SPICES

1. Introduction

The American Spice Trade Association defines spices as "any dried plant product used primarily for seasoning purposes." This definition includes typical aromatic plants parts such as the berries of black pepper, the bark of cinnamon, and the roots of ginger. Leafy materials such as oregano, marjoram and basil are also included in this definition. However, these leafy materials are also commonly referred to as herbs. The seeds of mustard, sesame and poppy are included in the definition of spices. The American Spice Trade Association includes dehydrated vegetables such onion and garlic in their definition. However, the FDA does not allow dehydrated onion or garlic to be called spices. According to FDA regulations, dehydrated vegetables are indeed vegetables and must be declared as such.

Seasonings are typically considered to be anything that enhances flavor or appearance of foods. Spices, salt, condiments (such as prepared mustard or catsup) and even MSG are considered seasonings. Typically, the word seasoning is applied to a mixture of flavoring materials. For example, chili powder is typically a combination of chili pepper (the pure spice), salt, garlic, oregano, cumin, and a possible host of other spices. Typically, the term spice applies to a single flavor component (such as chili pepper), where as the term seasoning applies to a mixture of flavor components.

Spices are derived from nearly every conceivable part of a plant. Black and white pepper are the berries of the *Piper nigrum* plant. Fennel, anise, poppy, sesame and cumin are seeds. Cloves are dried flower buds. Herbs such as parsley, oregano, thyme are leaves. Ginger and turmeric are roots (rhizomes). Saffron is the stamen of a flower.

When harvested, many spices are not necessarily shelf stable. Most items are dried after harvesting to a water activity level that allows dry storage. In

most cases, the drying process does not significantly alter the flavor strength of the spice. However, some herbs are exceptions. Dried cilantro leaves contain very little flavor. Many chefs like to work with fresh herbs as most tend to have stronger, more well developed flavor profiles than their dried counterparts. However, the use of fresh herbs in food production has its own unique problems (storage, harvest times). For the most part, whole spices are more likely to retain their flavor profile than the ground material. Any spice that has an aroma, is losing flavor.

The flavors of most spices are due to the presence of volatile organic compounds. In some cases, nonvolatile organic components contribute to the flavor. A good example of this is black pepper. The bite of black pepper is due to piperine, a nonvolatile organic compound. The volatile components of black pepper are what one smells when black pepper is ground with a pepper mill. The actual volatile components of black pepper are very difficult to detect in food products. Typically, black pepper is just used for its bite.

2. Cultivation

It is commonly said that spices represent the second oldest profession. The lure of spices has encouraged the exploration of this planet and even today, the sourcing of spices world wide has resulted in more spices being grown in more countries than ever before. Typically spices grow in the tropical regions of the world. Some seeds and herbs are grown in more temperate areas, but for the most part, spices are grown in the tropics. Although there are some large plantations growing spices, the spice industry today remains quite a cottage industry. In India, a large number of families will harvest spices from plants in their back yards. These items are typically dried in the sun on the ground or driveways. These materials are taken to town and collected by consolidators. These combined products may or may not be additionally cleaned before being transported to ports where they are combined with lots from additional consolidators before being placed on ships and exported. This consolidation from a number of individual “farmers” represents one of the most serious problems in obtaining uniform product from shipment to shipment, let alone from year to year.

Spices are being grown commercially in over 70 countries. Some spices might be able to be grown in any country that can grow crops. However, the major spice producing regions are the tropical countries. Herbs, red pepper, paprika and some of the bakery seeds can be grown in more temperate areas. Many spices are still wild-collected, but as demand has increased, many of these items are now grown as agricultural crops. Through the years, various countries have moved into the production of certain spices. Ten years ago, Vietnam was not a major producer of black pepper. Most recently, Vietnam has become the world’s largest producer of the black pepper. Since, their agriculture department decided black pepper would be a suitable crop and initiated a program to introduce this crop to farmers. As the initial crops became available, their quality was considered to be substandard. Initially, Vietnam had difficulties supplying black pepper that would regularly pass inspection upon import into the United States. As the farmers learned how to care for their crops, the

quality improved and today Vietnamese black pepper is considered a suitable source. This process of crop improvement over time has occurred time and time again. Other examples would be fennel that is in Egypt and caraway seed grown in Canada.

Many spices are harvested by hand as they do not lend themselves to commercial harvesting. These spices will tend to be produced in countries that have cheap labor available. Crops that can be harvested mechanically will find more areas were they can be grown. The herbs are a fine example. In many cases, herbs are still wild-collected. But as prices increase, some of these herbs can be grown commercially. Recently, Turkish oregano is showing such a conversion. Another interesting example is chili peppers and paprika that are grown the southwest United States. The chili pepper and paprika pods do not all mature at the same time. Mechanical harvesting is likely to harvest a selection of red and green pods. By using hand harvesting, and a couple of passes through the field, only red pods can be harvested. If someone is trying to produce a crushed paprika flake, the pods must be hand harvested in order to manually de-stem the pods.

When spices are grown in new areas, there are often subtle differences in flavor and/or appearance. These differences are probably due to different soil and climate conditions. In some cases, the farmers can develop procedures to produce a crop that is commercially acceptable. Interestingly, some spices taste pretty much the same regardless of where they are grown. Bay leaves are a prime example.

India represents the largest spice growing country in the world. At the same time, India is the largest spice consuming country in the world. However, the consumption is growing faster than the production; a fact that occasionally results in India being a net importer. It will not be long before India regularly consume more than it imports. Interestingly, Vietnam uses very little black pepper internally. They will likely be an overall exporter black pepper for years to come.

The supply of spices varies from year to year. These changes in production volume are generally the result of climate conditions, but recently some farmers are seeing better opportunity with other crops. With interruptions of the annual monsoons, black pepper crops can be adversely affected.

Many spice crops have a long lead time. For example it takes three to four years before black pepper vines produce their first significant crop. The vines remain productive for eight to ten years before their yield begins to fall. This time lag somewhat helps to explain the 10-year cycle of black pepper prices that occured for the last 40 years or so. When black pepper prices rise significantly, farmers start planting. As these vines being to produce three or four years later, supplies surge and prices fall. Farmers are reluctant to maintain their plantations or replant due to the low prices. As the vines wear out, production falls, prices rise and the cycle starts again.

Nutmeg and mace are harvested from the fruits of a tree. Cloves are the dried flower buds of a tree. Cinnamon is the bark of a tree. It takes time for these trees to reach maturity. The recent hurricanes in Grenada pretty much wiped out the nutmeg production in that country. It will take time before they can replant and reach prior pre-hurricane levels.

