animal waste and food waste in fields. • Evaluate the degree to which weeds pose risks to the crocus flowers in terms of competing for nutrients, encouraging pests, or production of toxins. Mechanical or manual removal of weeds should be done whenever possible, before use of any kind of weed killing chemicals. • Ensure that adjacent crops, especially non-food crops that use a lot of pesticides, are far enough away or isolated enough that wind cannot carry pesticides to the crocus flowers, resulting in detectable levels of non-permitted pesticides. • Evaluate the potential access by domestic or wild animals to the production area or to water resources used in saffron cultivation. Identify the possibilities of faecal contamination of both soil and water and the likelihood of crop contamination. • Animals should be excluded as much as possible from production and handling areas (using methods that follow animal protection regulations). • If evaluations of location and environment indicate contamination risks, measures should be implemented to prevent or minimize these risks. • Plan out the production site ahead of time, designating areas for waste disposal, storage facilities, toilets and washrooms, agrochemicals mixing area, etc.
Agricultural inputs	
Soil	• Verify levels of microbiological and chemical contamination of the soil through laboratory analysis. • If laboratory analysis shows that contamination levels are high enough that they would compromise the safety of the saffron crop, control measures should be implemented to reduce hazards to acceptable levels over time. • If available control measures cannot reduce the hazard, then the soil should not be used for cultivation. • A soil-monitoring programme should be used to ensure that naturally occurring heavy metals such as those present from natural ores do not become potential problems for the saffron crop. • Batteries should not be disposed anywhere near the production area. • Prevent access to the production area by domestic or wild animals to reduce the risk of faecal contamination of the soil. • Compost manure or incorporate it prior to planting instead of top-dressing with fresh manure to reduce the risk of contamination. • Avoid applying manure for three months prior to harvesting and do not apply fresh or liquid manure once the crop is in the field. • Never use ‘night soil’. • Analyse the type of soil and its depth for good root growth. • Avoid soil erosion and compression, use contour planning, terrace or strip-cropping as appropriate. • Practice crop rotation, avoid always tilling the soil to the same depth and change position of planting beds periodically.
Water	• Identify the sources of water used in saffron production whether it is from the municipality, re-used irrigation water, well water, open canals, reservoirs, rivers, lakes, pond, etc. • Where necessary, have irrigation water tested for microbial and chemical contaminants, such as pesticide residues from crop run-off further upstream. Testing may be more necessary after flooding or heavy rainfall when water is at a higher risk of contamination. • Where present, upstream activities such as heavy industry or mining operations should be monitored to reduce risk of heavy metal contamination, and water should be tested annually for this. • Surface water should be tested quarterly for faecal coliforms, especially if the water is in close proximity to sewage treatment or livestock areas.

Source	Recommended practice to prevent a safety hazard
	• Avoid storing manure or biological fertilizers near water sources and avoid animal access. • Only use potable water for crop protection sprays such as fertilizer, herbicides or pesticides. • If overhead irrigation is used, use it early in the day so leaves dry quickly, minimizing microbial growth. • Trickle irrigation involves less risk of microbial contamination than flood irrigation. • Do not over-irrigate; use only the amount needed. • Keep water flow channels free of waste.
Corms	• Use only high-quality corms that are free from disease or other abnormalities. • Employ corms of sufficient size and weight to ensure high yields and progeny. • Develop practices to eliminate pests and diseases from corms. • Select an ideal sowing date to avoid droughts and sow at an adequate distance.
Crop protection products	• Whenever possible, use natural pesticides such as neem or others which are more acceptable to some importing countries. • Consult an expert to recommend chemicals that are fit for saffron and in accordance with the pests, diseases and weeds affecting it. • If agricultural chemicals are used, use only chemicals that are authorized for the cultivation of saffron, in both Afghanistan and the country where the saffron is to be exported. • Do not assume that because a chemical is allowed on one type of crop, it will be allowed on saffron. • Purchase chemicals solely from authorized sellers who can give assurances that the chemical is authentic. • Chemicals should be used strictly according to the manufacturer's instructions, including dose levels, dilution levels, and number of applications. • Never mix crop-protection chemicals near water sources. Do not store crop-protection chemical application equipment near water sources. • Keep records of chemical applications (dates of application, names of chemicals used, dilution and dose levels, crops sprayed, targeted pests, method of application, frequency of application) as well as records of harvesting times to ensure that the time between application and harvesting is appropriate. • Pesticide holidays, usually from 10–30 days, should be observed so there is a sufficient gap between application and harvest, which will enable chemicals to dissipate through the plant prior to harvest. Labels of agrochemicals should specify this information. • Calibrate agricultural chemical sprayers as necessary to control the accuracy of the rate of application. • Workers applying pesticides should be fully trained, sufficiently equipped and protected, and equipment used should be capable of ensuring acceptable application levels. • Equipment used should be washed thoroughly and at an appropriate frequency to avoid cross-contamination with previously used pesticides. • Chemical containers should be disposed of properly and not left in fields after application. • Attention should be given to the colours of any plant-protection chemical purchased as highly coloured pesticides can leave traces of colour on crops, especially if applied late in the growing cycle. • If appropriate, for preventative purposes, fungicides may be used on seedbeds or fields to avoid the introduction of mycotoxin-producing moulds.
Organic and inorganic fertilizers	• If fertilizers are used, make sure they are from a reputable supplier. • When needed, obtain documentation from fertilizer suppliers identifying the origin, treatments used, tests performed and results. • Adopt proper treatment procedures such as composting, pasteurization, heat drying, alkali digestion, sun drying or combinations of these that are designed to reduce or eliminate pathogens.

Source	Recommended practice to prevent a safety hazard
	• Use untreated or partially treated organic fertilizers only if appropriate corrective actions are being adopted to reduce microbial contaminants, such as maximizing the time between application and harvest. • Minimize direct or indirect contact between manure, bio solids or other natural fertilizers with the saffron crop, especially close to harvest. • It is better to use small amounts of fertilizers regularly than using a large amount at one time, as this can result in a growth spurt, which can weaken the structure of the plant and make it more susceptible to pest attack.
Workers hygiene and worker protection	• Written procedures should address worker training, facilities and supplies to enable workers to practice proper hygiene. • Toilets, potable drinking water, break areas and hand-washing facilities should be available to agricultural workers, and supervisors need to ensure that workers make reasonable use of these facilities and understand the importance of GHP. • Workers harvesting or handling the crocus flowers or stigmas should be healthy, free from disease and with cleanly washed hands. No one who is known or suspected of carrying an illness or disease should enter the production area. • Refrain from activities that could result in the contamination of the saffron, for example, smoking, spitting, eating, drinking, chewing gum, sneezing or coughing near the product. • Non-essential persons should not enter the production area as they may present an increased risk of contamination. If they are present, take measures to ensure they will not be sources of contamination. • Do not wear jewellery, watches or other items in production areas. • Basic sanitary practices should always be observed (e.g. wash hands every time after using toilets). Maintain a high degree of personal cleanliness and, where appropriate, wear masks, protective clothing, gloves and footwear. • Agricultural workers should be encouraged to report symptoms of illness to their supervisors, so that they are not unnecessarily exposed to the production area. Health of workers should be monitored. • First aid kits should be available and well-stocked to treat minor injuries. Emergency phone numbers should be clearly displayed. • Cuts or wounds should be covered with securely fixed waterproof dressings along with a second layer on top in between the dressing and the plants handles, such as a glove.
Growing practices	• Apply agricultural inputs correctly during implementation of production practices based on Integrated Crop Management and Integrated Pest Management Systems.
Harvesting, transport and storage	• Harvest the crocus flowers using the appropriate technique at the appropriate harvest time. • Avoid contact with soil or dirty surfaces. If flowers have fallen to the ground during collection, they should be kept separate and examined for dirt and dust (and cleaned if necessary) prior to their inclusion with the rest, and discarded if beyond repair. • Plant matter that is damaged or other plant waste material should be disposed of properly and removed from the harvest area to minimize the potential for it to serve as a source of mycotoxin-producing moulds. • Cover collection or storage baskets after collection and during transport. • Any vehicles used to transport harvested crocus flowers should be dry and clean. Extra attention should be given to vehicles that may have been used for different purposes before transporting harvested flowers. • Transport times should be kept to an absolute minimum. • Process saffron as soon as possible after collection to reduce risk of mycotoxin contamination during storage. If the amount harvested exceeds processing capabilities, excess flowers should be stored under appropriate conditions.
Facilities associated with the crop	• Make available hygienic and sanitary facilities to ensure appropriate degree of personal hygiene. As far as possible, such facilities should: – Be located far enough away from the fields to avoid risks of contamination, be of sufficient number to accommodate personnel and be easily accessible.

Source	Recommended practice to prevent a safety hazard
	– Be of appropriate design to ensure hygienic removal of wastes and avoid contamination of growing sites, harvested crops or agricultural inputs. – Have adequate means of hygienically washing and drying hands, be equipped with trash cans, toilet paper, washbasin, potable water, soap and towels. – Be maintained under sanitary conditions and good repair. • Make available potable water and clean and safe rest areas. Follow legal employment conditions. • Implement effective pest control systems. • Implement effective waste management systems.
Equipment, tools, utensils	• Adopt cleaning and maintenance programmes for all equipment and tools. • Equipment and containers coming into contact with flowers or stigmas should be made of non-toxic materials. They should be designed and built to ensure that, when necessary, they can be cleaned, disinfected and maintained to avoid contamination. • Before harvesting and also at the end of each day, make sure to clean all baskets or storage containers to be used. This also applies to any other tools to be used, such as tweezers or scissors. This is especially important for equipment that has not be used since the last harvest. • Clean water should be used to clean all equipment and equipment should be allowed to fully dry before use. • Ensure good functioning of equipment and tools according to the use for which they are designed without damaging the product. Such equipment should be maintained in good order.

Source: Summarized and adapted from Food and Agriculture Organization of the United Nations (2016). *A Scheme and Training Manual on Good Agricultural Practices (GAP) for Fruits and Vegetables*.[71]; American Spice Trade Association (2016). *General Guidelines for Good Agricultural Practices for Spices.*[72]; Codex Alimentarius Commission (2014). *Code of Hygienic Practice for Spices and Dried Aromatic Herbs (CAC/RCP 42-1995)*.[73]

Good Manufacturing Practices (GMP)

GMP can be defined as a set of operational requirements that must be in place for a food business to produce safe and quality food. GMP are a key aspect of an effective overall HACCP system and should be implemented by any facility that handles food in order to ensure food safety. There is not only a moral responsibility for a food business to ensure food does not harm consumers, but also a legal one as there is a strong emphasis on compliance with GMP in food safety legislation around the world.

Like GHP and GAP, failure to adopt GMP can result in significant costs in the form of rejected, spoiled or poor-quality saffron. The consistency of saffron quality relies on several factors and processes that occur between the farm and the final consumer. GMP cover many of these factors including: Processing facility design (interior and exterior), sanitary and worker facilities, equipment design and maintenance, pest control and chemicals, personal hygiene and health, control of operations and corrective actions, training, supervision and recordkeeping. Key GMP for controlling food safety are found in Table 26.

