EVALUATION OF ADULTERATION IN FOUR SEASONING POWDER

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Abstract

Adulteration is the act of making something impure or altering its original form by adding materials or elements that aren't usually part of it, especially inferior ones. It was aimed to find the adulterants in four seasoning powder such as turmeric, galangal, chili and black pepper. This study was carried out from January to August, 2020. Both raw materials and powders of turmeric, galangal, chili and black pepper were bought from the market and herbal shop. The macroscopic, organoleptic and microscopic characters were observed. As a result of macroscopic characters**,** some bulb turmeric rhizomes bought from herbal shop are found to be similar to rhizomes of *Curcuma zedoaria* Roscoe**.** In an organoleptic inspection, taste of homemade and readymade turmeric powder has slightly bitter because of mixing with *Curcuma zedoaria* Roscoe. Yellow food coloring matter, metanil yellow in readymade turmeric powder, can be found when it was tested with both concentrated Hydrochloric acid (HCL) and water. Adulteration in readymade chili powder changed the color of water into red due to the presence of food coloring matter. In the iodide test**,** yellowish brown precipitates in aqueous extract of homemade chili. Adulteration in readymade galangal powder showed cloudy water because of mixing with other condiment containing starch. According to the powder microscopic analysis, the starch grains were found abundantly in three seasoning powder, except chili powder. Altered starch grains and unaltered starch grains were found in both homemade and readymade turmeric powder, but the colour of altered starch grains was deep yellow in readymade turmeric powder. Starch grains were oval in shape that found in readymade chili powder. Readymade galangal powder can be mixed with the powder of *Alpinia galangal*. As the powdered spices available in the market are often contaminated with the artificial colors and other condiments containing starch, consumers should select right products. Furthermore, it is necessary to maintain its quality and purity for the commercial market.

Keywords: Adulteration, seasoning powder, organoleptic, condiments, commercial market

Introduction

Spices are the most important aspect of Indian cuisine and our food relies heavily on them for a flavor, aroma and appearance. However, due to their high demand, manufacturers may add certain adulterants that can lower overall quality of the product (Gaurang, 2019). Dried seasonings are mostly made through drying the root, stem, foliage, fruit and other parts of the plants, such as pepper, chili, anise, fennel, mustard, cinnamon, ginger slice, ginger and *Amomum tsaoko* fruit, which have a special spicy or pungent taste. Most of the powdered seasonings from plant origins belong to this category, such as chili powder and pepper powder. They are made through grinding the plant tissues and are widely applied in the food industry of China, especially the traditional food (Zhichun, *et. al*., 2011 and Ying, 2010). The commonly used adulterations have been found to be wheat bran, corn flour, rice bran, rosin powder, or traditional Chinese medicine residue. The reported identification techniques of the potential adulterants are sensory recognition, microscopic recognition (Xu & Li, 2004), and iodide test for starchy material identification (Li, 2008).

As *Curcuma longa* L. belonging to the family Zingiberaceae called Nanwin in Myanmar name or turmeric in English name is a herbaceous root commonly used for food seasoning as well as for medicinal purposes (Tayyem, *et. al*., 2006; Li, *et. al*., 2011). Turmeric is cultivated in India, China, Java, and other tropical countries. The rhizome has long been employed both as a spice and as a colouring agent. Studies have reported by the mixing of *Curcuma zedoaria* Roscoe**,** a wild relative of turmeric, into turmeric powder due to its close resemblance with turmeric (Sasikumar, *et. al*., 2004; Sen, *et. al*., 1974). *Curcuma zedoaria* cultivated in India has circular slices of rhizome

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resembling bulb turmeric. Turmeric rhizomes are short knob-like branched, longitudinally wrinkled or marked with large circular scars (Wallis, 1967); and a characteristic aromatic odour and taste (Wallis, 1967; Kraemer, 1907). Stone cells were not present; tracheae, altered starch grains and unaltered starch grains present (Kraemer, 1907).

Alpinia officinarum Hance belonging to family Zingiberaceae is called Lesser Galangal in English and Padegaw-gale in Myanmar name. Galangal rhizome is a native of and cultivated on the island of Hainan and the neighbouring south-east coast of China. It is not much used in England, but is still employed in some countries both as a medicine and as a spice. Galangal rhizomes may be distinguished into branched, frilled remains of cataphyllary leaves, longitudinally striated or shrivelled, hard and tough. Galangal rhizome has spicy odour and a strongly pungent spicy taste (Wallis, 1967), and aromatic and pungent taste (Kraemer, 1907). *Alpinia galanga* consisted of plenty of starch grains which were simple starch grains, oval in shape; and fibres (Silvy Mathew, *et. al*., 2013).