3. Processing

3.1. Extracts. Volatile organic compounds can be extracted from many spices and do provide a very well rounded representation of the flavor of the freshly ground spice. Typically, these volatile compounds are referred to a "volatile oil" or "essential oil". Generally, they are extracted by boiling the spice in water and condensing the steam. The volatile oil will generally form a layer above the water. This oil can be separated and used as a flavoring or fragrance component in food. These oils are typically thin liquids; very easy to pour and/or use.

The volatile oil of a spice is also a typically measure of the "quality" of a spice; the higher the volatile oil, the stronger the flavor and the fresher the spice.

Another commonly used spice extract is referred to as oleoresin. In this case, the ground spice is soaked in a volatile, nonaqueous solvent. The solvent dissolves the volatile oils as well as many nonvolatile materials. The ground residue is filtered off and the solvent removed. The selection of the solvent is critical to the end result. The idea is to pick a solvent that will remove the flavor components but not the starches, cellulose and fiber that do not contribute to the overall flavor profile. Originally, the oleoresin extraction process was developed in industrialized countries. Today, many of these oleoresin plants are located in the spice growing countries. The benefit of producing the oleoresins at source is the oleoresin process significantly concentrates the flavor. For example, 5 pounds of oleoresin black pepper can typically replace 100 pounds of a good quality ground black pepper. Producing the oleoresins at the source significantly reduces the weight that has to be shipped. These oleoresins are not susceptible to flavor loss or microbiological problems. In addition, importation of oleoresins bypasses the rigid scrutiny of FDA, U.S. Customs and the USDA at the port of entry.

The decision to use a volatile oil or an oleoresin depends on which fraction the flavor component needed is in. For example, a volatile oil of black pepper does not contain the piperine and, thus, has no bite. It smells wonderful (like fresh-ground black pepper), but has no bite. The oleoresin of black pepper does contain the piperine and as such can contribute the desired bite. Similarly, red pepper does not have an appreciable amount of volatile oil. For practical purposes, oleoresin of red pepper contains "all" the flavor of red pepper. However, for most spices, the volatile oil is all that is really needed to provide the desired flavor.

There are also a number of other forms of extracts. These include, eg, tinctures, extracts, and resinoids. However, these are not widely used and can vary significantly from supplier to supplier.

3.2. Microbiology. As mentioned earlier, most spices are dried at the time of harvest to reduce their water activity to inhibit microbiological growth. If dried sufficiently, spices are shelf stable for long periods of time. Their flavor may sell decrease or change over time, but microbiological growth will not be problem. While drying may make the spice shelf-stable and prevent the additional growth of microorganisms, the drying operation will not eliminate the microorganisms that are present to start. Considering that most spices are grown in third world countries and the cleanliness standards are

not necessarily the same as in developed countries, the presence of dangerous bacteria is a common problem. Methods have been developed to help reduce the bacterial loads of spices. The most common process involves the use of ethylene oxide (ETO) or propylene oxide (PPO). While ethylene oxide is considered a carcinogen by inhalation, the minor risks of using this chemical are more than offset by the reduction of microbial flora it can affect. The FDA has issued regulations allowing the treatment of spices with ETO or PPO. These regulations also restrict the amount of ETO or PPO that can remain in the treated spice. The EPA also issues regulation restricting the amount of ETO or PPO that can be used in the treatment process and severely restricts the amount of ETO or PPO that can be released to the atmosphere. These restrictions indirectly limit the amount of ETO or PPO that can be left in spice after modern day treatments.

There are other treatment processes currently in use. Irradiation of spices is also legal in the United States (21*CFR* part 179) (1). Exposure of spice to irradiation is very effective in reducing microbiological counts in spices. Irradiation is by far the most effective procedure, but also the most expensive. Irradiation's use is usually restricted to spices being used in microsensitive food products such as dairy dips and dressings. The use of irradiation is restricted and closely controlled. Irradiated spices are required to be labeled as such. Retail spices that are irradiated must show a radura symbol, and as such, most spice retailers have shied away from this process. Irradiated spices being used in another food product do not have to indicate their use on finished product labels. However, many large U.S. food processors have decided to stay away from the use of irradiated spices due to the marketing issues that could arise.

Steam treatment is used occasionally. This process exposes the spice to steam to reduce microorganisms, but is fraught with a number of problems. As mentioned earlier, volatile oils are removed with steam, so steam processes need to find a way to expose the spice to heat while not removing the flavor. Although steam can be quite effective on whole seeds or berries, it is quite difficult to achieve reliable kills for herbs and other delicate spices, for example, red peppers may turn brown upon exposure to heat. In addition to exposing the spices to heat, they are also exposed to moisture which has to be removed promptly after treatment to avoid growth of organisms. Although the use of steam treatment is growing, there are still a limited number of processors offering such treatment.

4. Quality Assurance

4.1. Parameters. There are a number of parameters that have been offered to measure the quality of spices. However, the most important one remains the most difficult to define. Sometimes spices are used for their visual effect, however, most uses of spices are for their flavor. While there are measures of flavor strength, these ingredients need to be evaluated by someone familiar with the individual flavor profiles of each spice. All the physical measures of quality may be in line, but if it does not taste right, it is not right for use.

The following quality parameters are more fully described in ASTA Standard Method Manual. Only the practical application of these methods are described here. For compete details, see the complete method.

One of most difficult problems with these quality parameters is the sample selection. There is quite a bit of variation within any lot of spices and single grab samples do not adequately reflect the quality of the entire lot. Under the best circumstances, multiple samples should be pulled and analyzed separately. This will give you the best estimate of the overall quality of the lot. However, the costs and time involved often results in multiple samples being pulled and composited before testing. While this does not reflect any variation within the lot, it does give a good idea of the "average" quality of the lot.

The most commonly used measure of quality is referred to as "volatile oil". In essence this is a measure of the volatile oil or essential oil described above. The procedure is a steam distillation procedure and is assumed to be a measure of the total strength of the flavor of spices where the essential oil represents to complete flavor of the spice. Again, black pepper is an excellent example. The bite of black pepper is not measured by the volatile oil. The volatile oil of black pepper essentially represents the odor of fresh ground black pepper. Another example is red pepper that has essentially no volatile oil. The flavor (heat) of red pepper is best measured by another test.

All spices contain a small amount of moisture. The moisture level of spices are important to control, as moisture levels above certain levels (different for each spice) can lead to mold growth. To maintain stable microbiology, the moisture needs to be kept below certain levels. While moisture in many food items can be measured by drying a sample in an oven until a stable weight is attained, this procedure does not work for most spices as the drying also drives off the volatile oil. The term "moisture" in spice generally refers to the results of co-distillation procedure. The spice is added to toluene and heated. The vapors are condensed and the water separates. The volume of water collected represents the moisture content.