Table 26 Good Manufacturing Practices for controlling food safety hazards

Source	Recommended Practice
Plant and grounds (premises)	
Building exterior	• Grounds around the saffron processing centre must be free from: – litter, waste or refuse – uncut weeds or grass close to buildings – excessively dusty roads, yards or parking lots – improperly drained areas (breeding areas for insects and microorganisms) – inadequately operated systems for waste treatment and disposal

[71] Food and Agriculture Organization of the United Nations (2016). *A Scheme and Training Manual on Good Agricultural Practices (GAP) for Fruits and Vegetables*.
[72] American Spice Trade Association (2016). *General Guidelines for Good Agricultural Practices for Spices.*
[73] Codex Alimentarius Commision (2014). *Code of Hygienic Practice for Spices and Dried Aromatic Herbs (CAC/RCP 42-1995)*.

Source	Recommended Practice
	– improperly stored equipment • Buildings should not be located in close proximity to any environmental contaminants • The building exterior should be designed, built and maintained to prevent entry of contaminants and pests. For example, the exterior should have no unprotected openings, air intakes should be appropriately located, and the roof, walls and foundation are maintained to prevent leakage. • The roof of the building should be clear of clutter, standing water, bird and pest harbourages. It must be easily accessible to plant security and inspectors, but not for non-authorized personnel. • Outside opening doors should be self-closing, tight-fitting and maintained in good repair.
Building interior	• Building construction and design shall provide enough space for sanitary arrangement of equipment and storage of materials • Floors, walls and ceilings must be built so that they are cleanable and must be clean and in good repair. They should be made of materials that are durable, impervious, smooth and suitable for food-processing activities. • Joints between walls, floor and ceiling should be sealed with coved angles, where possible, to prevent contamination and facilitate cleaning. • Ceiling surfaces and other overhead equipment such as ventilation units, pipes, etc. must be clean, in good repair, free of flaking paint, rust, dust, mould, holes, unsealed openings, water leaks, condensation or other conditions that could result in product contamination. • Walls should be free of dust, dirt, flaking paint and cracks, as well as holes and crevices that could inhibit cleaning or provide harbourage for soil or pests. • Floors should be sufficiently sloped so that liquids can drain properly into designed outlets. Maintain floors in a clean and dry condition. • Windows should be sealed or equipped with close-fitting screens to keep out birds, animals and vermin such as insects and rodents. • If possible, windows should be constructed of materials that are not prone to breakage and should be adequately protected. • Internal window seals, if present, should be sloped to prevent use as shelves. • Doors should be close-fitting, have smooth, non-absorbent surfaces, and be self-closing where appropriate. • Separate by partition, location, time and other means, any operations that may cause cross-contamination of food products with undesirable microorganisms, chemicals, filth or other extraneous material. • Provide adequate ventilation to prevent contamination of saffron with odours, noxious fumes vapours (including steam), excessive heat, condensation and dust, and to minimize entry of contaminated air. • All ventilation systems must be cleanable and properly functioning. Ventilation fans in walls should be screened to avoid pest introduction when fans are turned off. Fans in roofs should be protected to prevent rain access and should not be located directly above any open processing or storage areas. • Maintain saffron processing areas under positive air pressure to prevent dust, insect entry and cross-contamination of unfiltered air. • Screen and filter all incoming air for saffron processing areas; air filters must be routinely inspected and replaced or cleaned. • All toilet facilities, locker rooms, labs and chemical storage areas must be ventilated to the outside. • Lighting levels should be appropriate for the activity being conducted (e.g. at least 540 lux in inspection areas) and the lighting should not alter the colour appearance of saffron. • Light bulbs, skylights or any other glass must be of a secure, safety type or protected so that glass contamination cannot occur in the event of breakage. • The plant and all fixtures must be kept in good repair and maintained in sanitary condition. Cleaning operations must be conducted in a manner that will minimize the possibility of contaminating foods or equipment surfaces that contact food.

Source	Recommended Practice
	• Wherever possible, any horizontal surface should be slightly sloped for easy cleaning.
Sanitary facilities	
Water supply	• Any water that comes into contact with processing equipment must be safe and of adequate sanitary quality. • Potable water should be available to workers at all times. • There should be no cross-connections between potable and non-potable water supplies and all hoses and taps should be designed to prevent backflow.
Sewage disposal	• All sewage waste must flow into an adequate sewage system or be disposed of through other adequate means.
Plumbing	• Plumbing must be of sufficient size and design to: – Supply enough water to areas in the facility where it is needed – Properly transfer sewage or disposable liquid waste away from the facility – Avoid creating a source of contamination or unsanitary condition • Provide adequate floor drainage where spray hose-type cleaning is done or where operations discharge water or liquid waste onto the floor • Ensure that there is no backflow from cross-connections between piping systems that discharge wastewater or sewage and those that carry water for food manufacturing
Toilet facilities	• Toilet facilities must be provided inside the saffron processing centre. • Toilet tissue must be provided. • Toilets must be kept sanitary and in good repair. • Toilet rooms must have self-closing doors. • Toilet rooms must not open directly into areas where saffron is exposed. • Written notices should be posted instructing workers to remove protective clothing before entering toilet facilities. • Signs must be posted that direct employees to wash their hands with soap or detergent after using the toilet.
Hand-washing facilities	• Adequate and convenient hand-washing and, if necessary, hand-sanitizing facilities must be provided anywhere in the building where the nature of employees' jobs requires that they wash, sanitize and dry their hands. • Hand-washing facilities must provide: – Running water at a suitable temperature from a single nozzle – Effective hand-cleaning and hand-sanitizing preparations – Clean towel service or suitable drying devices – Easily cleanable waste receptacle – Water control valves designed and constructed to protect against recontamination of clean, sanitized hands – Signs directing employees to wash and, if appropriate, sanitize their hands before starting work, after each absence from the workstation, and any other time when their hands have become soiled or contaminated.
Worker break rooms, locker rooms	• Worker areas should be well lit, clean, orderly and effectively ventilated. • Lockers should have a separation between clean and used work clothing. • Written notices should be posted of what is allowed or banned in lockers. • There should be a designated storage area for employees' lunch items. • Suitable refrigeration units should be provided if employees are permitted to bring their own meals. If used, they should be cleaned and inspected at appropriate intervals. • Written notices should be posted informing workers of proper hand-washing before starting work and after breaks. • Period inspection of these areas should be in force for hygiene purposes. • Lunchrooms and change rooms are adequately ventilated and maintained in a clean condition. They are separate from and do not lead directly into food-processing areas.
Waste management	• All waste and rubbish must be handled in such a manner that they do not serve to attract or harbour pests or create contaminating conditions. • Adequate facilities and equipment are provided and maintained for the storage of waste prior to its removal from the establishment.

Source	Recommended Practice
	• Containers used for waste are clearly identified, leak-proof and, where appropriate, covered. • After waste is removed, containers are cleaned and sanitized at an appropriate frequency to minimize the potential for contamination.
Equipment and tools	
Design and function	• Equipment, containers and tools must be designed and constructed so that they are adequately cleanable and will not adulterate food with lubricants, fuel, metal fragments, contaminated water, colours, etc. • Equipment should be installed so that it and the area around it can be thoroughly cleaned. • Equipment should be free of flaking paint, rust or other contaminants that could become detached. Stainless steel is preferred. • Food contact surfaces shall be made of non-toxic materials, corrosion-resistant, smooth, non-absorbent, free from pitting, cracks or crevices and able to withstand repeated cleaning and sanitation. For this reason, wooden equipment should never be used. • Seams on food contact surfaces shall be smoothly bonded or maintained to minimize the accumulation of food particles, dirt and organic matter. • When coatings, paints, chemicals, lubricants and other materials are used for food contact surfaces or equipment, the substances should be appropriate for the intended use and in accordance with the manufacturer's instructions. • Equipment in processing areas that does not come into contact with food shall be constructed so that it can be kept clean. • Equipment and tools used to handle inedible material must not be used to handle edible material. • Wherever possible, equipment should be manufactured with continuous welding to facilitate easy cleaning and prevent microbial risk. • Vessels containing saffron should be covered where the potential exists for contamination. • Instruments and controls used for measuring, regulating or recording temperatures, humidity, etc. shall be adequate in number, accurate and maintained. They should be accessible and convenient to read.
Cleaning and maintenance of equipment and tools	• A fully documented cleaning and maintenance programme outlining activities and frequencies should be developed, documented and verified by a designated person. • Utensils and equipment surfaces that are in contact with saffron must be cleaned and sanitized as often as necessary to prevent food contamination. If necessary, such equipment should be taken apart for thorough cleaning. • Equipment surfaces that are not in contact with saffron should be cleaned as frequently as necessary to minimize accumulation of dust, dirt, food particles, etc. • Where there is the possibility of introducing undesirable microorganisms into saffron, all utensils and equipment surfaces that contact saffron must be cleaned and sanitized before use and following any interruption during which they may have become contaminated. • When utensils or equipment are used in a continuous production operation, they must be cleaned and sanitized on a predetermined schedule. • Single-service articles such as disposable utensils, paper cups, paper towels, etc., should be: – Stored in appropriate containers – Handled, dispensed, used and disposed of in a manner that prevents contamination of food or equipment
Storage and handling of portable equipment and tools	• When portable equipment or tools have been cleaned and sanitized, they should be stored in a manner that will protect the food contact surfaces from water splashes, dust and other contamination. • When mobile equipment moves between areas, measures should be taken to minimize cross contamination.
Pest control and chemicals	

Source	Recommended Practice
	• No animals or birds are allowed anywhere in the facility. • Programmes must be in effect to prevent contamination by animals, birds and pests, such as rodents and insects. • Pest control programmes should list all pests that are covered by the programme and consideration should be given to local pests. An individual should be charged responsibility for pest control. • Fly-killing devices and/or pheromone traps should be placed correctly to prevent expulsion of insects or fragments from the devices into the product or process. Maps of trap placements should be created and maintained. • Set up a protocol of what to do when pest activity has been identified. • In the event of an infestation or any evidence of pest activity, immediate action should be taken and any potentially affected products should be handled according to established procedures. • Proper care must be given to the use of all pest control equipment. • Maintain an approved pesticide list, indicating for each the storage location, level of toxicity and labelled instructions for proper use. An accurate log should be kept tracking all chemicals used and the stock balance. • Pest control chemicals should be stored in a designated and locked room. • Only those individuals properly trained or certified to handle pesticides should do so. • Limit and control pesticide use in food areas. Keep pesticides, traps and other devices away from open food products. • Identify which chemicals are food-grade and which are not. Define which chemicals are allowed in a food-processing environment. • Ensure each chemical has a material safety data sheet and a specification. • Label and or identify containers of chemicals at all times. • All personnel must be aware that chemicals are toxic and inadvertent exposure is a possibility. Personnel should be instructed to notify a manager if any pest activity is detected. • The use of toxic chemicals should be avoided if possible, but if they are used they should be carefully controlled to prevent contamination of food or packaging materials.
Personal hygiene and health	
Uniforms and protective clothing	• People who work in direct contact with saffron or saffron processing activities must wear clean outer garments and protective clothing. These items should be food-grade. • Buttons are a potential physical contamination risk, so snaps or Velcro are preferred. • Disposable white gloves should be worn and changed whenever contamination is a possibility. • Protective footwear such as designated shoes for processing areas, or foot/shoe covers should be worn and maintained in a sanitary manner. • Protective footwear should not be worn outside of the facility and should be designed for easy cleaning. • Clothing should be washed at an appropriate frequency by a competent in-house laundry or laundry service. • Workers must not store personal clothing or other personal belongings in food-processing areas. • Responsibility for ensuring that all personnel comply with the requirements should be allocated to a competent supervisor and these rules should be clearly communicated in both oral and written form.
Hair and jewellery	• Personnel who directly handle the saffron should remove any jewellery. If jewellery cannot be removed (e.g. wedding bands or medical alert devices), then it should be fully secure and covered. • Hair restraints should always be worn at all times, such as hairnets and beard covers. • False eyelashes, false fingernails, nail polish and other loose items that may contaminate the saffron should not be worn by workers.
Cleanliness	• People who work in direct contact with saffron or saffron processing activities must maintain a high degree of personal cleanliness and conform to hygienic practices while on duty.