Piper nigrum L. belonging to the family Piperaceae named Black pepper in English or Ngayok-kaung in Myanmar has a certain hot taste that can be associated with it. Peppercorns and the ground pepper derived from them may be described simply as pepper, or more precisely as black pepper (cooked and dried unripe fruit), green pepper (dried unripe fruit), or white pepper (ripe fruit seeds) (*Harrison, 2016).* Black pepper is native to present-day South India (Harrison, 2016). It is usually dried and used as a spice and seasoning (Hajeski & Nancy, 2016). Odour of blackpepper has aromatic, slightly empyreumatic; taste aromatic and pungent (Kraemer, 1907). Papaya seeds are a very common adulterant present in a packet of black peppercorns (Gaurang, 2019). Stone cells of the endocarp, pericarp pigment with yellowish-brown and reddish-brown tannin masses; and parenchyma cells containing numerous starch grains **(**Kraemer, 1907).

Red pepper or Chili peppers (*Capsicum annuum* L. var. *longum*) consists of dried ripe fruits known commercially as chilies that are the third important crop of the family *Solanaceae* after tomato and potato (Naz, *et. al*., 2006). Chili peppers originated in Mexico. They are widely used in many cuisines as a spice to add heat to dishes (Kraft, *et. al*., 2013). India is the largest producer of chilies in the world followed by China. Other important chili producing countries include Pakistan, Ethiopia, Myanmar, Mexico, Vietnam, Peru, Ghana and Bangladesh. Pakistan contributes around 6% to the world's total chili production (Khan, *et. al*., 2012). *Capsicum* fruits have a characteristic but not powerful odour, and as extremely fiery, pungent taste (Wallis, 1967)**,** and odour distinct and pungent taste (Kraemer, 1907). Aleurone grains are found abundantly in the endosperm of the *Capsicum* seed treated with iodine solution that is stained yellowish brown (Shah & Seth, 2010). Starch grains somewhat spherical and 1.5 per cent of starch present; stone cells present (Kraemer, 1907). Each epidermis is developed as a secretion epithelium having thin-walled polygonal-tabular cells; inner epidermis, the endocarp consisting of cells with slightly wavy walls. The epidermis cuticle is raised in large bladdery patches. The seeds contain traces of starch (Wallis, 1967). Seed shell epidermis with mesenteric cells, cell wall very undulated, side wall markedly thickened and stratified, slightly greenish; inner epidermis of the fruit with marked pitted rosulate cell; oily droplets (Nidal and Samah Al-Jabi, 2005).

Powder analysis plays a significant role in identification of crude drug. These characters will help in the identification of right variety and search for adulterants. Powder microscopy is one of the simplest and cheapest methods for establishing the correct identity of the source materials (Sandhya, 2015). As the current detection methods used to identify the adulterated powdered seasonings are deficient, organoleptic inspection is the most common method, or sometimes supplemented by physical and chemical inspection (Zhichun, *et. al*., 2011 and Ying, 2010). This study aims to find the adulterants in four seasoning powder such as turmeric, galangal, chili and black pepper and to observe their macroscopic, organoleptic and microscopic characters.

Materials and Methods

Both raw materials and powders of turmeric, galangal, chilli and black pepper were bought from the market and herbal shop. Raw materials were washed, dried and grinded into a fine powder. Each seasoning powders were taken and put it on the microscope slides to observe and photograph the microscopic characters of the constituents of the seasoning powders and identify the adulterating substances. To find whether the adulterants present in seasoning powders, it was chemically and naturally tested by following ways according to literature of Gaurang (2019) and Marini-Bettalo, (1981).

Test for Checking Adulteration in Turmeric Powder

(1) Add a spoonful of turmeric powder in a glass of water. Natural turmeric powder leaves a certain light yellow color after settling down, whereas, an adulterated turmeric powder leaves a strong yellow color in the water while settling down.