Total ash and acid insoluble ash are measures of inorganic filth that might be present. Well cared for spices will all show natural occurring levels of ash and acid insoluble ash, but excess levels indicate the presence of dirt or contamination. These levels vary by spice.

The nonvolatile methylene chloride extract (NVMCE) used to be a valuable measure for those spices with the important flavors were not measured by volatile oil. Where as methods have been identified for piperine (the bite causing chemical) in black pepper, the NVMCE is still useful for ginger where the flavor is from a volatile and nonvolatile fraction. Any added vegetable oil (or other possible adulterants) will be measured as NVMCE and can lead to false results.

Granulation is often used as a quality parameter, but it often misused. The granulation of spices is measured by sifting the spice under a given set of conditions. The goal of a spice processor is generally to get the spice fine enough that it can be easily dispersed in a food product and not feel gritty on the tongue. However, the finer the particle is ground, the more heat that is generally produced and the more flavor that is driven off. The most common measurement parameter used is in terms of United States Standard (USS) screen sizes. There are other screen size measurement available within the industry and

the numbers and screens do not necessary match one another. It is important to use the same types of screens to match up specifications. Most spices are ground to a USS 30 or USS35 size. However, black pepper is often ground to a wide variety of particle sizes. Different particle sizes of black pepper are quite visible in food products and the particle size is often selected based on the visual appeal desired.

There are also established methods for the microbiological quality of spices. While these methods are quite similar to many microbiological methods, the one issue that needs to be kept in mind is that some spices contain chemicals that inhibit the growth of colonies during standard microbiological testing. The accuracy of these tests are often limited when lower dilutions (higher concentrations of spice) are used.

There are also a number of spice specific tests for quality measurement. Not all will be described here.

Piperine levels in black and white pepper are a measurement of the "bite" of these spices. Whereas many specifications tout the volatile oil levels for these spices, the actual "bite" is actually the more important taste parameter.

The heat levels of red peppers are caused by a different class of chemicals than the bite of black and white pepper. The bite caused by these two spices affect the mouth and tongue quite differently and should not be confused. The heat of red peppers used to be measured by a test called Scoville Heat. This method was an organoleptic taste panel procedure that was carried out by a trained panel of five tasters. They were given dilute solutions of a red pepper extract with increasing levels of the extract present. When the panelist first detected the heat in their mouth, the dilution level was the measure of heat. While a trained panel could fairly accurately repeat its own results, interlab variations could vary by $+/-50\%$. A more accurate high pressure liquid chromatography (HPLC) method was developed to replace that test. This method is much more repeatable and predicts fairly accurately the heat produced in a finished food product.

The color intensity of paprika, chili pepper, and red peppers are measured by a procedure referred to as ASTA color. The color is extracted with an organic solvent and measured spectrophotometrically. The surface color and ASTA color of paprika can be independently controlled. A higher ASTA paprika does not necessarily mean a darker or brighter red color. It only measures the coloring power of paprika when the pigments are extracted into a food product.

The coloring power of turmeric is measured by extracting the curcumin and measuring spectrophotometrically. Turmeric is generally sold based on its color strength.

4.2. Labeling. The subtle difference between the American Spice Trade Association and FDA definitions is of importance only during the labeling of spices in prepared food products. As mentioned above, the FDA requires dehydrated onion, garlic, and other vegetable (carrots, bell peppers, tomato) to be labeled by name. In addition the FDA does not consider sesame and poppy seeds as spices and requires that they must be declared by name. These items cannot be lumped under the term "spices" on food labels as permitted for FDA's list of real "spices". Just to make matters more complicated, the FDA allows spices to be labeled as "flavor", "flavors", "natural flavor", or "natural flavors". However, there are

exceptions. The FDA requires spices that also contribute color (such as paprika, turmeric, and saffron) be declared by name or the term "spices and coloring". The USDA has labeling requirement very similar to the FDA, however, the USDA does allow onion and garlic to be labeled as "flavoring".

5. Safety Concerns

5.1. Adulteration. Recently the problem of adulteration of spices has been an issue. In the United States, the American Spice Trade Association had been pretty effective at eliminating most of the past abuses. Fifteen years ago most spices used in the United States were imported into the country in the whole state. These whole spices were recleaned and processed in plants located in the U.S. under the inspection of the FDA. As many of the spice growing regions of the world have started to advance, many of the growers and shippers have decided they could process the spices in their countries of origin and add more value to their offerings. Note that there are cleanliness standards in place for whole spices. The FDA has their Defect Action Levels (DALs) which can generally be interpreted to mean the minimum cleanliness standards for whole spices. The American Spice Trade Association has a similar program (with very similar cleanliness standards) that is generally used by its members for contracting and importing. However, there are no accepted standards for the cleanliness of ground spices. Once a spice is ground, it is much more difficult to determine what was present in the whole spice. A prime example would be the limits for rodent droppings in whole spices. How does one determine the presence of droppings in ground spice?

In an effort by some unscrupulous spice processors in India to cheapen their processed spices, one of the largest food product recalls in the world occurred a couple of years ago in England. These Indian spice processors have used a group of carcinogenic dyes to improve the appearance of the ground red pepper. Some of these ground red peppers were being sold for less than the cost of the corresponding whole red peppers. They were using stems, moldy pods, seeds, ghost pods (light colored pods where the pigments had not developed) and producing a ground product that was not necessarily a typical red color. To fix the problem they decided to use a collection of dyes referred to as Sudan red. They dyes were commonly available in India being used to dye fabric. Apparently, one of Indian processors used an excess of Sudan I, which is yellow in color. In an effort to correct the color, they then had to add more of the redder Sudan dyes. This ended up making their ground red pepper look very unnatural. It is probably that strange color that caught the attention of a French food inspector who initially identified the problem. The European Union spread the word through Europe. Great Britain caught a couple shipments entering that country and initiated an investigation into these imported products. Great Britain ended up ordering recalls for over 600 food products and levied fines totaling over $200 million dollars.

British food laws are somewhat similar to those in the United States. The importers are responsible for the products they import. While the importers paid huge fines and some companies spent millions on these recalls, none of the Indian spice processors responsible have paid a single dollar. While the Indian government has taken some action to put these people out of business, it is

generally assumed these culprits have just opened shop again under new names. Indian laws do little to allow the government to promptly respond to these types of problems.