Source	Recommended Practice
	• Workers must wash their hand thoroughly. If they are working at a job where it is necessary, workers should sanitize their hands before starting work, after each absence from the workstation, any time after handling contaminated materials (e.g. picking up objects off the floor, handling garbage, cleaning chemicals, or raw incoming materials), after breaks, and after using toilet facilities or blowing their nose. • Educate employees of the increased danger of product contamination when touching the face, wiping the forehead, or placing fingers in the mouth, nose or ears. • Fingernails should be kept very clean and properly trimmed. • Eating food, drinking a beverage or using tobacco (in any form) must not be allowed in food-processing areas. • All necessary steps must be taken by supervisors to prevent workers from contaminating saffron with microorganisms or foreign substances such as perspiration, hair, cosmetics, tobacco, chemicals and medication.
Illness and injury	• Any individual who has an illness or open lesions including boils, sores, infected wounds or any other abnormal source of microbial contamination must not work in any operation that could result in the food, food contact surface or food-packaging material becoming contaminated. • Management should have a policy in place to prevent personnel from working in saffron handling areas if they are known to be suffering from any of these issues. Policy should require workers to notify management if they have symptoms of a communicable disease such as fever, sore throat, cough, vomiting, diarrhoea or discharges from the ear, nose or eye. • Any person who is affected with or has been exposed to a communicable disease in the past 10 days must be prohibited from entering the production environment. • Employees with open cuts or wounds must not handle food or food contact surfaces unless the injury is completely protected by a secure waterproof covering (e.g. rubber gloves)
Personnel and visitor controls	• Access of personnel and visitors is controlled to prevent contamination. There should be a formalized system for the management of visitors to the site. • Each visitor should be informed of food safety controls associated with their visit and should offer their signature to verify their healthy status. • Visitors must, at a minimum, follow the same procedures as any employee. • The traffic pattern of employees should be designed to prevent cross-contamination of the product.
Control of operation (processes and controls)	
Raw materials	• Raw materials must be: – Inspected and sorted to ensure that they are clean, wholesome and fit for processing into food. – Stored under conditions that will protect against contamination and minimize deterioration. – Cleaned to remove soil and other contamination • Raw materials shall not contain levels of microorganisms, mycotoxins or pests, or extraneous material that may produce food poisoning or other disease. • Containers and carriers should be inspected to ensure that their condition has not contaminated raw ingredients. (e.g. damaged containers or stains, pests, insects, rodents, bird droppings, moulds, foreign material, lubricants, other chemicals). • When needed, cleaning/sorting controls should be in place to remove damaged, decomposed and mouldy products from incoming raw materials, prevent the use of raw materials noticeably contaminated with lubricants, fuels, etc., and remove extraneous matter (e.g. stones, wood, insects, glass). • Agreements should be made with suppliers demonstrating that saffron was grown, harvested and handled using GAP.
Product preparation/control	• Saffron should be processed, packaged and stored under conditions that will minimize the potential for undesirable microbiological growth, toxin formation, deterioration or contamination. This requires careful monitoring of factors such as time, temperature,

Source	Recommended Practice
	humidity, air flow, light, etc., to ensure that time delays, temperature fluctuations or other factors do not allow the foods to decompose or become contaminated. • Measures such as sterilizing or irradiating, while effective in destroying or preventing the growth of undesirable microorganisms, should never be used on saffron as it degrades the quality significantly. • Finished saffron as well as work-in-process saffron shall be protected from contamination. • Saffron that is adulterated shall be disposed of in a manner that prevents other food from being contaminated. • Food additives (e.g. anti-caking agents) should not be used in saffron or saffron powder. Inadequate control of food additives and/or processing aids could result in chemical or biological hazards. • Measures should be in place to prevent the presence of allergens. Areas that may require control include: cross-contamination or carry over, inappropriate use of rework, unknown raw materials (e.g. saffron purchased from a new supplier) • Procedures are in place when grinding saffron into saffron powder to minimize contamination with metal and other physical hazards. Grinding can produce dust that can attract rodents and insects, so it is important that this is a controlled process.
Packaging	• Incoming packaging materials should meet food contact material requirements such that no biological, physical or chemical hazards result in the food. • Packaging materials should meet written specifications according to the manufacturer and be appropriate for the intended use. • Each lot of incoming packaging material should be examined for signs of physical damage or contamination. Damaged or contaminated packaging material should not be used. An effective system should be in place to prevent their usage. • Filling, assembling, packaging and other operations shall be performed in such a way that the food is protected against contamination by: – Use of a quality control operation in which the critical control points are identified and controlled during manufacturing – Adequate cleaning and sanitizing of all food-contact surfaces and food containers – Using materials for food containers and food-packaging materials that are safe and suitable – Providing physical protection from contamination, particularly airborne contamination – Using sanitary handling procedures • Only packaging materials required for immediate use should be kept in the packaging or filling area.
Labelling	• Measures should be in place to ensure that the correct label is applied to the correct product such as: – Product types (stigmas vs. powder, size differences) are effectively separated during changeovers. – Different product labels or pre-labelled packaging are effectively separated, and the number of product label types is kept to a minimum. – During storage, care is taken to prevent mixing of individual labels or bundles of labels (e.g. storing labels in separate boxes, no loose labels and unused labels are returned to correct box). – Procedures are in place to ensure the saffron product being labelled corresponds to the labels in use. • Inaccurate or misleading nutrition content claims and health claims should not be made as they may pose a risk for consumers who are making food choices based on the nutrient content of the food. • Controls must be in place to ensure that labels are complete and accurate and meet requirements of the intended market. • Labelling should provide adequate information to ensure that the end consumer or individuals at the next stage in the food chain will handle, store, process or prepare the product safely.

Source	Recommended Practice
Product coding (traceability)	• A coding system should be used to allow identification and segregation of lots of saffron that may be contaminated. In some cases, coding may not be mandatory, but it is highly recommended. • Pre-packaged saffron products are permanently marked with a legible code or lot identification on the label, package or container. • The coding system identifies where the product was manufactured (facility, line, etc.) and when (shift, day, month, year, etc.) • A record of all code marks and their meaning is maintained by management and made available upon request.
Storage (incoming materials and finished products)	• Saffron should be held under conditions that prevent the growth of undesirable microorganisms and toxins. Dark, cool and dry conditions are ideal. Saffron should never be refrigerated. • Low-moisture foods like saffron should be protected from moisture pickup by using suitable storage materials so that moisture levels do not reach unsafe levels. • Saffron is stored and handled under conditions that minimize damage, deterioration and prevent contamination including cross-contamination with raw materials and/or allergens. • Storage areas need to be clean, dry, protected against pests and separate from the rest of the facility. Other equipment, chemicals or personal items should not be stored in the same space. • For both incoming materials and finished products, stock rotation is controlled to prevent deterioration and spoilage (i.e. first-in, first-out principle). • Finished products (dried, finished saffron) should not be stored in the same area as incoming materials (crocus flowers).
Transport	• Containers and vehicles used in transport should be designed, built, maintained, cleaned and used in a manner that prevents food contamination. • Containers used in transport are clean, dry, weatherproof, free of infestation and sealed to prevent water, rodents or insects from reaching the products. • Transport vehicles should have an adequate cleaning and sanitizing programme in place. • Vehicles and containers should be inspected upon receipt of incoming raw materials and prior to loading of final products to ensure they are free from contamination and suitable for transportation of saffron. • Inspectors should check the condition of arriving vehicles, whether there are any holes and/or water damage, condensation due to temperature changes, damage to product containers and presence of non-food items, as well as environmental conditions such as temperature and humidity controls. • The incoming materials reception area should be protected from weather, have sufficient lighting to allow for accurate inspection and have good pest protection devices. • During inspections carried out when loading and unloading, systems should be in place to prevent birds, insects and other pests from gaining entrance to the facility. • Inspections of dispatching vehicles should include checks for: general cleanliness, holes that can allow pests or rain to get onto the product, aroma, flaking paint, door seals, presence of allergenic material, presence of non-food items or residues, wooden materials that could host pests, presence of oil, grease or other liquid. Temperature and humidity controls should also be present. • Finished saffron products should be loaded, transported and unloaded in a manner that protects them from any damage, contamination or water. • Make sure that only the designated items go into the container and that it is suitably sealed to ensure that the product cannot be tampered with. Transporters should have systems in place to prevent accidental or deliberate contamination during transport.
Deviations and corrective actions	• A system should be in place to identify deviations from established critical limits of acceptability. • Unsatisfactory saffron needs to be isolated, clearly marked and controlled. • A qualified person should evaluation unsatisfactory saffron products.

Source	Recommended Practice
	• Documented corrective actions should be in place including: – An investigation to determine the cause of the deviation – Preventative measures taken to prevent recurrence of the deviation – Verification by the manufacturer of the effectiveness of the corrective action taken. • The product must not be released until the evaluation has determined that no health hazard exists and the product complies with appropriate legislation.
Training, supervision and recordkeeping	
Training	• Any workers who handle the saffron must be trained in personal hygiene and hygienic handling of food, and they should understand the necessary precautions to prevent contamination of saffron. • A written training programme for employees should be in place and appropriate records should be maintained. • Provide appropriate training in personal hygiene and hygienic handling of saffron to all workers at the beginning of their employment. • Training should be reinforced or updated at appropriate intervals, or when a worker's duties change.
Supervision	• All people charged with monitoring sanitation programmes must have the education and/or experience to demonstrate that they are qualified. • Someone must be assigned the responsibility of ensuring that all personnel will comply with all the requirements of these GMP.
Recordkeeping	• Information should be recorded in a manner that represents an accurate history of the product or process. • Record entries should be made by the responsible person at the time the specific event occurs. The responsible person signs and dates the completed records. • Records should be kept on file for at least one year after the durable shelf life of the saffron products and should be made available upon request. • Types of records kept include: process design records, incoming material control records, product preparation records, process control records, deviation and corrective action records, verification records, equipment maintenance/calibration records, water-quality records, sanitation records, pest control records, complaint-handling and recall records, distribution records.

Source: Summarized and adapted from: Dauthy, M.E. (1995) *Fruit and vegetable processing*. FAO Agricultural Services Bulletin No. 119.[74]; Canadian Food Inspection Agency (2014). *Food Safety Practices Guidance for Spice Manufacturers*. 27 January.[75]; American Spice Trade Association (2015). *Good Manufacturing Practice (GMP) Guide for Spices.* April.[76]

Hazard Analysis and Critical Control Point (HACCP)

HACCP, defined by FAO as 'a system, which identifies, evaluates and controls hazards which are significant for food safety', is a proactive concept used by food businesses to ensure the safety of food from harvest to consumption ('from farm to fork'). HACCP is a preventative, risk-based system that enables food businesses to identify critical control points (CCP) for physical (e.g. glass, metal, hair), chemical (e.g. pesticide residues), and/or microbiological (e.g. pathogens, bacteria) hazards before they compromise the safety of food.