(2) Take one teaspoon of turmeric powder in a test tube. Then add a few drops of concentrated Hydrochloric acid (HCL) in it. If pink, violet or purple color appears instantly but then disappears after adding some water turmeric does not have the artificial color. But if the color remains, it has artificial color –metanil yellow.

Test for Checking Adulteration in Chilli Powder

Sprinkle chilli powder on the surface of water taken in a glass of water. The artificial colourants will immediately start descending in colour streaks.

Test for Checking Adulteration in Black pepper Powder

Add some amount of black pepper to a glass of water, pure black pepper settles at the bottom. In the adulterated black pepper, papaya seeds float on the surface of water.

Test for Checking Adulteration in Galangal Powder

Add a teaspoon of galangal to the glass of water. Do not stir it and leave it still for a while. Check after about 20 minutes or so. If powder settles down at the bottom of glass with clear water above, the galangal is pure. The cloudy water indicates possible adulteration.

Test for starch

Powdered sample (2 g) was boiled with distilled water for about 20 minutes and then filtered. The filtrate was treated with two drops of iodine solution. Bluish-black precipitate was formed which indicated the presence of starch (Marini-Bettalo, 1981).

Results

Macroscopic characters of Turmeric

Primary rhizomes were vertically growing condensed swollen, shorter and thicker; short pieces known as bulb or round turmeric, ovate-oblong, conical to pear-shaped, 3 to 7 cm long, 2 to 3 cm wide; secondary lateral branches arising from the primary rhizomes known as finger or long turmeric were cylindrical curved or nearly straight pieces, bluntly tapering at eachend, occasionally short knob-like branched, 4 to 10 cm in length and 1 to 1.5 cm in diameter, longitudinally wrinkled or marked with large circular scars; both the rhizomes were hard and heavy, with short fracture; outer surface being a deep yellowish-brown color, marked with transverse rings (leaf-scars); internally having a uniform dull brownish-yellow, tough horny and waxy in appearance.

Figure 1 Turmeric rhizome (A) Bulb turmeric (B) Long turmeric

Macroscopic characters of Galangal

A branched rhizome was about 12 mm thick, in pieces about 5 to 10 cm long, frequently cylindrical; tapering or enlarged, and often branched, hard and tough; longitudinally striated or shrivelled, at interval of about 5mm pale, encircling, sinuous or frilled remains of cataphyllary leaves; reddish-brown color internally.

Figure 2 Galangal rhizome

Macroscopic characters of Chilies

The fruits of *Capsicum annuum* L. were a narrowly ovoid pod, about 7 to 12 cm long and 5 to 12 mm wide; inferior calyx and pedicel remain attached, about 20 to 40 mm long; calyx about 5 mm long, cup-shaped; pericarp glabrous, shrunken, thin, leathery and red in colour; seeds 5 to 20, disc-shaped, about 3 to 4 mm long and 2.5 to 3 mm wide.

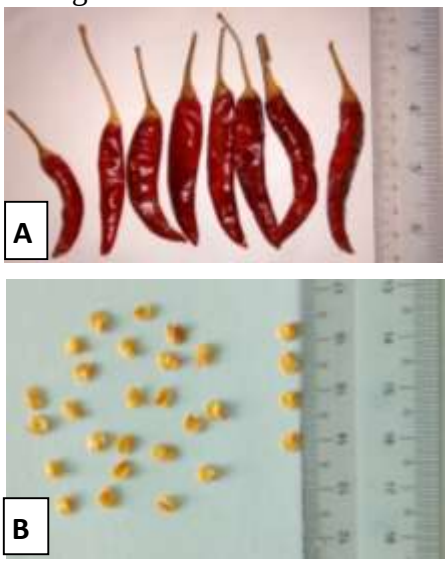

Figure 3 Fruits of Chilies (A) Fruits (B) Seeds

Macroscopic characters of Black pepper

The fruits of black pepper were dark red, 4-6 mm in diameter and contained a single seed, like all drupes; globose or ovoid; epicarp very thin; externally brownish to black with wrinkled surface, sarcocarp and endocarp dark brown.