As in the United States, many of the companies in England affected by this adulterated product had guarantees from their suppliers that this red pepper met British food regulation. In the United States, most food companies operate under the protection of Continuing Commodity Guarantees. This FDA accepted process allows a food processor to buy and use ingredients without completely testing the materials. The guarantee from a supplier affirms the materials being supplied meet all the requirement of Food, Drug and Cosmetic Act. Interestingly, these guarantees are not valid unless issued by a U.S. citizen. Holders of Continuing Commodity Guarantees from foreign countries are not valid. Without a valid Continuing Commodity Guarantee, the user is ultimately responsible for any irregularities.

The FDA is expected to protect the consumer from these types of problems, but the task of trying to test for all the possible adulterants that might be present in processed foods, let along just in processed spices is enormous. Food processors in the United States have an obligation to their customers that the ingredients they use be free from any dangerous materials.

Articles can be found (1) that highlight the long history of adulteration of foods in India. It appears that it is acceptance to adulterate foods in India as long you do not get caught.

More cases of spice adulteration have been identified recently. These include the use of Para Red in paprika, Sudan I in turmeric, foreign colors in paprika, and lead in various spices. India is not the only culprit.

In the United States, the American Spice Trade Association has become so alarmed about the various adulteration issues in the United States that they have announce a Self Regulation Program that allows members to notify ASTA of potential adulteration issues. ASTA will attempt to confirm the adulteration and tries to work with the culprit to eliminate the problem. If they cannot correct the problem, they notify the FDA.

In ASTA's Self Regulation Program, ASTA identifies a number of adulteration issues it sees as a problem. These include:

- Spices Containing Nonspice Material
  - Presence of defatted paprika in paprika and chili
  - Presence of spent black pepper meal in black pepper
  - Presence of black pepper shell in black pepper
- Spices Containing Undeclared or Unapproved Color Additives
  - Presence of turmeric and other color additives in paprika
  - Presence of Sudan Red I in chili powder
  - Presence of various color additives in saffron
- Spices with Valuable Constituents Removed
  - Undeclared use of defatted paprika
- One Spice Represented as Another
  - Decorticated black pepper being represented as white pepper

These issues require a word of explanation. The first is the term "defatted paprika". This term is applied to the by-product resulting from the production of oleoresin paprika from ground paprika meal. The byproduct of the oleoresin paprika extraction process is a mixture of solvent and all the nonsolvent soluble residue of the extracted paprika. This amounts to somewhere around 95% of the paprika extracted. Once the solvent is removed, the processor is left with a dry granular product that is slightly reddish brown in color. In the past, this material was composted, used as cattle feed, or otherwise disposed of. This defatted paprika is used to dilute pure paprika or chili pepper. Since it does have a brown cast to it, its use is somewhat limited in paprika as it tends to turn the paprika brown in color, but it nearly ideal for chili pepper where it has nearly the same color. ASTA considers the use of defatted paprika in paprika or chili pepper an adulterant because something of value (coloring) has been removed and not declared.

Similarly, the "spent black pepper" is the residue resulting from the extraction of oleoresin black pepper from black pepper.

The "Presence of black pepper shell in black pepper" and "Decorticated black pepper being represented as white pepper" are related. Black pepper and white pepper are harvested from the same plant. Black pepper is harvested when the berries are immature and still green. As they dry in the sun, they turn black. As the pepper berry matures, it turns from green to red. White pepper is harvested when the berries begin to turn red. They are soaked in water for a few weeks which softens the red out skin. The berries are then rubbed together to rub off the soft outer skin. When the berries are washed and dried in the sun, the berries dry to light buff color. The characteristic odor of white pepper is slightly musty/moldy due to the period of soaking. This characteristic odor is descriptive of true white pepper.

An alternative method of producing a ground pepper that is white in color is to start with black pepper. Certain varieties of black pepper can have their black out shell mechanically abraded. In essence the idea is to scrape off the black out shell and leave the whiter colored inner part of the berry intact. This decorticated black pepper can then be ground and unscrupulous processors will sell this as white pepper. Typically, true white pepper sells for about a 40% premium over black pepper (low yield, more processing). While black and white pepper can be processed from the same plant, traditionally, white pepper and black pepper growers work completely independently of each other. These two markets do work independent of one another. Due to market conditions, there are periods where white pepper sells for prices similar (and occasionally even cheaper) to black pepper. When market conditions move white and black pepper prices to narrow, the processors supplying decorticated black pepper can not afford to manufacture the same product. Interestingly, the production of a white decorticated black pepper is typically not financially advantageous unless the processor has an outlet for the black pepper shells they produce. The obvious outlet for the shells is to put it into ground black pepper. The spice processor willing to do this ends up supplying a mislabeled white pepper and dilutes the flavor of their black pepper since the shells contain nearly no black pepper flavor. While it could be argued that both products are manufactured from the same plant, this is not adulteration. However, ASTA takes the position that white pepper is basically

defined by the process (and the flavor). Anyone selling decorticated black pepper as white pepper is mislabeling the product. The use of shells from decorticated black pepper in ground black pepper is inappropriate because something of value (flavor) has been removed.

ASTA also lists "Presence of Sudan Red I in chili powder". Keep in mind that they are actually referring to ground red pepper, not the "chili powder" as used in the United States. World wide, the term "chilies" refers to ground red pepper. (Only in the United States, and possibly Mexico are chili peppers used.) These chili peppers typically have more color than traditional red peppers and less heat than traditional red peppers. Chili peppers (as used in the United States) are more like paprika, but typically have more sugars present. It is the presence of these sugars that allow chili peppers to be roasted to give richer brown colors. In ASTA Position Paper on Sudan, ASTA points out one of safest methods to ensure the absence of Sudan dyes in red pepper is to ensure the ground red pepper is being processed from whole or chopped red pepper by the spice processor. They point out that dying the whole or chopped red pepper is very difficult to hide. When the dye is applied to whole or chopped peppers, the pods or particles will have a red oily coating that is easily transferred to the hands. In addition, the stems or seeds present will have the same red coating. A visual inspection like this would be very effective in identifying the present of these illegal dyes. Buying red pepper from a spice processor in the United States that imports the whole or chopped pods and processes them in the U.S. allows for inspection by the FDA at the import stage as well as the inspection of the spice processor themselves.

While ASTA's list of adulterated spices includes comments about the use of "turmeric and other color additives in paprika", a new approach to adulteration has been recently identified in Europe. Authorities there have identified batches of paprika containing bixin and norbixin. These are the color pigments in annatto. While not clearly explained, it could be assumed that the spice processors involved are using the spent residue of extracted annatto seed in place of defatted paprika. This would be another case where the spice processor is trying to take advantage of another cheap diluent.