Each step in food production – including purchasing, receiving, storage, processing, packaging, warehousing and distribution up to the point of consumption – is subjected to hazard analysis and necessary controls are introduced. The premise is simple: if each step of the process is carried out correctly, the end product will be safe. HACCP is not a standalone system. GHP, GAP and GMP are all foundational prerequisites for implementation of an HACCP system and should be in place before developing an HACCP plan.

[74] Dauthy, M.E. (1995) *Fruit and vegetable processing*. FAO Agricultural Services Bulletin No. 119.

[75] Canadian Food Inspection Agency (2014). *Food Safety Practices Guidance for Spice Manufacturers*. 27 Jan.

[76] American Spice Trade Association (2015). *Good Manufacturing Practice (GMP) Guide for Spices.* Apr.

There are many reasons saffron production and processing businesses should use HACCP.

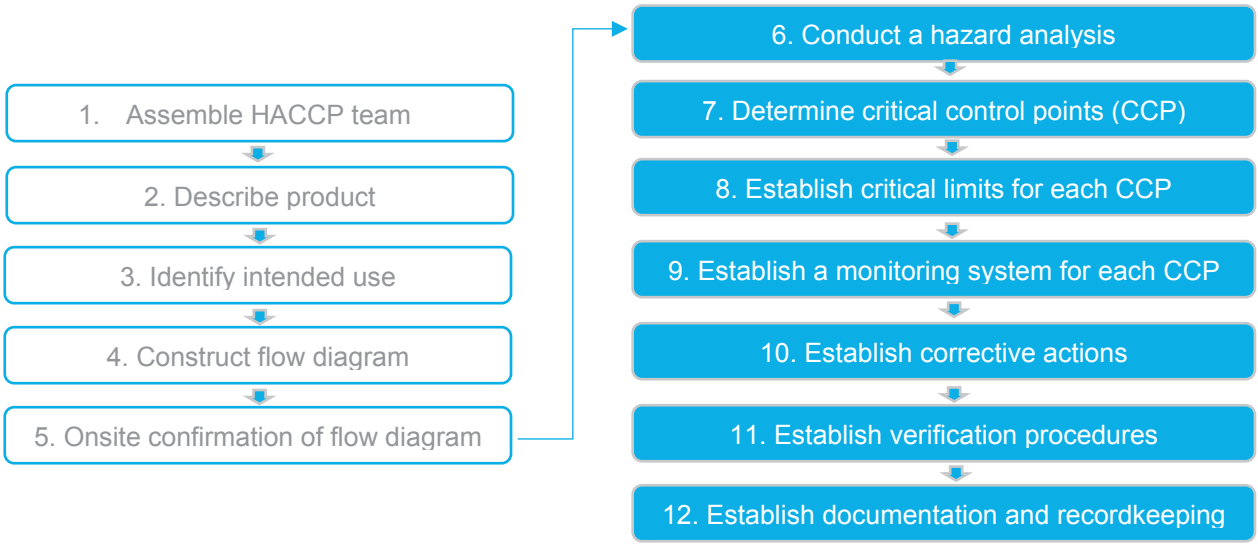
First, it provides a systematic means to identify and control all hazards, both current and potential. Second, it brings internal benefits such as reduced risk of manufacturing and selling unsafe saffron, which will in turn foster consumer confidence in these products. Third, it helps to convert a company from one that relies heavily on inspection and testing into one that focuses on prevention and quality assurance. Fourth, it is a cost-effective way to reduce potential losses due to food safety issues such as product rejections or recalls. Finally, food regulatory authorities in many countries are adopting or are likely to adopt HACCP in their food regulations.

By implementing HACCP, an exporter of saffron will have greater chances for market access in these countries. For example. EU rules on food hygiene state that all food businesses (i.e. dealing with food of animal origin, food of non-animal origin and food containing both processed ingredients of animal origin and ingredients of plant origin), after primary production, must put in place, implement and maintain a procedure based on HACCP principles. There are a number of FSMS standards based on HACCP principles that can be adopted and certified against to give additional assurances of food safety to buyers. Read more about these standards in Chapter 5 (Europe).

The following HACCP summary was extracted and adapted from the publicly available FAO document *Food Quality and Safety Systems – A Training Manual on Food Hygiene and the Hazard Analysis and Critical Control Point (HACCP) System*[77]. For a more thorough understanding of how to create and implement an HACCP system, please consult this training manual, a link to which can be found at the end of this chapter.

[77] Food and Agriculture Organization of the United Nations (1998). *Food Quality and Safety Systems – A Training Manual on Food Hygiene and the Hazard Analysis and Critical Control Point (HACCP) System*.

Figure 16 Logic sequence for application of HACCP (12 tasks)



Assemble the HACCP team

The first task in the application of HACCP is to assemble a team with the knowledge and expertise to develop an HACCP plan. The team should be composed of individuals involved at different stages of saffron production, which could include plant personnel from production, transport, storage, processing, quality assurance, laboratory and inspection. It is essential to assemble the right blend of expertise and experience, as the team members will collect, collate and evaluate technical data and identify hazards and CCPs. In smaller establishments, one person may fulfil several roles or even constitute the whole team. In the latter case, the use of external consultants or advice may be necessary.

The team should also include personnel who are directly involved in daily processing activities, as they are more familiar with the specific variability and limitations of the operations. Their representation will foster a sense of ownership among those who implement the plan. The HACCP team may require independent outside experts to advise on identified issues or problem areas. However, complete reliance on outside sources is not recommended in developing the HACCP plan, as such an approach may lack the support of the plant personnel.

Describe the product and identify intended use

The HACCP team must completely describe each food product – including all ingredients/processing methods/packaging materials, etc., used to make the product – to assist in the identification of all possible hazards associated with the product. In brief, the product description should include:

- name of the product
- ingredients and composition
- potential to support microbial growth (e.g. water activity [A_w], moisture levels)
- brief details of the process and technology used in production
- appropriate packaging and labelling
- intended use of the product
- intended consumers
- regulatory requirements for different markets
- shelf life
- handling and transport conditions.

To complete this description as accurately as possible, the team must be familiar with the properties, destination markets and use of the product. The HACCP team needs to have as complete an understanding of the product as possible. All details of its composition and processing should be known and understood.

This information will be particularly essential for microbiological hazards, because the product's composition must be assessed in relation to the ability of different pathogens to grow.

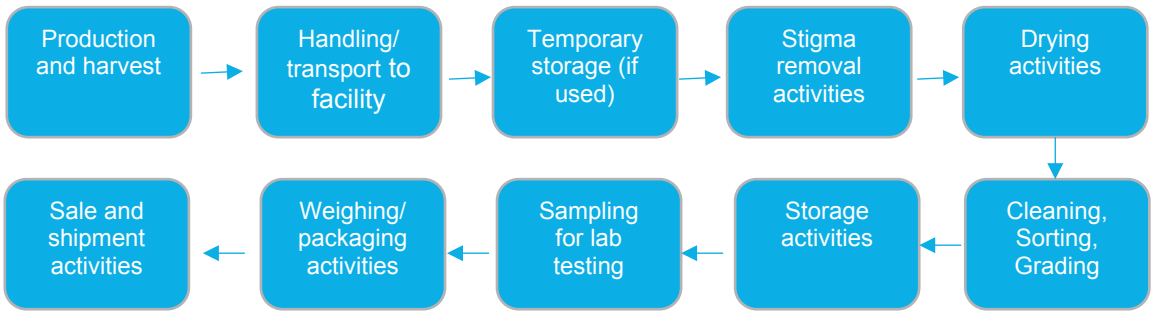
Create flow diagram and onsite confirmation of flow diagram

It is easier to identify routes of potential contamination, to suggest methods of control and to discuss these within the HACCP team if there is a flow diagram. The review of the flow of raw materials from the point they enter the production through processing to departure is the feature that makes HACCP a specific and important tool to identify and control potential hazards.

A process flow diagram must be based on interviews, observation of operations and other sources of information. The diagram will identify the important process steps used to produce the specific item being assessed. There should be enough detail to be useful in hazard identification, but not so much as to overburden the plan with less important points. It should take into consideration layout of facilities and equipment, processing equipment and steps that affect product characteristics, handling, transport/transfer stages and steps with potential for delays. Each process step should be considered in detail and the information expanded to include all relevant process data.

Steps must be taken to confirm the processing operation against the flow diagram during all stages and hours of operation and amend the flow diagram where appropriate. A person or people with sufficient knowledge about the processing operation should confirm the flow diagram. A very basic example of a process flow diagram for saffron is below in Figure 17. An accurate and effective diagram would be more detailed and customized to the operations of the company.

Figure 17 Generic, basic example of flow diagram for saffron



Conduct a hazard analysis

Hazard analysis is the first HACCP principle. An inaccurate hazard analysis would inevitably lead to the development of an inadequate HACCP plan. Hazard analysis requires technical expertise and scientific background in various domains for proper identification of all potential hazards. Knowledge of food science and HACCP is necessary to perform a satisfactory hazard analysis.

First, the HACCP team should list all hazards that may be reasonably expected to occur *at each step* according to the scope from primary production, processing, manufacture and distribution until the point of consumption. Next, the team should conduct a hazard analysis to identify for the HACCP plan which hazards are of such a nature that their elimination or reduction to acceptable levels is essential to produce safe food.

In conducting the hazard analysis, wherever possible the following should be included:

- the likely occurrence of hazards and the severity of their adverse health effects;
- the qualitative and/or quantitative evaluation of the presence of hazards;
- survival or multiplication of microorganisms of concern;
- production or persistence in foods of toxins, chemicals or physical agents; and
- conditions leading to the above.

A severity and likelihood matrix, an example of which can be seen in Table 27, can be a useful tool in conducting a hazard analysis. Placing each hazard into a box in the matrix depending on its likelihood and severity provides a visual depiction of those hazards that need to be controlled for to a greater degree. Hazards placed in the upper-right categories (coloured in red) will require the most attention in terms of intensity and frequency of controls.

Table 27 Basic example of a severity and likelihood matrix

Severity and likelihood matrix		Likelihood		
		Low probability of occurring (1)	Medium probability of occurring (2)	High probability of occurring (3)
Severity	Would result in serious or permanent health issues (3)	3 x 1 = 3	3 x 2 = 6	3 x 3 = 9
	Would result in health issues that are temporary and easily treated (2)	2 x 1 = 2	2 x 2 = 4	2 x 3 = 6
	Would result in very minor health issues with no need for medical attention (1)	1 x 1 = 1	1 x 2 = 2	1 x 3 = 3

Special consideration should be given to cross contamination 'vectors' where a hazard can be transferred from one area to another. Vectors may include air and water flow, foot traffic by workers or visitors, equipment or tools used in more than one area, sampling processes, cleaning practices and waste disposal. Consideration should be given to what control measures, if any exist, can be applied to each hazard. More than one control measure may be required to check for a specific hazard(s) and more than one hazard may be covered by a specified control measure.

Some hazards, once present in saffron, cannot be removed. These include chemicals used to grow the saffron, such as pesticide residues, or naturally occurring mycotoxins such as aflatoxin, bacteria or heavy metals. The hazards shown in Table 28 need to be controlled for through GHP, GAP and GMP.