Figure 4 Fruits of Black pepper

Galangal powder

Black pepper powder

Figure 5 Brand of readymade seasoning powder sold in the market

Table 1 Organoleptic characters of seasoning powder

Organoleptic characters	Seasoning Powder							
	Turmeric		Galangal		Chilies		Black pepper	
	Home made	Ready made	Home made	Ready made	Home made	Ready made	Home made	Ready made
Color	Deep orange-yellow	yellow	light brown	light brown	orange-red	red	grayish-black	grayish-black
Odor	aromatic	aromatic and pungent	spicy	aromatic	very pungent	very pungent	aromatic	aromatic
Flavor	Slightly bitter	Slightly bitter	Strongly pungent and spicy	sweet and pungent	very pungent	very pungent	very pungent	very pungent
Texture	Slightly coarse	fine	coarse	fine	coarse	coarse	coarse	coarse

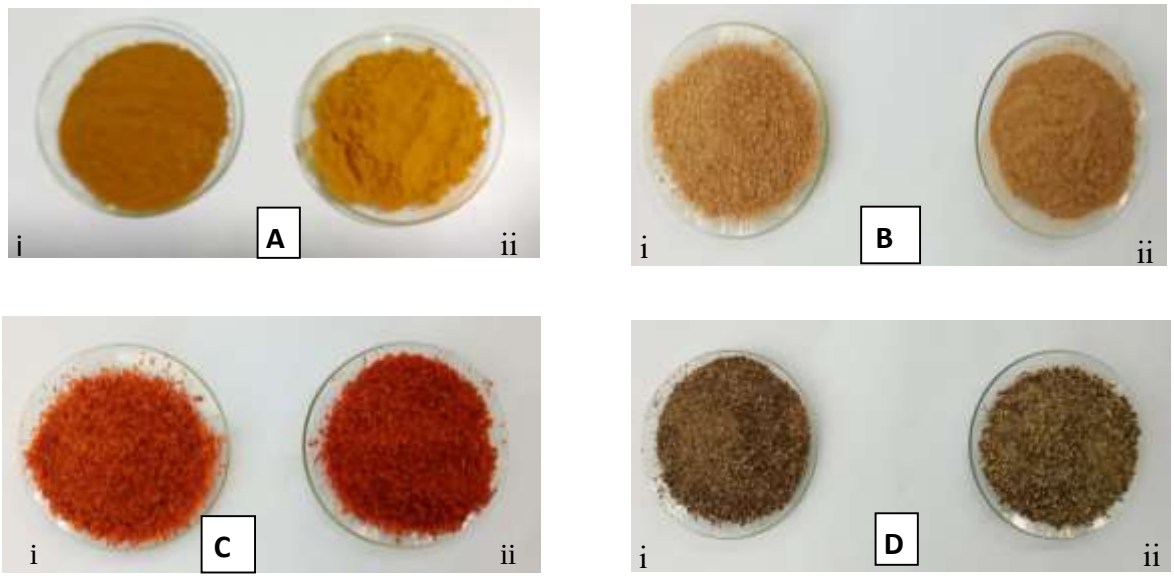

Figure 6 Comparative macroscopic characters of seasoning powder between (i) homemade and (ii) readymade, (A)Turmeric (B) Galangal (C) Chillie (D)Black pepper

Table 2 Test for checking adulteration in seasoning powder

Test Solution	Seasoning Powder							
	Turmeric		Galangal		Chillies		Black pepper	
		Ready made	Home made	Ready made	Home made	Readymade	Home made	Readymade
Water	light yellow	deep yellow	white	light brown	orange	red	brown	brown
Iodine	bluish – black ppt	bluish – black ppt	bluish – black ppt	bluish – black ppt	yellowish brown ppt	bluish –black ppt	bluish –black ppt	bluish –black ppt