Most of these issues have been newly identified as problems at the same time most spice processing has moved off shore to the countries of origin. Identifying adulterants in much harder is ground spices than it is in whole spices.

6. Individual Spices

6.1. Allspice. Allspice (*Pimenta dioica* L.) is the dried, nearly ripe berry of a tropical evergreen tree that grows semiwild in Jamaica and other Latin American countries. The berries are about 1 cm in diameter and are usually slightly rough due to raised oil glands on the surface. The name Pimenta causes some confusion due to the similarity of the name to a variety of red pepper called pimento or pimiento. The early Spanish explorers (looking for black pepper) called the plant pimiento (pepper in Spanish) because of the similar appearance. Most of the allspice used in the United States comes from Honduras, Mexico, and

Jamaica. Allspice has a warm sweet flavor reminiscent of cinnamon, cloves and nutmeg; hence the name, allspice. Allspice is used to flavor vegetables, fruits, pickles and spicy table sauces.

6.2. Anise Seed. Anise seed (*Pimpinella anisum* L.) is the seed harvested from an annual herb related to parsley. The seed is small and curved, about 0.5 cm long and looks quite a bit like caraway seed. The seeds as harvested have hairlike protrusions on each end that are typically broken off during processing. Most U.S. anise comes from Canada, Egypt, Spain, Syria, and Turkey although it can be grown in most temperate climates. The flavor is similar to fennel, but with a richer licorice note. Anise seed is used to flavor anisette, confectionary, salad dressings, and sausages (notably Italian and pepperoni).

6.3. Star Anise. Star anise (*Illicium verum* Hook F.) is the fruit of a small evergreen tree native to China. When ripe, the fruit opens up and resembles a five pointed star. The flavor is similar to anise seed. The uses are similar, but more localized.

6.4. Basil Leaf. Basil leaf (*Ocimum basilicum* L.) is the grayish green dried leaves of an annual herb of the mint family. Basil is cultivated in Egypt, southern France, Morocco, and the United States. The leaves of the plant are typically about 5 cm long and 2 cm wide. When dried, these leaves are quite fragile and when sold as "whole" one generally sees pieces of about $\frac{1}{4}$ inch. The flavor is warm and sweet with a touch of mint and licorice. It is used to flavor fish, poultry, meats, cheese, and especially tomato-based sauces.

6.5. Bay Leaves. Bay leaves (*Laurus nobilis* L.) are also known as laurel leaves. The leaves are harvested by hand from an evergreen tree. The leaves are dried in shallow layers and often pressed to keep the leaves from curling when drying. These trees are grown in Turkey, eastern Europe, and Central America. These leaves are quite tough and withstand cooking in the whole state very well. When used as whole or cracked leaves, the remnants of the leaves are often removed prior to serving. Industrially, this spice is most commonly ground. The flavor is aromatic and bitter. It is used extensively in meats, meat dishes, sauces, stews, and for pickling spice.

6.6. Capsicum Group. The capsicum group (*Capsicum annum*, *Capsicum frutescens* and others) includes paprika, chili pepper, and red peppers. The nomenclature of these spices is quite confusing. Whereas most of the world refers to red peppers as chilies, the United States tends to use the word chilies to mean chili pepper and uses the term red pepper for the hot stuff. On one end of the spectrum is paprika, which is sweet and mild (little to no heat); through chili peppers which, in general, contain less color, slightly more heat, and more sugars. The other extreme is red pepper where there is generally little color and high heat levels. There are no distinct lines of separation between the three groups, but paprika is generally used for its coloring, while red peppers are used for their heat value. The chili peppers are pretty much a uniquely American spice. The extra sugars present allow them to be roasted, which develops the richer flavors often desired in the dish referred to as chili (spellings vary but often consist of beans, meat, and tomatoes). The spice often referred to as chili powder is generally a blend of straight chili pepper, salt, cumin, oregano, and garlic powder (and often a host of other spices). A chili powder will typically have much more flavor because of the salt and other spices present.

These spices are of an annual often grown in tropical and semitropical areas with a long growing season. The spice is the ground or crushed pods; often including the seeds and stems. The size of the pods vary quite dramatically, but in general, the smaller the pod, the higher the heat. There have been a wide range of varieties selected for cultivation. The difference between these varieties can be a subject of an entire book. The important point is that paprika is generally used for its coloring purposes in meats, salad dressings, soups, and sauces. Red peppers are widely used in the full range of foods; where ever the heat is desired. The heat is widely used, even in low levels to round out the flavor profile, in many foods such as barbeque sauces, hot sauces, curries, meats etc. The chili pepper group finds use in many Tex-Mex menus.

Paprika is grown in the United States, Israel, Spain, Peru, Ecuador, and southern Africa. A variety is grown in Hungary that has a special flavor that makes it unique. As mentioned, chili peppers are basically a southwestern United States crop with some also grown in Mexico. The largest red pepper crops are grown in India, Pakistan, and China.

6.7. Caraway Seed. Caraway seed (*Carum carvi* L.) is the fruit a plant from the parsley family. Each seed is a half of the fruit of the plant. The brown seeds are about 0.5 cm long and slightly curved. Caraway is grown in Europe, western Asia, and Canada. The flavor is warm and aromatic. Its most distinctive use is in rye bread, but also finds uses in meats, sauerkraut, cheese, and cookies.

6.8. Cardamom Seed. Cardamom seed (*Elettaria cardamomum* Maton) is the dried fruit of a plant from the ginger family. Whole cardamom is actually a seed pod containing 6–8 highly flavored, black irregular round seeds. Cardamom pods are available as whole green cardamoms, dried tan-colored cardamoms, or whole bleached cardamoms. The bleached cardamoms are whitened with sulfur dioxide fumes and are the most expensive. Ground cardamom is generally produced from grinding the whole pods. Cardamom is also available in a decorticated form; just the black seeds. The flavor of cardamom is aromatic and somewhat camphoraceous. Throughout Arab countries, cardamom is most often used in a coffee-like beverage. It also used in baking pastries and pies, meats, curry powder, and pickles.

6.9. Celery Seed. Celery seed (*Apium graveolens* L.) is the fruit of an herb from the parsley family. The fruit itself is two united carpels that each produce a single seed. The seed is small, about 1–2 mm in length, oval, and greenish brown. The plant celery seed is harvested from is not the same plant commonly eaten as a vegetable in the United States. Today celery seed is primarily grown in India. The flavor is warm and somewhat bitter. It is used in tomato ketchup, sauces, soups, pickles, salads, and some cheeses.