Table 28 Examples of hazard types for saffron

Chemical Hazards	Physical Hazards	Biological Hazards
Pesticide residues	Metal	Salmonella
Fertilizers	Glass	E. Coli
Heavy metals	Plastic	Spore-forming bacteria
Mycotoxins	Dirt/dust	Other non-spore-forming bacteria
Food additives (e.g. colours)	Stones	Viruses
Allergens	Wood	Parasites
Cleaning chemicals	String/fibres	
Laboratory chemicals	Hair	
Pest control chemicals	Insects	
Paint	Bone	

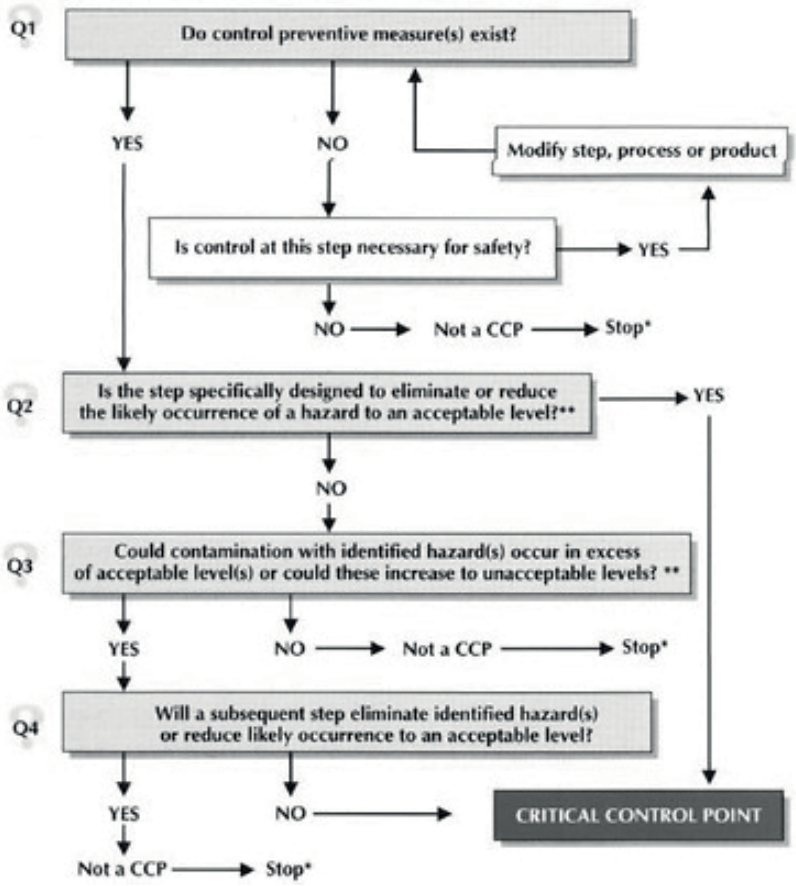
Determine critical control points

The determination of critical control points (CCP) is the second principle of HACCP. The Codex guidelines define a CCP as 'a step at which control can be applied and is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level'.

If a hazard has been identified at a step where control is necessary for safety and if no control measure exists at that step, then the product or process should be modified at that step, or at an earlier or later stage, to include a control measure.

Using a decision tree (like the one in the Codex *Hazard Analysis and Critical Control Point* (*HACCP*) *system and guidelines for its application,* which is based on logical reasoning) can make it easier to determine a CCP in the HACCP (see Figure 18). Application of the decision tree should be flexible according to the type of operation (production, processing, storage, distribution or other).

Figure 18 Critical control point decision tree



Source: Food and Agriculture Organization of the United Nations (1998). *Food Quality and Safety Systems – A Training Manual on Food Hygiene and the Hazard Analysis and Critical Control Point (HACCP) System*.

Establish critical limits for each critical control point

Critical limits are established and specified at each CCP. Critical limits are defined as criteria that separate acceptability from unacceptability. Such limits represent the boundaries that are used to judge whether an operation is producing safe goods. Critical limits may be set for factors such as temperature, time (minimum time exposure), physical product dimensions, water activity, moisture level or pesticide residues. These parameters, if maintained within boundaries, will confirm the safety of the product.

The critical limits should meet requirements of government regulations and/or company standards and/or be supported by other scientific data. In some cases, food control regulatory authorities provide information on which to establish the critical limits, based on known food hazards and the results of risk analysis.

The person(s) responsible for establishing critical limits must know the process and the legal and commercial standards required for the product. Sources of information on critical limits include:

- Scientific publications/research data
- Regulatory requirements and guidelines
- Experts (e.g. thermal process authorities, consultants, food scientists, microbiologists, equipment manufacturers, sanitarians and academics)
- Experimental studies (e.g. in-house experiments, contract laboratory studies).

If the information needed to establish critical limits is unavailable, a conservative value should be selected or regulatory limits used. Rationale and reference materials used should be recorded. The materials become part of the support documentation of the HACCP plan.

Establish a monitoring system for each critical control point

Monitoring is the scheduled measurement or observation of a CCP relative to its critical limits. The monitoring procedures must be able to detect loss of control at the CCP. Therefore, it is important to specify fully how, when and by whom monitoring is to be performed.

The purposes of monitoring include the following:

- To measure the performance level of the system's operation at the CCP (trend analysis)
- To determine when the performance level of the system results in a loss of control at the CCP, e.g. when there is deviation from a critical limit (see Task 10)
- To establish records that reflect the performance level of the system's operation at the CCP to comply with the HACCP plan.

The producer relies on monitoring to show that the HACCP plan is being followed. Monitoring provides accurate records enabling the producer to show that production conditions comply with the HACCP plan.

Ideally, monitoring should provide information in time to allow any adjustments to the process, thus preventing loss of control of the process and critical limits being exceeded. In practice, operating limits are often used to provide a safety margin that allows extra time to adjust the process before the critical limit is exceeded.

There are many ways to monitor the critical limits of a CCP. Monitoring can be done on a continuous (100%) or batch basis. Continuous monitoring is designed to detect shifts around target levels, allowing correction of these shifts and preventing deviation beyond the critical limits. Where feasible, continuous monitoring is preferred, as it is more reliable.

When monitoring is not continuous, it should be sufficiently thorough and frequent to provide an acceptable level of certainty that the CCP is under control. The more frequent the monitoring – that is, the less time between each instance of monitoring – the less product will be affected when control is lost at the CCP.

Establish corrective actions

The Codex *Hazard Analysis and Critical Control Point (HACCP) system and guidelines for its application* defines corrective action as ‘any action to be taken when the results of monitoring at the CCP indicate a loss of control’.

Loss of control is considered as a deviation from a critical limit for a CCP. Deviation procedures are a predetermined and documented set of actions to be implemented when a deviation occurs. All deviations must be addressed by taking action(s) to control the noncompliant product and to correct the cause of noncompliance. Product control involves proper identification, control and disposition of the affected item.

The control and disposition of the affected product and the corrective action(s) taken must be recorded and filed.

The diversity of possible deviations at each CCP means that more than one corrective action may be necessary at each CCP. When a deviation occurs, it will most likely be noticed during the routine monitoring of the CCP. Deviation and corrective action procedures are prescribed so that employees responsible for CCP monitoring understand and are able to perform the appropriate corrective action(s) in the event of a deviation.

Process adjustments should also be made when monitoring results indicate a trend towards loss of control at a CCP. Action should be taken to bring the process within the operating limits before a deviation occurs.

Establish verification procedures

Verification and auditing methods, procedures and tests, including random sampling and analysis, can be used to determine if the HACCP system is working correctly. Careful preparation of the HACCP plan with clear definition of all the necessary items does not guarantee its effectiveness. Verification procedures are necessary to assess the effectiveness of the plan and to confirm that the HACCP system adheres to it. Verification allows the producer to challenge the control measures and to ensure that there is sufficient control for all possibilities. For example, verification may ensure that adequate contingency procedure plans are in place when critical limits are exceeded at a CCP.

Verification should be undertaken by a qualified individual or individuals who can detect deficiencies in the plan or its implementation. Verification should be done when the HACCP study is completed, when there is a change in product, ingredients or process, when a deviation occurs, in the event of newly identified hazards and at regular predetermined intervals. Routine monitoring activities for critical limits should not be confused with verification methods, procedures or activities.

Establish documentation and record keeping

Records are essential for reviewing the adequacy of the HACCP plan and the adherence of the HACCP system to that plan.

A record shows the process history, the monitoring, the deviations and the corrective actions (including disposition of product) that occurred at the identified CCP. It may be in any form, e.g. processing chart, written record or computerized record. The importance of records to the HACCP system cannot be overemphasized. It is imperative that the producer maintain complete, current, properly filed and accurate records.

Four types of records should be kept as part of the HACCP programme:

- Support documentation for developing the HACCP plan
- Records generated by the HACCP system
- Documentation of methods and procedures used
- Records of employee training programmes.

Box 12 Additional reading for reducing risks

Additional reading on GHP

- Codex Alimentarius commission document on the General Principles of Food Hygiene: http://www.fao.org/input/download/standards/23/CXP_001e.pdf
- Codex Alimentarius Code of Hygienic Practice for Spices and Dried Aromatic Herbs: www.fao.org/input/download/standards/27/CXP_042e_2014.pdf
- Codex Alimentarius Code of Hygienic Practice for Low-Moisture Foods: http://www.fao.org/input/download/standards/13921/CXP_075e_2015.pdf

Additional reading on GAP

- International Organization of Spice Trade Associations and the International Trade Centre Guidelines for Good Agricultural Practices on Spices and Culinary Herbs: https://www.esa-spices.org/download/iosta-gap-final.pdf
- American Spice Trade Association Good Agricultural Practices Guide (GAP): http://www.astaspice.org/food-safety/good-agricultural-practices-guide-gap-guide/
- FAO – A Scheme and Training Manual on Good Agricultural Practices (GAP) for Fruits and Vegetables: http://www.fao.org/3/a-i6677e.pdf

Additional reading on GMP

- Canadian Food Inspection Agency Food Safety Practices Guidance for Spice Manufacturers: http://www.inspection.gc.ca/food/safe-food-production-systems/haccp-generic-models-and-guidance-documents/guidance-spices/eng/1366340448103/1366340494598
- American Spice Trade Association Good Manufacturing Practice (GMP) Guide for Spices: http://www.astaspice.org/food-safety/good-manufacturing-practice-gmp-guidelines-for-spices/
- FAO Agricultural Services Bulletin No. 119 on Fruit and Vegetable Processing, Chapter 10: http://www.fao.org/docrep/V5030E/V5030E0t.htm

Additional reading on HACCP

- Food Quality and Safety Systems – A Training Manual on Food Hygiene and the Hazard Analysis and Critical Control Point (HACCP) System: http://www.fao.org/docrep/W8088E/w8088e00.htm#Contents
- An Introduction to HACCP, published by International Trade Centre: http://www.intracen.org/uploadedFiles/intracenorg/Content/Exporters/Exporting_Better/Quality_Management/Redesign/EQ71%20eng_HACCP(1).pdf
- American Spice Trade Association HACCP Guide to Spices and Seasonings: http://www.astaspice.org/food-safety/haccp-guide-to-spices-and-seasonings/
- Manual on the Application of the HACCP System in Mycotoxin Prevention and Control: http://www.fao.org/docrep/005/y1390e/y1390e00.htm#Contents

Appendix III – Phytosanitary certificates, ISPM-12 model and completed

Model Phytosanitary Certificate

No. _____

Plant Protection Organization of _____
TO: Plant Protection Organization(s) of _____

I. Description of Consignment

Name and address of exporter: _____
Declared name and address of consignee: _____
Number and description of packages: _____
Distinguishing marks: _____
Place of origin: _____
Declared means of conveyance: _____
Declared point of entry: _____
Name of produce and quantity declared: _____
Botanical name of plants: _____

This is to certify that the plants, plant products or other regulated articles described herein have been inspected and/or tested according to appropriate official procedures and are considered to be free from the quarantine pests specified by the importing contracting party and to conform with the current phytosanitary requirements of the importing contracting party, including those for regulated non-quarantine pests.