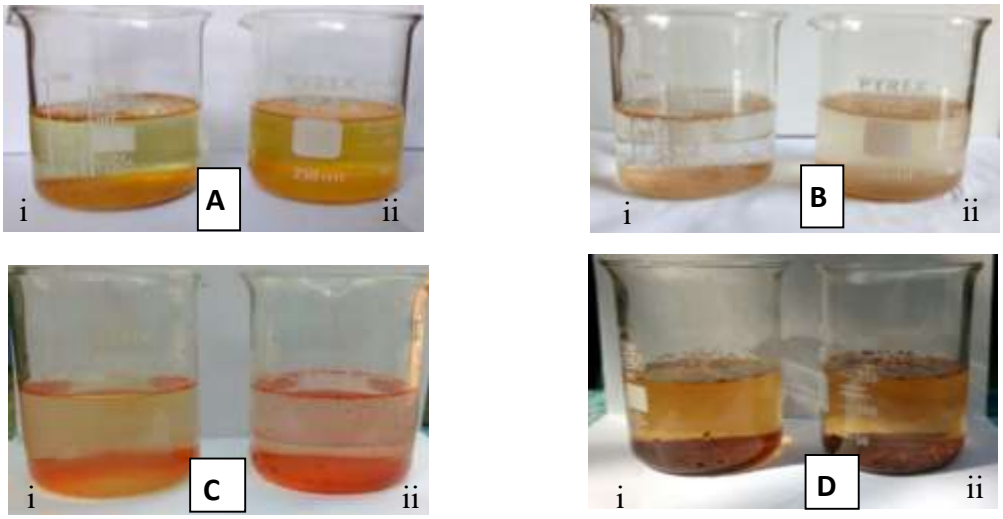

Figure 7 Comparative seasoning powder between (i) homemade and (ii) ready made to check adulteration using water (A) Turmeric (B) Galangal (C) Chilies (D) Black pepper

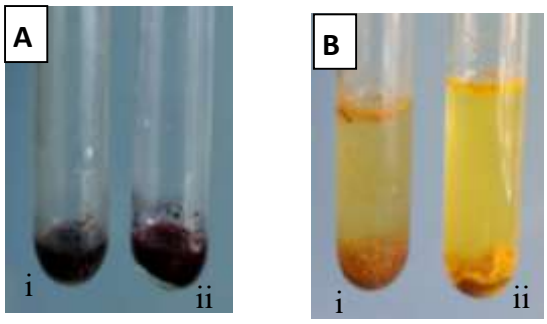

Figure 8 Comparative seasoning Turmeric powder between (i) homemade and (ii) readymade to check adulteration using (A) concentrated Hydrochloric acid (B) water

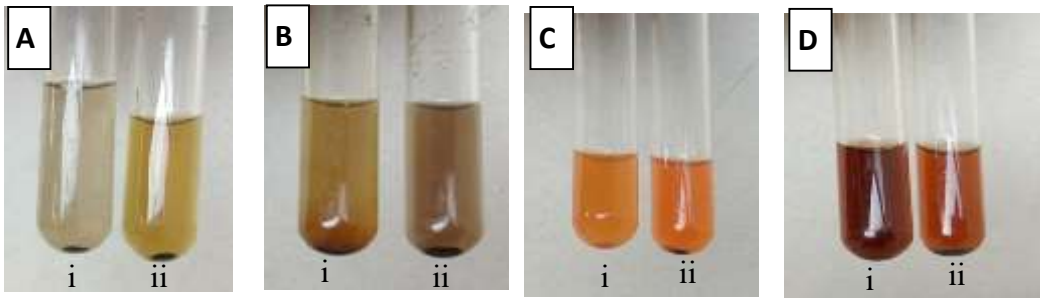

Figure 9 Comparative seasoning powder between (i) homemade and (ii) readymade to check adulteration using iodine solution (A) Turmeric (B) Galangal (C) Chilies (D) Black pepper

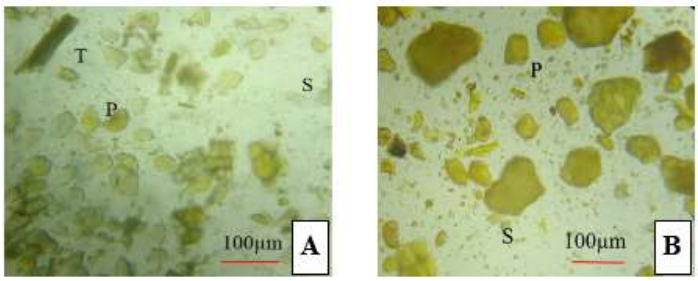

Figure 10 Microscopic characters of Tumeric powder
(A)Homemade; T, tracheae; P, fragments of paranchyma containing swollen and altered starch grains; S, unaltered starch grains
(B)Readymade; P, fragments of paranchyma containing swollen and altered starch grains; S, unaltered starchgrains