6.10. Cinnamon and Cassia. Cinnamon and cassia (*Cinnamomun verum* Presl.; *C. cassia* Presl.; *C. loureirii* Nees; *C. burmannii* Blume) are best consider together as nomenclature varies around the world. Both spices are the bark of tropical evergreen trees. The trees are stripped of their bark and the bark is allowed to dry and curl up into quills. The quills can be cut up and used as cinnamon sticks or cracked and used for grinding. Any of the four species listed can be called cinnamon in the United States, but in other countries differing distinctions can be required. *C. verum* Presl is known as Ceylon, Seychelles, or “true” cinnamon. This product is much lighter in color and flavor than the

other varieties and not often offered in the United States. *C. loureirii* Nees is known as Saigon or Vietnamese cinnamon. It has a sweeter flavor and a higher volatile oil. Saigon cinnamon was once well known in the United States. Since the Vietnamese War, the United States has adopted the Korinjte cinnamon flavor as the product of choice. More recently, Vietnamese shippers have been offering a reliable source for this variety. *C. cassia* Presl is known as Chinese cinnamon. Very little Chinese cinnamon makes it way into the United States. It is grown and used in China and most often used to produce cassia oil since this bark is quite high in volatile oil. The last type of cinnamon is *C. burmanii* Blume and is known as Korintje or Batavia cinnamon. Most of this cinnamon is grown on the island of Padang in Indonesia. This cinnamon has a somewhat sharp biting cinnamon flavor. It has found wide acceptance in the United States. Commercially this product is sold based on its volatile oil content. In general, the older the bark on the tree, the higher the volatile oil content and the stronger the flavor. However all the bark on the tree is harvested. The bark from the stems and twigs are quite young and have very little flavor. This weak flavored product still finds use where the cinnamon color is desired but not necessarily the flavor. All these varieties of cinnamon are used in bakery goods, confectionary, pickling, and spicy table sauces.

6.11. Clove Buds. Clove buds (*Eugenia caryphyllus* Thumb. or *Syzygium aromaticum* L.) are literally the dried unopened flower buds of an evergreen tree belonging to the myrtle family. These buds are hand picked just before the buds open. As they are dried in the sun, they turn a rich brown in color and end up resembling a nail with a large head. The tree was indigenous to the Molucca Islands. The Dutch and Portuguese controlled these islands and the trade in cloves until 1770 when shoots were smuggled out the country and plantations were eventually established on Mauritius, Reunion, Zanzibar and other locations. The flavor of cloves is very strong, aromatic, hot and spicy. Cloves are widely used in baking, confectionary, puddings, desserts, sweet syrups, pickles, meats and spicy table sauces. About one-half of the worlds' production of cloves is mixed with tobacco to supply kretek cigarettes to Indonesia.

6.12. Coriander Seed. Coriander seed (*Coriandrum sativum* L.) are the ripe seeds of an annual herb from the parsley family. The seeds are round, about 0.5 cm in diameter and a light tan in color. The warm spicy flavor is used in sausages, cheese, curry and pickling spices. The leaves of this same plant are the source of cilantro. Fresh cilantro has a fresh, green flavor and is commonly used in salsas. When dried, cilantro looses much of its flavor. Coriander is grown in Canada, China, Egypt, Morocco, and Eastern Europe.

6.13. Cumin Seed. Cumin seed (*Cuminum syminum* L.) is the dried ripe fruit of an annual herb of the parsley family. The seed is a greenish tan color and long and narrow in shape. Cumin seed looks similar to caraway, but generally lacks the curve of caraway seed. Cumin seed is warm and earthy in flavor. In large doses it can be quite unpleasant. However, when used at appropriate levels, it provides a nice rounded background flavor that is very desirable. Cumin seed is grown in China, India, Pakistan, Turkey, and Syria. Cumin seed is used in chutney, chili powder, chili con carne, meats, and cheeses.

6.14. Curry Powder. Curry powder is often considered a spice, but in reality it is a blend of spices. The composition of curry varies dramatically

depending on its origin and use. It is used as a flavoring in exotic dishes, particularly Indian, Indonesian, and Chinese. In the United States one thinks of curry as being based on turmeric, but traditional curry can be combination of coriander, ginger, nutmeg, clove, cinnamon, red pepper, onion, and salt.

6.15. Dillseed. Dillseed (*Anethum sowa* and *Anethum graveolens* L.) is the seed of an annual plant of the parsley family. Dillseed is oval and brown to tan in color and up to 2–3 mm in length. The flavor is similar to caraway, but thinner. Dillseed is grown in India and Pakistan and is used to flavor condiments, soups, processed meat, sausages, spicy sauces and pickling. It often finds use as a substitute (adulterant) for caraway seed.

6.16. Dillweed. Dillweed (*Anethum sowa* and *Anethum graveolens* L.) comes from the same plant at dillseed. Dillweed is the dried leaves of the plant (3–4 mm in length) which must be harvested before the seeds ripen. Dillweed is generally used for its bright green color and mild, sweet flavor. Dillweed is used in dips, soups, and sauces.

6.17. Fennel Seed. Fennel seed (*Foeniculum vulgare* Mill) is the dried fruit of a biennial or perennial herb of the parsley family native to Europe and India. The seed is light green to gray, about 0.75 cm long and curved. It is now commonly cultivated in India, Egypt, and Turkey. The flavor is sweet and similar to anise without the licorice notes. Fennel seed is used in baked goods, soups, fish dishes, and sausages (particularly Italian sausage and pepperoni).

6.18. Fenugreek. Fenugreek (or fenugreek) seed (*Trigonella foenum-graecum* L.) is the seed of an annual herb, unusual for a spice, because it belongs to the bean or Leguminosae family. It is native to southern Europe and now commonly cultivated in India, Turkey, and Morocco. The seed is irregularly oval, up to about 0.5 cm in length and is brownish yellow. Ten to twenty seeds grow in a pod much like peas. The flavor is bitter with undertones of maple or burnt sugar. It is used in curry powders, chutney, and imitation maple flavors.

6.19. Garlic. Garlic (*Allium sativum*) is used as a spice in its dried form. It is produced from a cultivated perennial herb with an underground compound segmented bulb. It comes in powdered, granulated, and minced forms. The product commonly available at retail is an agglomerated product which is more free flowing than the commercially available powder. The aroma and taste is powerful and offensive. The flavor is developed by enzymatic reaction when the clove is crushed or moistened. When used in a more dilute form, the flavor is attractive and indispensable. It is used in appetizers, meats, sausages, salad dressings, gravies, fish, poultry, and snack foods. There is also are large market for fresh garlic. In the past, most garlic used in the United States was grown domestically, but recently most has been imported from China and India. Care must be used in the labeling of garlic. Although commonly considered a spice, the FDA does not allow garlic to be lumped under the term spices. It must be declared by name. The USDA does allow garlic to be labeled as natural flavor in meat products.