They are deemed to be practically free from other pests.*

II. Additional Declaration

III. Disinfestation and/or Disinfection Treatment

Date _____ Treatment _____ Chemical (active ingredient) _____
Duration and temperature _____
Concentration _____
Additional information _____
_____

Place of issue _____

(Stamp of Organization) Name of authorized officer _____

Date _____ (Signature)_____

No financial liability with respect to this certificate shall attach to (name of Plant Protection Organization) or to any of its officers or representatives.*

* Optional clause

Source: Secretariat of the International Plant Protection Convention (2001). *International Standards for Phytosanitary Measures – ISPM No. 12, Guidelines for Phytosanitary Certificates.*

Islamic Republic of Afghanistan
Ministry of Agriculture, Irrigation and Livestock
Plant Protection and Quarantine Department
Phythosanitary Certificate

Plant Protection of: ...AFGHANISTAN
To: Plant Protection Org (S): ...POLAND
No: 145281

Description of Consignment

Original

1. Full name and address of exporter:	2. Full name and address of consignee:
ARIANA SAFFRON COMPANY CO	QUDRIFY KLAUDIA SUBOCZ NIP 673-18-31 902 libelta 1A/2,61-706 POZNAN
3. Number and description of package: ONE CARTON	4. Distinguishing marks: INV NO. 001
5. Place of origin: AFGHANISTAN	6. Declared means of conveyance: BYAIR
7. Declared port of entry: POLAND	8. Name of product and quality declared: SAFFRON ONE KGS
9. Botanical name of plants: CROCUS SATIVUS	

This is to certify that the plant of plant products described above have been inspected according to appropriate procedures and are considered to be free from quarantine pests, and practically free from other injurious pests and that they are considered to conform with the current Phythosanitary regulation of the importing country.

Disinfection and, or disinfestations treatment

10. Treatment: NIL	11. Chemical active ingredient:	
12. Duration and temperature: NIL	13. Concentration:	14. Date:
15. Additional information: NIL.		
16. Additional declaration:	Date: 14/06/2018	
17. Place of issue: KABUL AIR PORT	Name and signature of the authorized office RUSTAMI	Stamp of organization

No Financial liability with respect this certificate shall be attached to name of plant protection and quarantine department or to any of its officers or representative.

Source: Mohammed Hashim Aslami, Senior Adviser of the Ministry of Agriculture, Irrigation and Livestock in Afghanistan

Appendix IV – European Union Pesticides Database, screen capture

Source: European Commission (2018). *EU – Pesticides database.*

Appendix V – European Union alerts for saffron

Classification	Date	Notifying Country	Subject
information for follow-up	09/08/2013	Switzerland	unauthorized use of colour E 102 - tartrazine (3 mg/kg - ppm) in saffron from Italy, with raw material from Iran
information for follow-up	12/03/2013	Czech Republic	unauthorized use of colour E 102 - tartrazine, of colour E 122 - azorubine and of colour E 124 - Ponceau 4R / cochineal red A in saffron from Spain, packaged in the Czech Republic
border rejection	28/02/2011	Greece	unauthorized colour toluidine red (246 mg/kg - ppm) in saffron from Georgia
alert	05/03/2009	Commission Services	unauthorized colours Sudan 1 (90 mg/kg - ppm) and Sudan 4 (7 mg/kg - ppm) in saffron from Portugal
alert	11/04/2005	United Kingdom	unauthorized colour Sudan 1 (100 µg/kg - ppb) in leek and saffron sauce for risotto from Italy

Note: ppb: parts per billion
Source: European Commission (2018). *Rapid Alert System for Food and Feed.*

Appendix VI – Labeling retail saffron

Source: Google Images

Appendix VII – Technical sheet, example from Aromatica SRL

Aromatica

TECHNICAL SHEET
SAFFRON THREADS

DESCRIPTION

SAFFRON THREADS

INGREDIENTS

100% GENUINE SAFFRON (pistils of the flower *Crocus Sativus*) - ISO1 Category (ISO 3632:2 2010)

ORGANOLEPTIC PROFILE

Aspect: brilliant dark red filaments

Flavour: Typical, with slightly bitter notes

CHEMICAL / PHYSICAL PROFILE

PARAMETER	RESULT	METHOD
Extraneous Matter (mass fraction) Fioral & Plant waste	≤ 0.5%	ISO 3632-2 (2010) clause 8
Foreign matter (mass fraction) From other plants	≤ 0.1%	ISO 3632-2 (2010) clause 9
Moisture& Volatile matter content (mass fraction)	≤ 12%	ISO 3632-2 (2010) clause7
Total Ash (mass) on dry matter %max	≤ 8%	ISO 928 (2010) clause12
Acid-insoluble ash (mass fraction) on dry matter	≤ 1%	ISO 930 (2010) clause 13
Soluble extract in cold water (mass fraction) on dry matter	≤ 65%	ISO 941 (2010) clause 11
Flavour strength (expressed as picrocrocin) on dry matter $A_1^{1\%}$ 257 nm	≥ 70	ISO 3632-2 (2010) clause14
Aroma Strength (expressed as safranal) on dry matter $A_1^{1\%}$ 330 nm	20-50	ISO 3632-2 (2010) clause14
Clouring Strength (expressed as crocin)) on dry matter $A_1^{1\%}$ 440 nm	≥ 200	ISO 3632-2 (2010) clause14
Artificial colorants	Absent	ISO 3632-2 (2010) clause 16 or 17

Mycotoxins: Aflatoxin B1 < 5 µg/kg; Aflatoxin sum (B1+B2; G1+G2) < 10 µg/kg

Heavy Metals: Lead < 1 ppm; Cadmium < 1 ppm

Pesticides: compliant with Reg EC 396/2005 and s.a.

MICROBIOLOGICAL PROFILE

TVC < 10^6 cfu/g Yeasts & molds < 10^4 cfu/g Total coliforms < 10^4 cfu/g

Salmonella spp: absent 25 g

SHELF LIFE – CONSERVATION NOTES

4 years in original packaging. Preserved from heat and direct light

ALLERGENS

In reference to Annex 2 EC Regulation 1169/2011, the product does not contain allergens

GMO

The product does not contain and does not derive from GMOs.

IRRADIATION

Product has not been subjected do irradiation.

PACKAGING

Saffron must be packed in plastic bags 1 kg each (primary packaging), then cartons for each bag (secondary packaging) that may preserve from direct sunlight. An extra outer carton to collect more single cartons is advisable.

Primary packaging must be food grade (compliant with Reg. EU 1935/2004 and s.a. and Reg EU 10/2011 and s.a.)

AROMATICA is a certified company:

BRC FOOD CERTIFICATED

GSFS Global Standard for Food Safety Issue 7

CSQA SISTEMA QUALITÀ CERTIFICATO UNI EN ISO 9001 – CERT. n° 27671

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Tel. +39 02 9254830 +39 02 9253216 **Fax** +39 02 9252251
e-mail info@aromatica.it **web** www.aromatica.it – www.zaffy.it

Source: Aromatica SRL

Appendix VIII – Chinese food safety laws and standards

Food Safety Law of the People's Republic of China (2015):
https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Amended%20Food%20Safety%20Law%20of%20China_Beijing_China%20-%20Peoples%20Republic%20of_5-18-2015.pdf

Chinese national standard GB 2763-2016 establishes maximum residue limits for pesticides in foods:
https://gain.fas.usda.gov/Recent%20GAIN%20Publications/China%20Releases%20New%20Maximum%20Residue%20Limits%20for%20Pesticides%20in%20Food_Beijing_China%20-%20Peoples%20Republic%20of_4-28-2017.pdf

Chinese national standard GB 2762-2017 sets limits for metals

2017 – Chinese version http://www.cirs-group.com/Uploads/file/20171207/1512627681_53240.pdf

2012 – English version:
https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Maximum%20Levels%20of%20Contaminants%20in%20Foods%20_Beijing_China%20-%20Peoples%20Republic%20of_12-11-2014.pdf

Chinese national standard GB 2761-2017 sets forth requirements regarding maximum levels of mycotoxins

2017 – Chinese version http://www.cirs-group.com/Uploads/file/20171205/1512463729_46822.pdf

2012 – English version:
https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Maximum%20Levels%20of%20Mycotoxins%20in%20Foods_Beijing_China%20-%20Peoples%20Republic%20of_12-29-2014.pdf

Chinese national standard GB 29921-2013 on maximum levels of pathogens in food:
http://www.mpi.govt.nz/dmsdocument/14371

National Standard GB 2760-2014 for Uses of Food Additives:
https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Standard%20for%20Food%20Additive%20Use%20-%20GB2760-2015_Beijing_China%20-%20Peoples%20Republic%20of_4-28-2015.pdf

National Standard GB 4806.1-2016 on General Safety Requirements for Food-Contact Material and Articles:
https://gain.fas.usda.gov/Recent%20GAIN%20Publications/General%20Safety%20Requirements%20of%20Food-Contact%20Materials%20and%20Articles_Beijing_China%20-%20Peoples%20Republic%20of_3-31-2017.pdf

National standard GB 7718-2011 set out general rules for label content of pre-packaged food meant for direct-to-consumer sale: http://www.mpi.govt.nz/dmsdocument/14371

Appendix IX – CNCA-accredited organic certification bodies

Certifier	Website	Email
China Quality Certification Center(CQC)	www.cqc.com.cn	cqcsc@cqc.com.cn
China Quality Mark Certification Group (CQM)	www.cqm.com.cn	cqm@cqm.com.cn
Shanghai Audit Center of Quality System (SAC)	www.sac.org.cn	service@sac.org.cn
Guangdong Zhongjian Certification Co., Ltd.(GZCC)	www.gzcc.org.cn	food@hjes.org.cn
Gainshine Assessment Co., Ltd. (GAC)（Former name: Zhejiang Audit Center for Quality System）	www.gac.org.cn	gac@gac.org.cn
WIT Assessment	www.wit-int.com	contact@wit-int.com
Beijing ZAZH Certification Center	www.zazh.com	zazhrzb@yahoo.com.cn
Beijing FQCC Quality Certification Co., Ltd		nqmp@163.com
China Organic Food Certification Center (COFCC)	www.ofcc.org.cn	ofcc@ofcc.org.cn
China Environmental United Certification Center Co., Ltd	www.sepacec.com	sepacec@sepacec.com
Organic Tea Research and Development Center (OTRDC)		OTRDC@mail.tricaas.com
Beijing Continental Hengtong Certification Co., Ltd	www.bjchtc.com	liguoq@163.com
Fangyuan Organic Food Certification Center	www.fofcc.org.cn	fofcc@163.com
Heilongjiang Green Environment Organic Food Certification Centre		cnhljofcc@126.com
Beijing BECC Certification Co., Ltd	www.becc.net.cn	
Liaoning Environmental Organic Food Certification center (LEOFCC)	www.leofcc.cn	LEOFCC@163.com
Beijing CHC Center	www.bjchc.com.cn	admin@bjchc.com.cn
Environmental Research Institution of Xinjiang Production and Construction Corps,	www.qsfruit.com	xhyirz@163.com
Certification Center of North-West University for Agriculture and Forestry Engineering	ylofcc.nwsuaf.edu.cn	ylofcc@yahoo.com.cn
Organic Food Development Center, MEP of China	www.ofdc.org.cn	info@ofdc.org.cn
Beijing Orient Jiahe Certification Co., Ltd	www.jiahe.org.cn	bjdfjh@126.com
ECOERT China	www.ecocert.cn	info@ecocert.cn
BCS China	www.ceres-osc.com	fangbeishu@vip.sina.com
JONA China	www.ofdc.ord.cn	info@ofdc.org.cn
IMO China	www.imochina.cn	imochina@hotmail.com
CERES China	www.ceres-osc.com	info@ceres-ocs.com

Note: As of June 2010.
Source: International Trade Centre (2011). *Organic Food Products in China – Market Overview*. Technical Paper.