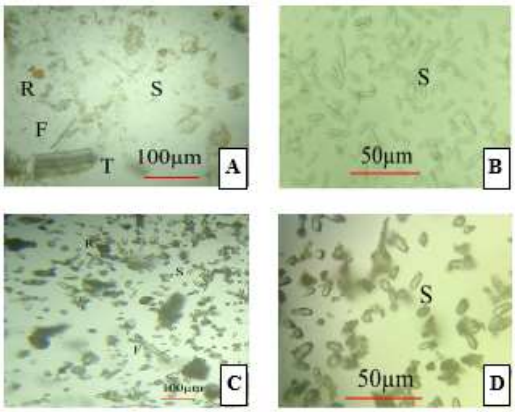

Figure 11 Microscopic characters of Galangal powder
(A) & (B) Homemade; R, cell with reddish brown pigment; F, fiber; T, tracheae; S, unaltered starch grains (C) & (D) Readymade; R, cell with reddish brown pigment; F, fiber; T, tracheae; S, unaltered starch grains

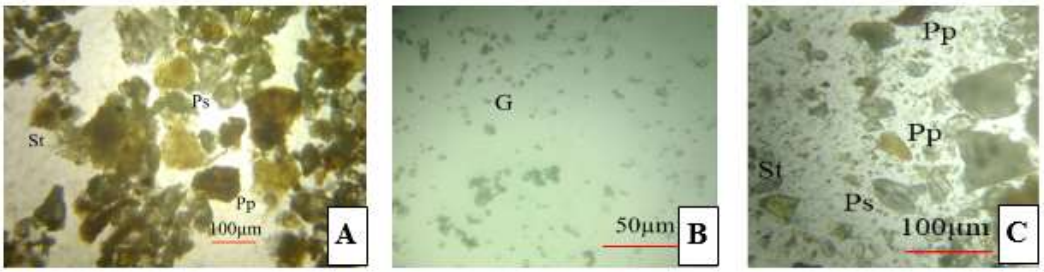

Figure 12 Microscopic characters of Black pepper powder

(A) Homemade; Ps, parenchyma cells of perisperm containing starch grains; Pp, pericarp pigment with yellowish-brown and reddish-brown tannin masses; St, stone cells of the epicarp

(B) G, starch grains

(C) Readymade;Ps, parenchyma cells of perisperm containing starch grains;Pp, pericarp pigment with yellowish-brown and reddish-brown tannin masses; St, stone cells of the endocarp

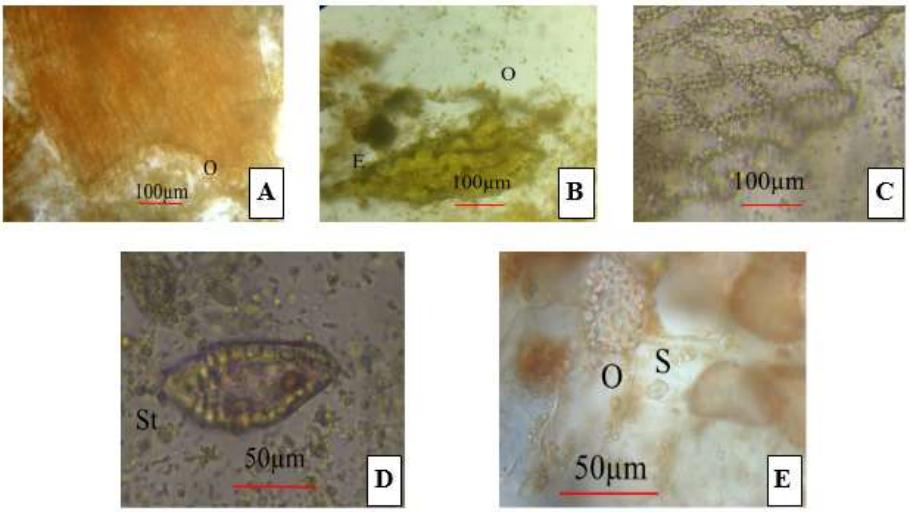

Figure 13 Microscopic characters of Chilli powder

(A) secretion epithelium having thin-walled polygonal-tabular cells; O, red oil globule

(B) E, large wavy yellow cells of the testa epidermis; O, red oil globules

(C) inner epidermis of pericarp with marked pitted rosulate cell

(D) St, stone cell

(E) Readymade; S, starch grains; O, red oil globules

Discussions and Conclusion

Adulteration is dangerous as it fails the quality of food, making it sub-standard for human consumption. The adulteration of seasonings is a long-standing problem. Pharmacognostic evaluation helps to screen the commercial varieties, substitutes, adulterants, and quality of the drugs. As a result of macroscopic characters, some bulb turmeric rhizomes bought from herbal shop are found to be similar to rhizomes of *Curcuma zedoaria* Roscoe**.**