6.20. Ginger. Ginger (*Zingiber officinale* Roscoe) is prepared from the rhizome of a plant native to southern Asia. It is a perennial plant but is usually grown as an annual for harvesting as a spice. The rhizomes of commerce are about 4–5 inches long and tan colored. They are often called “hands” or “fingers” due to their shape. When harvested, ginger has a hard outer coating. Once the rhizomes are washed, the outer layer is scraped to allow the product to dry. The

traditional ginger used in the United States originally came from Cochin and was known by that name. This product has a rich ginger flavor. Today, ginger is also grown in China and Africa. The Chinese spice has more of a lemony flavor. Ginger is used in soft drinks, baked goods (gingerbread) confectionary, curry powder, meats and pickling. While Jamaican ginger is highly recommended, Jamaica actually produces very little. Much material being sold as Jamaican actually comes from other sources.

6.21. Nutmeg and Mace. Nutmeg and mace (*Myristica fragrans* Houtt) need to be discussed together. They are actually parts of the same fruit from a large evergreen tree native to the Moluccas Island and the East Indian Archipelago. The fruit of the tree has a fleshy exterior. Inside is a large seed encased in a shell. Surrounding this shell is a lacy, netlike covering or aril, which is scarlet to crimson in color. This aril is mace. Inside the hard shell is the nutmeg. The shells are dried in the sun or artificially. When dry, the nutmeg will rattle in the shell. Nutmeg is stored this way and either shelled mechanically or by hand. The layer of mace is dried is the dark and the color changes to a pale orange or yellow. Mace and nutmeg are grown in both the East and West Indies. The island of Grenada was a major producer of these spices until recent hurricanes decimated the plantations. The flavor of nutmeg is warm, pleasant, spicy and aromatic. Nutmeg is used to flavor baked goods, processed meat, curries and beverages (eggnog). The flavor of mace is somewhat softer and more full. It is used in baked goods, sausages and vegetables.

6.22. Marjoram. Marjoram (*Origanum marjorana* L.) are the leaves of an annual member of the mint family. The leaves are grayish green, narrow and about 1 cm long. Marjoram is native to the Mediterranean region and western Asia. The flavor is aromatic, warn and somewhat bitter. It is sometimes confused with oregano (sometimes purposefully) as it has somewhat similar flavors and usually is more economical that oregano. It is used in salad dressing, vegetables, meats, sausages, soups, and poultry stuffing.

6.23. Mints. Mints [*Mentha spicata* (spearmint) and *Mentha piperita* (peppermint)] are the leaves of hardy perennial herbs. While indigenous to Europe, these spices are widely grown in the United States. While the extracts find wide use in toothpaste, mouthwashes, chewing gum and confectionary, the leaves also find more traditional spice use in sauces, desserts, salad dressings, teas, and meats.

6.24. Mustard Seed. Mustard seed (*Brassica hirta* Moench and *Brassica juncea*) are the seeds of a group of closely related genera, species and varieties of herbaceous annuals. *B. hirta* refers to white or yellow mustard while the *B. juncea* refers to oriental or brown mustard seeds. Another species, *B. nigra* is black mustard but not used much in the United States. All mustard seeds are short season crops that can be grown in Canada, Montana, France, and China. The seeds are small, round, and hard. When crushed and mixed with water, mustard produces a sharp and pungent flavor. The flavors of two mustards are extremely different. While both will produce the hard, pungent flavor; the enzyme reaction in oriental mustard seed produces a flavor like strong horseradish. When fully developed, the flavor of oriental mustard is one of the strongest spice flavors known. One needs to be extremely careful in its use, but when used at an appropriate level, it can produce a

very satisfying result. Mustard seeds are typically available in three forms; whole, ground, and mustard flour. The ground mustard is prepared by grinding the whole seed. To produce mustard flour, the hard outer layer of the seed in removed and inner endosperm is ground. While whole and ground mustard find wide use in the meat industry, mustard flour finds wider use. Mustard is very useful in creating and stabilizing emulsions. It finds significant use as both an emulsifier and flavor agent in mayonnaise and salad dressing. Mustard flour is used in these applications because the hard outer shell of mustard is difficult to grind and the small pieces remaining tend to make the smooth mayonnaise texture slight grainy. Once the shell is removed, this fault is also removed. Large quantities of mustard are used in the condiment, prepared mustard.

6.25. Dehydrated Onion. Dehydrated onions (*Allium cepa* L. and other species) are ground to produce this spice. These bulbs are grown world wide and certain varieties have found to be useful for drying and, thereby, producing a dried onion. In the presence of moisture, an enzymatic reaction takes place that generates the familiar sharp, pungent flavor that is quite desirable upon dilution. It is very widely used in meats, sauces, vegetable, snacks, dips, etc. As with garlic, the FDA does not allow onion to be lumped under the term "spices" on product labeling. It must be declared by name. However, the USDA will allow onion powder to be labeled as "natural flavor". While dehydrated onion is available as a powder, it is also available as granulated, ground, minced, chopped, and large chopped. One needs to be particularly careful when labeling anything larger than a powder as they are now considered a vegetable rather than a spice.

6.26. Mediterranean Oregano. Mediterranean oregano (*Origanum vulgare*) is the leaf of a perennial herb from the mint family. Mediterranean oregano is the true oregano and different in flavor from marjoram and Mexican oregano. The leaves of the plant are about 1.5 cm long and typically crushed to a slightly finer size. The flavor is warm and aromatic, similar to marjoram, but typically stronger. While Mediterranean oregano used be grown quite widely in Greece (once referred to as Greek oregano), most production has moved to Turkey. The flavor between the two is very similar. Mediterranean oregano is used in Italian specialties, gravies, salad dressings and various meat.

6.27. Mexican Oregano. Mexican oregano (*Lippia graveolens* or *Lippia berlandieri*) is the leaf of a perennial herb from the mint family. Mexican oregano has a flavor similar to Mediterranean oregano, but is much sharper and more bitter. It can sometimes be used in place of Mediterranean oregano but it finds much more use in the stronger flavored Mexican specialties. The leaves of this plant are significantly larger than the Mediterranean oregano and is often offered crushed to simulate the size of Mediterranean oregano (often referred to as "Greek cut").

