



Physical & chemical analysis of adulteration of spices

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Abstract

Adulteration in all types of food is bringing up so fast. Spices are among the top five most commonly adulterated food types because they are expensive commodities that are processed before sale, used most frequently and consumed. The powdered spices are commercially processed and packaged by some leading food industries, while some local non-branded industries also exist. Ground spices may be adulterated with husk, sawdust, artificial colour, chalk powder, dung, lead chromate, papaya seeds, argemone seeds, etc to increase their weight and enhance appearance. High value ground spices are frequently adulterated for economic gains. Adulteration is difficult to identify by visual and sensory inputs alone. In this article physical and chemical methods of testing of adulteration of spices illustrated.

Keywords: spices, commodities, adulteration, appearance, sensory inputs

Introduction

Food is one of the fundamental necessities of life, required for growth and maintenance of our body ^[1]. The act of intentionally debasing the quality of food offered for sale either by the admixture or substitution by inferior substances or by the removal of some valuable ingredient is known as adulteration ^[2, 3]. Adulteration of food commonly defined as, "The addition or subtraction of any substance to or from food, so that the natural composition and quality of food substance is affected". The substance that is used to lower the quality is known as adulterants. Food adulterants are cheap substances that are added to food and thereby adversely affect the nature and quality of the food. Some adulterants are found to be a hazard to human health especially if consumed over a long period. Un-permitted food additives or permitted food additives added in excess; both can cause serious damage to health. Adulteration in foods decreases our moral and social value.

Spices are any pungent, aromatic plant substances used to flavor food or beverages ^[4].

Spices have been an integral part of our food for centuries, and today. They are an important commodity in every Indian kitchen and no meal is complete without them. Indian spices are well known in the world for their sweet aroma, excellent taste, unique colour and good flavour.

Spices are consumed in various forms such as whole spices, ground spices, oleoresins, extracts etc and play an important role in enhancing the flavour and taste of processed foods. Spices contain plant-derived chemical compounds that are known to have disease preventing and health promoting properties. Spices are also used in medicine for the treatment of diseases because of their carminative stimulating and digestive properties ^[5, 6]. The components in the spices have been found to have an anti-clotting function (prevent clogging of platelets in the blood vessels) and thus help to ease blood low, preventing stroke episode, and coronary artery disease. Spices employed in traditional medicines as anti-helminthes to treat worm infestation in the gut. Spices contain a good amount of minerals like

potassium, manganese, iron, and magnesium. Potassium is an important component of cell and body fluids that helps in controlling heart rate and blood pressure. The human body uses manganese as a co-factor for the antioxidant enzyme, superoxide dismutase.

Adulteration of Spices

Spice adulteration can be categorized into two separate groups namely, incidental and intentional adulteration. Incidental adulteration occurs when foreign substances are added to a food due to ignorance, negligence or improper facilities. This can occur during the harvesting of spices; examples include inclusion of pesticide residues, droppings of rodents/birds and bacterial contamination. Intentional adulteration, better known as economic adulteration, entails the deliberate addition of inferior materials to a food to heighten appearance qualities and value for economical gain. These inferior substances include ground material (e.g. saw dust), leave, powdered products (e.g. starches) and other spice species ^[7].

Ground spices may be adulterated with artificial colours, starch, chalk powder, etc. to increase their weight and enhance appearance. High value ground spices are frequently adulterated for economic gains. The most obvious and simplest reason of spice adulteration is to increase profit. Consumption of adulterated spices can cause various diseases like skin allergies, liver disorder etc.

Materials and Methods

The sample of spices collected from the markets. Most commonly used spices were shortlisted for testing adulteration i.e. chili, turmeric, cumin, coriander powder etc. and seed packets of cumin, mustard and black pepper cinnamon, cloves, cardamom and saffron. The materials viz. water; heater, glass, spoon, spices, iodine solution, hydrochloric acid sulphuric acid etc are required during the test. The physical and chemical methods adopted for detection of adulterants are given in table.