Appendix X – Saffron assessments of using spectroscopy and chromatography

Method	Objective	Reference
Ultraviolet-visible spectroscopy	Detection of artificial red colourants in saffron	Ordoudi and Tsimidou, 2004
	Influence of corm provenance and environmental condition on yield and apocarotenoid profiles in saffron	Siracusa et al., 2010
	Detection of artificial colours in saffron	Zalacain et al., 2010
	Evaluation of saffron adulteration	Sabatinoa et al., 2011
	Rapid determination of Safranal in the quality control of saffron spice (based on non-polar solvent extraction)	Maggi et al., 2011a
	Geographical origin differentiation of saffron spice	Maggi et al., 2011b
	Characteristics of Picrocrocin, Safranal and Crocins	Jouki et al., 2012
	Influence of drying conditions on Crocins, Picrocrocin and Safranal contents	Cossignani et al., 2014
	Quality assessment of the saffron samples (quantitative analysis of synthetic colourants in adulterated saffron)	Masoum et al., 2015
Near infrared spectroscopy (NIR)	Saffron quality control and safety characterization	Zalacain et al., 2004
	Determination of chemical composition and geographical origin	Zalacain et al., 2005b
Mid-infrared spectroscopy (MIR)	Differentiation of saffron from four countries	Anastasaki et al., 2010
	Quality control of traded saffron that suffers various types of fraud	Ordoudi et al., 2014
Nuclear magnetic resonance (NMR)	Structural characterizations of saffron derivatives	Pfister et al., 1996 Straubinger et al., 1998
	To analyse Italian protected designation of origin	Cagliani et al., 2014
	To characterize saffron samples of different geographical origin	Sobolev et al., 2014
	Quality control of saffron by prediction length of storage after its harvest	Ordoudi et al., 2015
	Evaluation of saffron adulteration with plant adulterants	Petrakis et al., 2015
	Identification and quantification of Sudan dyes in adulterated saffron	Petrakis et al., 2017
Diffuse reflectance infrared fourier transform spectroscopy	Assessing saffron adulteration with plant-derived adulterants	Petrakis and Polissiou, 2017
Liquid chromatography (LC)	Analysis of saffron components	Lozano et al., 2000 Verma and Middha, 2010
	Exploiting saffron metabolome for determining its authenticity	Rubert et al., 2016
High performance liquid chromatography	Analysis of the saffron metabolites: Crocins, Picrocrocin and Safranal for the determination of the spice quality	Sujata et al., 1992
	Determination of saffron components in crude plant	Tarantilis et al., 1995
	Saffron components and its purity	Lozano et al., 1999
	Separation of several ingredients from alcoholic extracts of four different saffron types.	Caballero-Ortega et al., 2004
	Quantification of major active components from 11different saffron samples	Caballero-Ortega et al., 2007
	Quantify the most important saffron components: Crocins, Picrocrocin, and Safranal	Lage and Cantrell, 2009

Method	Objective	Reference
	Influence of corm provenance and environmental condition on yield and apocarotenoid profiles in saffron	Siracusa et al., 2010
	Effects of altitude on anatomy and concentration of Crocins, Picrocrocin and Safranal	Zarinkamar et al., 2011
	Evaluation of Saffron (Crocus sativus L.) Adulteration	Sabatinoa et al., 2011
	Identification of saffron from saffron raw material	Sheikh et al., 2013
	Analysis of bioactive constituents of saffron	Chaharlangi et al., 2015
	Geographical classification of Italian saffron based on chemical constituents	D'Archivio et al., 2016
Liquid chromatography-mass spectrometry (LC-MS)	Detection of chemicals attributing color, flavor, taste and medicinal properties to saffron	Verma and Middha, 2009
	Identification and quantification of flavonols, anthocyanins and lutein diesters In tepals of saffron	Goupy et al., 2013
	Detection of saffron adulteration with gardenia extracts through the determination of geniposide	Guijarro-Díez et al., 2017a
Thin-layer chromatography	Analysis of the saffron metabolites: Crocins, Crocetins, Picrocrocin and Safranal for the determination of the quality for the spice	Sujata et al., 1992
	Quantitative analysis of Picrocrocin and Crocetins of saffron	Corti et al., 1996 Ahmad Pathan et al., 2009
	Discrimination of saffron based on its origin	Djozan et al., 2014
Gas chromatography (GC)	Analysis of the saffron metabolites: Crocins, Crocetins, Picrocrocin and Safranal for the determination of the spice quality	Sujata et al., 1992
	Composition of Crocins and Picrocrocin from Spanish saffron	Alonso et al., 2001
	To relate volatile content to origin and post-harvest processing	Carmona et al., 2006
	Characterization of aroma active compounds of Spanish saffron	Cullere et al., 2011
	Classification of gas chromatographic fingerprints of saffron	Aliakbarzadeh et al., 2016
Gas chromatography-mass spectrometry (GC-MS)	Saffron quality evaluation by sensory profile	Narasimhan et al., 1992; Tarantilis and Polissiou, 1997
	Determining the authenticity of saffron aroma	Alonso et al., 1998
	Analysis of volatile organic compounds from saffron	D'Auria et al., 2004
	Characterization of volatile components of Iranian saffron	Jalali-Heravi et al., 2009
	Identification of changes in saffron volatile profile according to its storage time	Maggi et al., 2010
	Determination of volatile components of saffron	Sereshti et al., 2014
	Characterization of the most aroma-active components in a representative aromatic extract from Iranian saffron	Amanpour et al., 2015

Source: Kiani, S., Minaei, S. & Ghasemi-Varnamkhasti, M. (2018). Instrumental approaches and innovative systems for saffron quality assessment. *Journal of Food Engineering, 216*, 1-10.

REFERENCES

Agencia Estatal Boletin Oficial del Estado. Orden de 30 de junio de *1988* sobre Normas de Calidad del Comercio Exterior del Azafrán. Available from https://www.boe.es/diario_boe/txt.php?id=BOE-A-1988-16642

Agricultural & Processed Food Products Export Development Authority (2014). *National Programme for Organic Production*. Available from http://apeda.gov.in/apedawebsite/organic/organic_contents/national_programme_for_organic_production.htm

Agroberichten Buitenland (2018). *China Food Safety Law – Practical Procedures, trends and opportunities for Dutch companies*. 7 Mar. Available from https://www.agroberichtenbuitenland.nl/actueel/nieuws/2018/03/07/china-food-safety-law---practical-procedures-trends-and-opportunities-for-dutch-companies

Alonso Diaz-Marta et al. (2006). White Book: Saffron in Europe – Problems and Strategies for improving the quality and strengthen competitiveness. Available from https://www.researchgate.net/publication/269709026_White_Book_Saffron_in_Europe_Problems_and_Strategies_for_improving_the_quality_and_strengthen_competitiveness

American Spice Trade Association (2015). *Good Manufacturing Practice (GMP) Guide for Spices.* Apr. Available from http://www.astaspice.org/food-safety/good-manufacturing-practice-gmp-guidelines-for-spices/

American Spice Trade Association (2016). *General Guidelines for Good Agricultural Practices for Spices.* Available from http://www.astaspice.org/food-safety/good-agricultural-practices-guide-gap-guide/

American Spice Trade Association (2016). *Identification and Prevention of Adulteration.* Available from http://www.astaspice.org/food-safety/identification-prevention-adulteration-guidance-document/

Anastasaki, E., Kanakis, C., Pappas, C., Maggi, L., del Campo, C. P., Carmona, M., . . . Polissiou, M. G. (2009). Geographical differentiation of saffron by GC-MS/FID and chemometrics. *European Food Research and Technology, 229*(6), 899–905. Retrieved from https://link.springer.com/article/10.1007%2Fs00217-009-1125-x https://doi.org/10.1007/s00217-009-1125-x

Aung, M. M., & Chang, Y. S. (2014). Traceability in food supply chain: Safety and quality perspectives. *Food Control, 39*, 172–184. Retrieved from http://www.uesc.br/cursos/pos_graduacao/mestrado/animal/[4]traceability_in_food_supply_chain.pdf https://doi.org/10.1016/j.foodcont.2013.11.007

Bononi, M., Milella, P., & Tateo, F. (2015). Gas chromatography of safranal as preferable method for the commercial grading of saffron (Crocus sativus L.). *Food Chemistry, 176*, 17–21. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/25624201 https://doi.org/10.1016/j.foodchem.2014.12.047

CABI Invasive Species Compendium (2018). *Lepidium draba (hoary cress)*. Available from https://www.cabi.org/isc/datasheet/10621

CABI Invasive Species Compendium (2018). *Myzus persicae (green peach aphid)*. Available from https://www.cabi.org/isc/datasheet/35642

Canadian Food Inspection Agency (2014). *Food Safety Practices Guidance for Spice Manufacturers*. 27 Jan. Available from http://www.inspection.gc.ca/food/safe-food-production-systems/haccp-generic-models-and-guidance-documents/guidance-spices/eng/1366340448103/1366340494598

Centre for the Promotion of Imports from developing countries, CBI (2018). *Exporting spices and herbs to Europe.* Market Information. Available from https://www.cbi.eu/market-information/spices-herbs/

Centre for the Promotion of Imports from developing countries, CBI (2014). *CBI Product Factsheet: Consumer-packed spices & herbs in the EU.* Available from https://www.cbi.eu/sites/default/files/market_information/researches/product-factsheet-consumer-packed-spices-herbs-europe-spices-herbs-2013.pdf

Chemical Inspection & Regulation Service (2014). *Labelling requirements on pre-packaged foods imported into China.* Jan. Available from http://www.cirs-reach.com/food/The_labeling_requirements_on_prepackaged_foods_in_China.html

Chemical Inspection and Regulation Service (2017). *List of Banned and Restricted Pesticide Products in China*. Available from http://www.cirs-reach.com/news-and-articles/List-of-Banned-and-Restricted-Pesticide-Products-in-China.html

China Business Review (2015). *Going Organic: Investing in China's Growing Health Foods Market*. 30 June. Available from https://www.chinabusinessreview.com/going-organic-investing-in-chinas-growing-health-foods-market/

China News 7 (2017). *This is a taste of traditional Chinese medicine, to bring hope to this war-torn country*. 28 Nov. Available from https://www.chinanews7.com/this-is-a-taste-of-traditional-chinese-medicine-to-bring-hope-to-this-war-torn-country/

Clarke, Renata (2010). *Private Food Safety Standards: Their Role in Food Safety Regulation and their Impact.* FAO, Rome. Available from http://www.fao.org/docrep/016/ap236e/ap236e.pdf

Codex Alimentarius Commision (2014). *Code of Hygienic Practice for Spices and Dried Aromatic Herbs (CAC/RCP 42-1995)*. Available from http://www.fao.org/input/download/standards/27/CXP_042e_2014.pdf