6.28. Parsley. Parsley (*Petroselinum cripsum* (Mill.) Nym.) is the dried leaves from a hardy perennial native to the Mediterranean region. It is now widely grown in Europe, Israel, and the United States. The flavor is mild and green and used for the seasoning of fish, soups, poultry, and salads. It is more often used for its appearance rather than flavor. While generally considered by many to be a spice, FDA regulations require it to be labeled as "parsley".

6.29. Black Pepper. Black pepper (*Piper nigrum* L.) is the dried unripe fruit of a perennial vine native to the tropics. The berries are harvested while still green and dried in the sun. While drying, the berries shrivel slightly and turn their characteristic black color. The flavor of black pepper is quite stable in its whole form. The berries vary in size from 3–5 mm in diameter. The berries have a light colored core covered by a shriveled black coating. However, the fresh aroma of freshly ground black pepper dissipates fairly quickly. The bite of black pepper comes from piperine, a chemical that does not dissipate. Black pepper is widely used in meats, poultry, fish, salad dressings, gravies, sauces and so on. One will find black pepper to be much more popular in the United State whereas in Europe, white pepper finds much more use. Black pepper is grown in many tropical countries around the world. Although there are subtle flavor differences, both are adequate for common use. While Tellicherry black pepper has a long history, it should be noted that Tellicherry is actually the extra bold berries harvested in the Malabar India crop. Its appearance in the whole state in jars of the shelf is good, once it is ground, it is the same as Malabar.

6.30. White Pepper. White pepper (*Piper nigrum* L.) is the dried ripe fruit of the same vine that black pepper is harvested from. The berries are allowed to remain on the plant and mature to a bright red color. The berries are then soaked in water for a couple weeks and the outer coating softens. The berries are then rubbed together under running water to wash off the outer skin. The berries are then dried in the sun where they dry to a light tan color. In many cases, black and white pepper are grown independently of each other. While black pepper producers could produce white pepper (if they have the water available for soaking) and the white pepper processors could produce black pepper by harvesting earlier, tradition, for the most part, has them grown in separate areas. White pepper has the same bite as black pepper but can be distinguished from black pepper by white pepper's musty odor and flavor (from the water soak).

6.31. Poppy Seed. Poppy seed (*Papaver somniferum* L.) is the seed from the same poppy plant used to produce opium. It is grown in Turkey, Iran, India, China, Australia, and the Netherlands. The seeds are black, kidney shaped, and about 1 mm in diameter. The seeds are not narcotic and have an agreeable nutty flavor when roasted. Poppy seeds is used whole as topping for breads, rolls and pastries and also used in pasta, salads and some vegetables. Poppy seed is not considered by the FDA to be a spice and must be labeled as "poppy seed".

6.32. Rosemary. Rosemary (*Rosmarimus* officinalis L.) is the dried leaves from an evergreen shrub growing wild in the Mediterranean countries. The leaves are brownish green and resemble slightly curved evergreen needles seldom exceeding 2.5 cm in length. The flavor is strong, aromatic, and somewhat bitter and camphoraceous. Rosemary is used to flavor stuffing, poultry, beef, fish, stews, and soups.

6.33. Saffron. Saffron (*Crocus sativus* L.) is the dried stigmas of a bulbous perennial native to southern Europe and Asia Minor. It is commonly cultivated in Spain. Saffron is the world's most expensive spice. The three stigmas per flower must be hand harvested from 75,000 flowers to yield about 500 grams of the spice after drying. It is used in exotic dishes, particularly in the coloring

and flavoring of rice in Spanish specialties. It is also used in cheese, pastry, and confectionary. Commercially, it is rarely used since the same rich color can generally be produced with turmeric.

6.34. Sage. Sage (*Salvia officinalis* L.) is the dried leaves of a perennial, low growing shrub. The dried leaves are grayish green or silver green and quite hairy. The flavor is strong, fragrant, warm, and slightly bitter. Sage is used in the flavoring of meats, poultry, sausages (pork sausage), and poultry dressings.

6.35. Savory. Savory (*Satureia hortensis* L.) is the dried leaves and flowering tops of an annual plant of the mint family. The leaves are narrow, elliptical, dark green and about 0.5 to 1.0 cm long. Savor is grown France, Spain, and the former Yugoslavia. The flavor is warm, aromatic and somewhat resinous. Savory is used in poultry seasonings, meats, soups, salads, and sauces.

6.36. Sesame Seed. Sesame seed (*Sesamum indicum* L.) is the whole dried seed of an annual plant now cultivated in Mexico and Central America. The seed is small, shiny, oval shaped and about 2 mm long. These seeds are available unhulled or hulled. The common seed found on bread products are hulled. The unhulled seeds are dark and when treated with lye to remove the hull, the resulting hulled seeds are pearly white. When baked, sesame seeds have a pleasant nutty flavor. They are most commonly used in baked goods.

6.37. Tarragon. Tarragon (*Artemisia dracunculus* L.) is the dried leaves and flowering tops of a perennial herb commonly cultivated in Spain, France and the United States. The flavor is warm, aromatic, and reminiscent of anise. It is used in salads, soups, stews, and sauces such as béarnaise and tartare.

6.38. Thyme. Thyme (*Thymus vulgaris* L.) is the dried leaves of a small perennial shrub native to the Mediterranean area and Asia Minor. It is commonly cultivated in Spain and Morocco. The leaves are tiny, brown-gray-green, narrow rarely exceeding about 0.6 cm in length. The flavor is aromatic and warm. Thyme is used to flavor fish, sausages, meats, and poultry.

6.39. Turmeric. Turmeric (*Curcuma longa* L.) is the processed from the cleaned, dried rhizomes of a herbaceous perennial of the ginger family. Turmeric has a peppery, musty, bitter taste but is primarily used for its coloring power. There are many varieties of turmeric. The one most commonly found in the United States is Alleppy (India) and does contain significant quantities of curcumin, the yellow pigment. Another variety of turmeric is grown in India and is known as Madras. This variety has less color and used more for its flavor in curry powders. The Alleppy variety is most often used to provide the rich yellow color of prepared mustards. It is also used as a replacement for expensive saffron in many foods when a yellow color is called for.

6.40. Vanilla. Vanilla (*Vanilla planifolia* And. and *Vanilla tahitensis* Moore) is the dried, cured full-sized, but not fully ripe fruit pods (beans) of an orchid vine. The vine is tropical and grown in southern Mexico, Central America, West Indies, and other tropical areas. The Madagascar-type bean is still the most important. The flowers need to be hand pollinated. One the beans are harvested, they go through a curing process to develop the warm, rich flavor. While some vanilla beans make their way into food products, most beans go through an extraction process to produce the common vanilla extract that is then used in ice cream, bakery goods, and desserts.

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