Chapter

# Introductory Chapter: Herbs and Spices - An Overview

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## 1. Introduction

Herbs and spices have been an essential part in human life for thousands of years that is used at a domestic and industrial level as flavoring, preservation, and coloring agent in nutraceutical, pharmaceutical, and cosmetics products [1]. Spice crop is being affected by insect pests, fungal, and nonpathogenic diseases causing production constraints. Therefore, the quality of spices is very low. For this purpose, agrochemicals are used to improve the quality and production of spices [2].

Most of the known herbs and spices originate from Europe, Africa, and Asian countries. Spices and herbs are obtained from non-woody and flowering plants. Spices are obtained from the dry part of the plant, such as creeping rootstalk, twigs and leaves, fruits, vegetables, nuts, flower buds, whole and ground seeds, and outermost layers of stems and roots, while herbs are always derived from the leaves. Moreover, spices and herbs are playing a significant role in the preparation of new food products. It provides a delectable, distinctive aroma, and taste to food products [3].

Most commonly spices and herbs are used in the preparation of different processing products like pickles, flavor sauces, salad dressings, bakery products, vinegar, beverages, meat products, and sausages. Furthermore, spices and herbs are excellent sources of phenolic and polyphenolic compounds with bioactive functions and phytochemicals [4–7]. Over the past few decades, there has been a significant increase in research into their health benefits, protect the spice crop, and ways to use them in the diet, as many herbs and spices have possessed properties associated with reducing the risk of chronic diseases [8].

## 2. Classification of spices

The spices and herbs are classified on the basis of botanical analogies or families or parts of the plant. Chili or hot pepper, dry white and black peppercorns, ginger root, mustard seeds, and cilantro belong to the category of hot spices. Aromatic spices include Pimenta, myrtle pepper, *Elettaria*, Chinese cinnamon, *Cinnamomum*, clove, fenugreek, and white and black cumin. Moreover, herbs include estragon, dill weed, Mediterranean herbs, and sweet basil [9]. These spices are most commonly used in the food processing for different purposes on a domestic and large scale [10].

## 3. Production of quality spices

The production of pest-free, high in quality, and clean spice crops is very important for international globalization. Therefore, organic spice crops are produced that cost 20–50% more than traditionally grown spices. These crops are good in quality, free of pesticides, and chemical residues. Moreover, appropriate agricultural techniques are adopted to reduce pathogens and non-pathogens diseases. In processing industries, quality assurance procedures such as HACCP must be applied as well as suitable packing material and storage practices for maintaining spice quality [11].

### 3.1 Beneficial microbe

People all over the world are becoming increasingly aware of the health risks associated with eating crops contaminated with pesticides. Every year, it is predicted that a large number of people become ill by the use of pathogen and pest-contaminated spices [12]. Therefore, the promotion of a farming approach that incorporates environmentally sound-evoked plant prevention measures and organic waste management can go a long way toward restoring soil health and lowering pesticide residues in farm products. Various helpful microorganisms, such as propagules, beneficials, and soil bacteria, are playing a significant role in improving the quality of crops and control pathogenic diseases while leaving no chemical residues on plants [13].

### 3.2 Irradiation process

Radiation processing is used to improve the shelf life of spices and also improve their quality and microbiological safety without altering their inherent flavor characteristics [14]. This method is most commonly used in North America and Europe for imported spices. Major spice-producing countries have also started setting up facilities for radiation processing of spices [15]. On the other hand, irradiated methods such as sterilization, pest control practices, UV irradiation, electron beam irradiation, and microwave irradiation are still widely used all over the world while most are in Asian countries. The delicate scent and flavor ingredients in spices are not affected by using these methods because it is a cold procedure. Irradiating wrapper or container spices has reduced the potential of chemical treatment [16]. High doses of irradiation cannot be assisted to prevent germination in ginger, onions, and other plants as compared to low doses. A medium-dose spray removes harmful bacteria and food microbes, whereas a high dosage application sterilizes food for particular needs and oxidative stability goods without refrigeration as shown in **Table 1** [15, 17].

### 3.3 Different packaging materials

Spices are hygroscopic in nature, because they are very sensitive to moisture, if they absorb too much moisture, they can cause caking, decolonization, hydrolytic rancidity, mold growth, and insects. Furthermore, heat, light, inadequate packing, and environmental factors are caused by the deterioration of fragrance and flavor components in spices during storage intervals. Therefore, the packaging material for spice packaging should be sterilized and standard so as to reduce contamination during storage [18]. Capsicum, cardamom, turmeric, and saffron contain natural coloring pigments that require light protection. Moreover, spices powders containing highly volatile sulfur compounds, such as onion and garlic, require special

| Spices | Irradiation dosage | | Reason |
|---|---|---|---|
| | Minimum | Maximum | |
| Garlic | 0.04 | 0.13 | Prevent germination |
| Shallots (small onion) | 0.03 | 0.14 | Prevent germination |
| Ginger | 0.03 | 0.16 | Prevent germination |
| Onion | 0.03 | 0.08 | Prevent germination |
| Spices | 6.2 | 13.7 | High-level sterilization |

**Table 1.**
*Radiation dosage for some spices.*

protection to prevent flavor loss or absorption [19]. The essential oil components found naturally in most spices are oxidized by oxygen in the air, resulting in off-flavors, especially at high storage temperatures. The factor's effect on spice oils and oleoresins packaged in epoxy-coated metal drums and plastic lab bottles is inhibited. Moreover, aluminum and food containers are utilized for the low-oxidative stability of oils and oleoresins. Polyethylene terephthalate (PET) bottles and food-grade high-molecular-weight high-density polyethylene (HMHDPE) containers are used to store essential oils and oleoresins, which have excellent smell barrier qualities [20, 21]. The pericarp and the natural antioxidants found in it protect most whole spices, so they do not need as much protection as ground spices [22].