Zhichun, *et. al*., (2011) and Ying (2010) stated that an organoleptic inspection was the most common method. As a result of organoleptic inspection, taste of homemade and readymade turmeric powder has slightly bitter because of mixing with *Curcuma zedoaria* Roscoe that are not agreed with Wallis (1967) and Kraemer (1907), but are agreed with Sasikumar, *et. al*., (2004) and Sen, *et. al*., (1974). Colour of readymade turmeric and chili powder is different from homemade powder due to the presence of the food colouring matter. Depending on the grinding machine,

texture of turmeric and galangal powder may be different. Odour and flavor of homemade and readymade galangal, chilies and black pepper powder are agreed with Wallis (1967) and Kraemer (1907). Thus, sensory recognition is able to distinguish the adulterations according to their color, smell, and taste, but this method depends on experience and is hard to quantify.

The readymade turmeric powder treated with concentrated Hydrochloric acid (HCL), and then after adding some water, colour remains. Thus, yellow food coloring matter, metanil yellow in readymade turmeric powder can be present.

The iodide test is only effective in identifying starchy adulterations. As a result, yellowish brown precipitates in aqueous extract of homemade chili indicated that was agreed with Shah and Seth (2010). Bluish–black precipitates in aqueous extract of readymade chili indicated that content of starch was slightly high. Thus, this experiment was agreed with Xu & Li (2004) that a mixture of other condiments contained starch in chili powder. Thus, physical and chemical inspection methods are more sensitive, but a plenty of time and chemical reagent will cost.

The generally applicable method which can be used to identify the adulterated seasoning powder quickly and intuitively is the process of separating them by using water. As a result, the adulteration in readymade turmeric powder was yellow food coloring matter when it was tested with the water as well as chili powder adulterated with food coloring matter changed the color of water into red. Adulteration in readymade galangal powder showed cloudy water due to the presence of other condiment containing starch. Above the statement of findings were agreed with literature of Gaurang (2019).

As a result of microscopic examination of turmeric powder, tracheae, altered starch grains and unaltered starch grains were found in both homemade and readymade turmeric powder, but the colour of altered starch grains was deep yellow in readymade turmeric powder. This finding was agreed with Kraemer (1907).

As a result of powder microscopy of galangal powder, it was found unaltered starch grains, tracheae, cell with reddish brown pigment; sclerenchymatous fiber or bast fiber in both homemade and readymade galangal powder. The shape of starch grains in readymade galangal powder was not only rod-shaped but also round- shaped and oval shaped that were agreed with Silvy Mathew, *et. al*., (2013). Thus, readymade galangal powder can be mixed with the powder of *Alpinia galangal*.

According to the microscopic characters of black pepper powder, stone cells of the epicarp and endocarp, parenchyma cells of perisperm containing starch grains**;** pericarp pigment with yellowish-brown and reddish-brown tannin masses were found that were agreed with the statement of Kraemer (1907).

As it was a combination of different powdered spices, chili powder from different manufacturers can have different tastes, which makes it quite tough to find adulterants present in it. In this study, secretion epithelium having thin-walled polygonal-tabular cells red oil globule; large wavy yellow cells of the testa epidermis; inner epidermis of pericarp with marked pitted rosulate cell; stone cell were found under the microscope that was agreed with Wallis (1967) and Nidal & Samah Al-Jabi (2005). Starch grains were oval in shape that found in readymade chili powder that was not agreed with Kraemer (1907).

According to Sandhya (2015), powder analysis plays a significant role in identification of crude drug. These characters will help in the identification of right variety and search for adulterants. Moreover, powder microscopy is one of the simplest and cheapest methods for establishing the correct identity of the source materials.

As a conclusion, before using of any seasoning powder, detection of adulteration requires. As the adulterant was indicated in the seasoning powders, it would determine that they are unsafe to consume. As the powdered spices available in the market are often contaminated with the artificial colors and other condiments containing starch, consumers should select right products. Furthermore, it is necessary to maintain its quality and purity for the commercial market.

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