Table 1: Physical and Chemical Test

Sr. No.	Spice	Adulterants	Test to check adulteration
1.	Red Chili Powder	Brick powder	Chili powder is added in a beaker containing water. Brick powder settles down while pure chili powder floats.
		Artificial colours like Sudan Red	One teaspoon of chili powder is added in a glass of water and mixed well. Change in the water colour indicates the presence of an adulterant- Sudan Red
		Red lead salts	Dilute nitric acid is added to the sample of chili powder and solution is filtered. 1 ml Potassium Iodide solution is added to the filtrate. Formation of yellow coloured precipitate indicates the presence of red lead salts.
		Rodamine B	2 g of chili powder is taken in a test tube and 5 ml of acetone is added. Immediate red colouration indicates the presence of Rodamine- B.
2.	Turmeric Powder	Corn flour (starch), yellow coloured chalk powder or sawdust	A teaspoon of turmeric powder taken in a glass of warm water stands that for 10 minutes. Water becomes cloudy which indicate the possibility of adulteration. 2 g of turmeric powder is taken in a test tube and dilute hydrochloric acid is added to it. Effervescence indicates the presence of chalk.
		Yellow Lead Salts Lead chromate	2 g of turmeric powder is taken in a test tube and conc. hydrochloric acid is added to it. Magenta colouration indicates presence of yellow oxides of lead. Turmeric powder mix with water, the water turns yellow, it indicates adulteration with lead chromate.
		Metanil Yellow	A sample of turmeric powder is taken in a test tube and conc. sulphuric acid is added. Disappearance of red colour on adding distilled water indicates the presence of metanil yellow. Turmeric powder is taken in a test tube and 3-5 ml alcohol is added to it and the tubes are shaken vigorously. On adding 1 ml of hydrochloric acid, solution turns pink or violet which indicate the presence of the chemical Metanil yellow.
3.	Cumin Powder and Cumin seeds	Sawdust,	Add a tablespoon of cumin powder to a glass of water and stayed for a few minutes. The adulterant sawdust float at the top and pure spice settled down at the bottom of the glass.
		Husk	One teaspoon of cumin powder mix with water and shaken. The husk floats on the surface as they are lighter in weight, whereas the pure spice settled at the bottom of the glass.
		Charcoal Dust	Small amount of cumin rubbed on palms. Palms turn black, indicate the presence of charcoal dust
		Colour Coated Seed	The cumin seeds are rubbed vigorously on palms. Appearance of colour in palms indicates the cumin seeds are coated with artificial colour.
4.	Coriander Powder	Husk	One teaspoon of coriander powder mix with water. As the husk is lighter in weight, it simply float above the surface of the water.
		Dung Powder	Coriander powder sample soaked by water. Dung and sawdust floated and gives bad smell.
		Common Salt	One teaspoon of cumin powder mixed with water and shaken. Then 5 ml silver nitrate is added to it. White precipitate obtained and confirms presence of common salt.
		Powdered Sawdust	Some coriander powder was sprinkled on the surface of water. Pure spice would not leave any saw dust/ powdered bran when floated on the water surface, whereas, adulterated spice shown, saw dust/powdered bran on the surface of water.
5.	Black Pepper	Papaya Seeds	Black pepper dropped in a glass of water. The black pepper settled at the bottom of water in the glass whereas the papaya seeds floated.
6.	Mustard Seeds	Argemone Seeds	On close observation it is found that mustard seeds have a smooth appearance, whereas argemone seeds have a grainy and rough surface and are black in colour. Argemone seeds have a rough exterior and are white inside while mustard seeds have a smooth exterior and are yellow on the inside it is confirmed by pressing mustard seeds on the palm.
7.	Cinnamon	Cassia Bark	Cinnamon bark is very thin and can be easily rolled around a pencil or a pen and also have a distinct smell. Cassia barks are tougher and thick.
8.	Cloves	Exhausted Cloves	On close observation it is found that exhausted cloves have small size and shrunken appearance as compared to true cloves.
9.	Cardamom	Used Cardamom Pods, Dyes	Green cardamom pods are appear plump and feel full to touch whereas used pods have shrunken appearance and feel emptier. Unadulterated cardamom pods have a green colour while adulterated ones are either pale or have been colored an unnatural green using a dye.
10.	Saffron	Dried tendrils of maize cob	When saffron pressed on palms it is found that dried tendrils of maize cob crumbled under pressure while saffron does not break on pressing.
		Safranal and Picocrocin	Pure saffron has honey and hay aroma. Collected sample of saffron have a pungent smell, this indicate the presence of high levels of Safranal and Picocrocin chemical in the saffron sample.
		Harmful coloring chemicals.	Saffron threads taken in a glass of cold water and stand for 5 minutes, deep red colour appears in the water this indicate the presence of coloured adulterant threads.

Conclusion

Indian food is incomplete without the addition of spices.

Ground spices adulterated with artificial colours, starch, sawdust dung chalk powder and harmful chemicals etc.

Adulterated spices consist of the physical adulterated particles other than spices. The study was conducted to determine the presence of non-permitted adulterants, colours such as metanil yellow, artificial colours etc. in spices. From this study, it was concluded that lead chromate, metanil yellow etc. are harmful colours that are added in various spices to enhance the colour of spices. The most obvious and simplest reason of adulteration is to increase profit. If adulterated spices are consumed daily it will be harmful for health. The safest way to avoid adulterated spices is to purchase properly packed spices from a trusted source and it is also wise to purchase raw spices and grind them at home to get a powder which is real, fresh safer also. If someone is selling adulterated products strict actions should be taken against them by the government.

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