### 3.4 Source of natural colors

A few centuries ago, spices are used to dye food products because they are an excellent source of natural color pigments and safe for humans [23]. For years, the food processing industry has been using synthetic food colorants that increase the risk of many diseases in humans, such as cancer, asthma, allergy, hyperacidity, and hypothyroidism [24]. Nowadays, the food industry is currently returning to natural colorants as a result of changes in laws and customer demand. Natural colors are used sparingly in food processing because of their poor stability (to changes in pH, oxygen, heat, and light), low solubility, off-flavor, and expensive cost. These issues can be solved by employing enzymes, microbes, supercritical carbon dioxide, membrane separation, and microencapsulation methods to improve solubility and stability [25, 26]. Most commonly chili, saffron, turmeric, and others were utilized in Indian dishes before synthetic colors were invented. The food organization has devised a method for producing natural food colors such as kokum (red) and chilies (red). Kokum is a natural color source for acidic food since it contains 2–3% of anthocyanin. Polyisoprenylated chalcone is a fat-soluble yellow component found in the dried skin of the Garcinia indica; hence, it is in food products up to 0.3% level to give a satisfactory color to the product [27–29].

#### *3.4.1 Saffron*

Saffron provides a beautiful golden color and nutraceutical properties to a functional food, but it is most commonly used in soups, stews, bread, and rice dishes around the world because of its strong and unique flavor. Saffron is considered a fancy and costly spice, so its use in cuisine is limited. Carotenoids are responsible for the intense color of saffron. Saffron also contains small amounts of alpha- and beta-carotene, lycopene, and zeaxanthin [30–32].

### *3.4.2 Curcumin*

Turmeric is a golden yellow component that is naturally present in curcumin, which is considered a pure color with relatively little flavor. It is not easily dissolved in water; it must be mixed in a solvent with a suspension of tween 80. It dissolves in an acidic pH solution. It appears a strong lemon-yellow color. It is mostly used in a concentration of 5–20 ppm [33, 34]. It is present in two forms such as curcumin powder and oleoresin, both of which are utilized as food coloring and natural food preservatives [35]. It is also used in confectionery, ice cream, and dairy industries as a natural color pigment, as well as other natural colors such as annatto and beetroot red [36].

### *3.4.3 Paprika*

Capsanthin and capsorubin are responsible for their color, which makes up 60% of the total carotenoids in paprika. Some other color components such as carotenoid, lipophilic compound, xanthophyll cycle, the precursor of ABA, and beta-carotene are also present in the paprika. Capsanthin and capsorubin are the essential components found in the skin of paprika. The oleoresin of paprika is orange in color, which is not desired in the worldwide souk because it is insoluble in water and more soluble in lipids. Moreover, oleoresin contains up to 50% of capsorubin. It is most commonly used in confectionery, dairy products, meat products, salad dressings, bakery products, and snacks as a coloring agent [37].

## 3.5 Spices as sources of natural flavors and essential oils

In previous years, many food industry countries have become more interested in using natural flavors in the preparation of various food products [4]. The major flavor components are found in spices given in **Table 2**.

The oleoresin and oils can be extracted from different spices, as well as the key distinctive components found in the spices. Various methods such as hydrocarbon extraction, separation process, supercritical fluid extraction, pressurized solvent extraction, metabolic process, chemical, and enzymatic treatment process are used

| Spice | Flavor compounds |
|---|---|
| Black | Piperine, S-3 Carene, b-caryophyllene |
| Chili | Capsaicin, dihydrocapsacin |
| Allspice | Eugenol, b-caryophyllene |
| Clove | Eugenol, eugenyl acetate |
| Mustard | Ally isothiocyanate |
| Ginger | Gingerol, shogaol, neral, geranial |
| Saffron | Safranal |
| Oregano | Carvacrol, thymol |
| Basil, sweet | Methylchavicol, linalool, methyl eugenol |
| Spearmint | 1-carvone, carvone derivatives |
| Dill | d-carvone |
| Cinnamon, cassia | Cinnamaldehyde, eugenol |

**Table 2.**
*Flavor profile of spice.*

to extract oils and oleoresins from spices [38]. On a commercial basis, supercritical fluid extraction from solid botanicals is currently being used. In this process, protic solvents, monoterpenes, and improved black keys are not produced in essential oils. On the other hand, the biopolishing process and fermentation of raw materials increase the efficiency and quality of extracted essential oil. Moreover, *in vitro* manufacture of lactones, acetone, and further flavoring compounds has recently been achieved using genetic engineering and recombinant DNA technology. Flavorist can also profit from cloning and single-cell culture procedures [39].

## 4. Function of spices in food products

They are used in food products for various purposes. The antioxidant properties of herbs and spices act as food preservatives against oxidative degradation and also improve the stability of products. The use of herbs and spices as natural preservatives is gaining more attention. Ground black pepper, for example, has been shown to prevent oxidative degradation in processed meat. Antioxidants also help the body to fight cardiovascular disease, some types of cancers (epithelial), and other ailments including arthritis and asthma [22]. Phenolic compounds of black pepper, oregano, thyme, and marjoram are used to protect against heart disease and Crohn's disease. The phenolic compound in ginger is a gingerol that works against intestine intoxication and enhancer of pharmacological activity. Capsaicinoids found in chili peppers are an anti-inflammatory that is utilized in both medicine and nutraceutical. Trigonella foenum-graecum, allium cepa, and allium sativum are all good for lowering cholesterol. Antimicrobial activities have also been discovered in a variety of spices [40].

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