Codex Alimentarius Commission (1969). *General Principles of Food Hygiene (CAC/RCP 1-1969)*. Available from http://www.fao.org/fao-who-codexalimentarius/sh-proxy/en/?lnk=1&url=https%253A%252F%252Fworkspace.fao.org%252Fsites%252Fcodex%252FStandards%252FCAC%2BRCP%2B1-1969%252FCXP_001e.pdf

Codex Alimentarius Commission (2007). General Standard for the Labelling of Prepackaged Foods. *Food Labelling 5th ed.* Available from http://www.fao.org/tempref/codex/Publications/Booklets/Labelling/Labelling_2007_EN.pdf

Codex Alimentarius Commission (2018). *Codex Texts.* Available from http://www.fao.org/fao-who-codexalimentarius/codex-texts/en/

Codex Alimentarius Commission (2018*). Pesticide Database, HS 0093 Spices*. Available from http://www.fao.org/fao-who-codexalimentarius/codex-texts/dbs/pestres/commodities-detail/en/?c_id=172

Credit Suisse (2017). *The Chinese Consumer in 2017: The Lifestyle Upgrade.* 17 May. Available from https://www.credit-suisse.com/corporate/en/research/research-institute/news-and-videos/articles/news-and-expertise/2017/05/en/the-chinese-consumer-in-2017-the-lifestyle-upgrade.html

Danish Committee for Aid to Afghan Refugees – DACAAR (2009). *Saffron: Afghanistan's Red Gold.* Available from: http://www.dacaar.org/Publications/5%20Manual/NRM/Saffron%20Manual.pdf

Dauthy, M.E. (1995) *Fruit and vegetable processing*. FAO Agricultural Services Bulletin No. 119. Available from http://www.fao.org/docrep/V5030E/V5030E00.htm#Contents

Delicious Italy (2010). *Story of Saffron Production in Abruzzo.* 9 Sep. Available from https://www.deliciousitaly.com/abruzzo-food/story-of-saffron-production-in-abruzzo

Douglas, M., Smallfield, B. M., Wallace, A. R., & McGimpsey, J. A. (2014). Saffron (Crocus sativus L.): The effect of mother corm size on progeny multiplication, flower and stigma production. *Scientia Horticulturae, 166*, 50–58. Retrieved from https://doi.org/10.1016/j.scienta.2013.12.007

European Commission (2010). *Guidance on the Implementation of Articles 11, 12, 14, 17, 18, 19 and 20 of Regulation (EC) N° 178/2002 on General Food Law.* Available from https://ec.europa.eu/food/sites/food/files/safety/docs/gfl_req_implementation-guidance_en.pdf

European Commission (2018). *EU – Pesticides database.* Available from http://ec.europa.eu/food/plant/pesticides/eu-pesticides-database

European Commission (2018). *Food Contact Materials: Legislation*. Available from https://ec.europa.eu/food/safety/chemical_safety/food_contact_materials/legislation_en

European Commission (2018). *Food Irradiation*. Available from https://ec.europa.eu/food/safety/biosafety/irradiation_en

European Commission (2018). *Fruits and vegetables: Marketing standards.* Available from https://ec.europa.eu/agriculture/fruit-and-vegetables/marketing-standards_en

European Commission (2018). *Rapid Alert System for Food and Feed.* Available from https://ec.europa.eu/food/safety/rasff_en

European Commission Agriculture and Rural Development (2018). *Producing Organic*. Available from https://ec.europa.eu/agriculture/organic/organic-farming/what-is-organic-farming/producing-organic_en

European Spice Association (2014). *ESA Adulteration Awareness Document*. 21 Jul. Available from https://www.esa-spices.org/download/esa-adulteration-awareness-document2

European Spice Association (2018). *Quality Minima Document.* Available from https://www.esa-spices.org/download/esa-qmd-rev-5-update-as-per-esa-tc-26-03-18.pdf

Food and Agriculture Organization of the United Nations (1992). Packaging. *Small-scale food processing – A guide for appropriate equipment.* Available from http://www.fao.org/Wairdocs/X5434E/x5434e0g.htm

Food and Agriculture Organization of the United Nations (1995). Chapter 6. *Natural colorants and dyestuffs*. Available from http://www.fao.org/docrep/v8879e/V8879e09.htm

Food and Agriculture Organization of the United Nations (1997). *Hazard Analysis and Critical Control Point (HACCP) System and Guidelines for its Application.* Available from http://www.fao.org/docrep/005/Y1579E/y1579e03.htm

Food and Agriculture Organization of the United Nations (1998). *Food Quality and Safety Systems – A Training Manual on Food Hygiene and the Hazard Analysis and Critical Control Point (HACCP) System*. Available from http://www.fao.org/3/a-w8088e.pdf

Food and Agriculture Organization of the United Nations (2016). *A Scheme and Training Manual on Good Agricultural Practices (GAP) for Fruits and Vegetables*. Available from http://www.fao.org/3/a-i6677e.pdf

France Agroalimentaire (2017). *French saffron – the spice earning its rightful place in our foods.* 19 Jan. Available from https://www.franceagroalimentaire.com/en/thematiques/all-products/articles/french-saffron-spice-foods/

Grand View Research (2015). *Saffron Market Analysis by Application, by Region and Segment Forecasts, 2018-2025*. May. Available from https://www.grandviewresearch.com/industry-analysis/saffron-market

Institute for the Control of Agrochemicals, Ministry of Agriculture (2012). *Maximum Residue Limits Database of China.* Available from http://202.127.42.84/tbt-sps/mrlsdb/mrlsdbEnglish.do

International Organization for Standardization (2018). *ISO 22000:2018, Food safety management systems – Requirements for any organization in the food chain.* Available from https://www.iso.org/standard/65464.html

International Organization for Standardization (2018). *ISO Survey*. Available from https://www.iso.org/the-iso-survey.html

International Organization for Standardization (2018). *ISO/NP 21983: Guidelines for harvesting, transportation, separation the stigma, drying and storage of saffron before packing.* Available from https://www.iso.org/standard/72280.html

International Trade Centre (2011). *Organic Food Products in China – Market Overview*. Technical Paper. Available from http://www.intracen.org/uploadedFiles/intracenorg/Content/Publications/Organic-food-products-in-China-market-overview.pdf

International Trade Centre. (2018). *Afghanistan's National Export Strategy 2018-2022*. Geneva: Saffron Sector.

International Trade Centre (2018). Sustainability Map. Available from https://sustainabilitymap.org/home

International Trade Centre (2018). Trade Map. Available from https://trademap.org/

Katawazy, A.S. (2013). *A Comprehensive Study of Afghan Saffron.* Afghanistan Investment Support Agency – Research, Planning and Policy Directorate. April. Available from https://www.doc-developpement-durable.org/file/Culture-epices/safran/Commercial/A%20comprehensive%20study%20of%20afghan%20saffron.pdf

Kiani, S., Minaei, S., & Ghasemi-Varnamkhasti, M. (2018). Instrumental approaches and innovative systems for saffron quality assessment. *Journal of Food Engineering, 216*, 1–10. Retrieved from https://www.sciencedirect.com/science/article/pii/S0260877417302686 https://doi.org/10.1016/j.jfoodeng.2017.06.022

Kooy, Steve (2017). *The Growth of Green Product Certification in China*. SCS Global Services. 20 Jun. Available from https://www.scsglobalservices.com/blog/the-growth-of-green-product-certification-in-china

Luz, R.M. & Preedy, V.R. (2016). *Electronic Noses and Tongues in Food Science.* Elsevier Science. Available from https://books.google.ch/books?id=lhIoCgAAQBAJ&lpg=PP1&pg=PR3#v=onepage&q&f=false

Markets Insider (2017). *Europe Nutraceuticals Market by Applications; by Types; by Country – Analysis and Forecast*. 3 Oct. Available from http://markets.businessinsider.com/news/stocks/europe-nutraceuticals-market-by-applications-by-types-by-country-analysis-and-forecast-1002974257

McKinsey & Company (2016). *The Modernization of the Chinese Consumer*. March. Available from http://www.mckinseychina.com/wp-content/uploads/2016/03/The-Modernization-of-the-Chinese-Consumer_EN.pdf?a9d170

Ministry of Agriculture and Rural Affairs of the People's Republic of China (2017). *China to complete product quality traceability system by 2020*. 25 Oct. Available from http://english.agri.gov.cn/news/dqnf/201710/t20171025_295549.htm

National Centre of Organic Farming (2015). *Participatory Guarantee System for India – PGS India.* Available from https://pgsindia-ncof.gov.in/pdf_file/PGS-India%20Operational%20Manual.pdf

Price Waterhouse Cooper (2015). *Changing Chinese diet brings China into era of food interdependence.* 5 Oct. Available from http://pwc.blogs.com/press_room/2015/10/changing-chinese-diet-brings-china-into-era-of-food-interdependence.html

Science Daily (2016). *Chemical fingerprints confirm the saffron fraud*. 20 Jan. Available from https://www.sciencedaily.com/releases/2016/01/160120113714.htm

Secretariat of the International Plant Protection Convention (2001). *International Standards for Phytosanitary Measures – ISPM No. 12, Guidelines for Phytosanitary Certificates.* Available from https://www.ippc.int/largefiles/adopted_ISPMs_previousversions/en/ISPM_12_2001_En_2006-05-03.pdf

Sina Finance (2015). *Organic food certification still faces a certain amount of operational space for crisis certification*. 29 Sep. Available from http://finance.sina.com.cn/chanjing/cyxw/20150929/023923373369.shtml

Spanish Foundation for Science and Technology (2016). *Chemical fingerprints confirm the saffron fraud.* PHYS.ORG. Available from https://phys.org/news/2016-01-chemical-fingerprints-saffron-fraud.html

The Research Institute of Organic Agriculture, FiBL (2018). *European organic market grew by double digits and organic area reached 13.5 million hectares in 2016.* News archive. 14 Feb. Available from

https://www.fibl.org/en/service-en/news-archive/news/article/european-organic-market-grew-by-double-digits-and-organic-area-reached-135-million-hectares-in-2016.html

The State Council of the People's Republic of China (2016). *Full text: Traditional Chinese Medicine in China.* 6 Dec. Available from http://english.gov.cn/archive/white_paper/2016/12/06/content_281475509333700.htm

Transport Information Service – GDV (2018). *Saffron.* Available from http://www.tis-gdv.de/tis_e/ware/gewuerze/safran/safran.htm

United States Department of Agriculture Agricultural Research Service (2018). *National Nutrient Database for Standard Reference Legacy Release – 02037, Spices, Saffron.* Available from https://ndb.nal.usda.gov/ndb/foods/show/299577?manu=&fgcd=&ds=&q=Spices,%20saffron

United States Department of Agriculture GAIN Report (2010). *Organics Report – People's Republic of China*. 26 Oct. Available from https://gain.fas.usda.gov/Recent%20GAIN%20Publications/Organics%20Annual_Beijing_China%20-%20Peoples%20Republic%20of_10-14-2010.pdf

Wen, Wang (2015). *TCM products find their niche overseas.* 20 Oct. China Daily USA. Available from http://usa.chinadaily.com.cn/epaper/2015-10/20/content_22234457.htm

Xinhuanet (2016). *China issues first white paper on traditional Chinese medicine*. Dec 6. Available from http://www.xinhuanet.com/english/2016-12/06/c_135883854.htm

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