ISSN: 0976-3031

Available Online at http://www.recentscientific.com

International Journal of Recent Scientific Research
Vol. 6, Issue, 8, pp.5938-5943, August, 2015

International Journal of Recent Scientific Research

RESEARCH ARTICLE

DETECTION OF FOOD ADULTERATION IN SELECTED FOOD ITEMS PROCURED BY HOMEMAKER

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ARTICLE INFO

Article History:

Received 14th, July, 2015
Received in revised form 23th, July, 2015
Accepted 13th, August, 2015
Published online 28th, August, 2015

Key words:

Sesamol, sperm count, sesamum indicum, Spermatocyte.

ABSTRACT

This study was "Detection of food adulteration in selected food items procured by Homemaker" conceived and carried out with the objective of identifying the presence of adulteration in food products / ingredients. Various food groups like cereals, pulses, milk and milk products, fats and oils, spices and condiments were selected. Out of these food groups the following ingredients namely wheat flour, par boiled rice, refined wheat flour, bajra, red gram dhal, green gram dhal, roasted Bengal gram dhal, besan flour, khoa, paneer, milk, curd, ghee, ice-cream, sunflower oil, Gingelley oil, mustard oil, pepper seeds, mustard seeds, tea powder, saffron, vinegar, turmeric powder, red chilly powder, coriander powder, red chilly, asafetida, coffee, common salt, sugar, sugar powder, jaggery, honey, green peas, watermelon and mangoes were selected. Both branded as well as unbranded samples were selected for the study to determine the adulteration levels and the qualitative difference between them. The tests were carried out by chemical analysis in a majority of products and through visual inspection in the few products. The procedures/ tests to check adulterants were taken from well-known and widely accepted publications like FSSAI, ISI, AGMARK, BIS etc. After the tests, the products containing adulterants were identified in branded and unbranded food products. This study attempted to bring in awareness to the public on the important subject to food adulteration and various simple methods available to detect food adulteration.

INTRODUCTION

Food is the basic necessity of life. One works hard and earns to satisfy our hunger and relax later. But at the end of the day, many of us are not sure of what we eat. We may be eating a dangerous dye, sawdust, soap stone, industrial starch and aluminum foil. Contaminated foods and drinks are common sources of infection (Dipak, 2011).

Adulteration means the addition of ingredients which are not permitted in food. They are added because of business profit only. Adulterated foods are harmful for human health as they contain the unauthorized food ingredients. Adulteration in foods also decreases our moral and social value. (Chayan, 2014, Shrawan, 2011,Bruhun 2001). According to Beckman (2013),in our daily life there are so many unhygienic and contaminated things which are harmful to our health. Most of the things are contaminated. Even the food, which we eat, is adulterated. The deliberate contamination of food material with low quality, cheap and non-edible or toxic substances is called food adulteration.In Chennai, a commercial shop was inspected for the standard products and the results shows that the products sold were adulterated and it was sold in the name of branded products. About 70% of adulteration was seen in oils and ghee and 10% in masala products (Joy A, 2011).

METHODOLOGY

The study methods are given by the following procedures and the test was done in the laboratory with both the chemical and physical analysis. Each item in the food groups were analyzed for various adulterants. The below table shows the food items tested in each food group.

Food groups	Food items
Cereals	Wheat flour, Refined wheat flour, Sago, Bajara, Parboiled rice.
Pulses	Khesari dhal, Roasted Bengal gram dhal, Green gram dhal, besan flour.
Fats and oils	Ghee, Butter, Sunflower oil, Gingelley oil, Mustard oil, Coconut oil.
Milk and milk products	Milk, Paneer, Curd, Khoa, Icecream.
Spices and condiments	Pepper, cloves, Saffron, Asafeotidia, Coriander powder, turmeric powder, Salt,Chilly powder, Red chilly, Mustard,
Sugars	Sugar, honey, jaggery
Vegetables and fruits	Peas, Sweet potato, mango, Watermelon.

RESULTS

D.Test for adulteration in selected foods Following are few tests that are done in our laboratory to find out the Food adulterants.

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Food item	*Adulterant*	*Brand tested*	*Rapid test*	*Inference*	*Result for Adulterant*	*Health hazards*
WHEAT FLOUR	Bran	i) Standard	Take a glass of water. Add 5grams of wheat flour to it.	If bran is present it floats in water.	i)Not found	Poisonous (Venkatesh,2013) Skin rashes(Sajid,2011)
	Chalk powder	i)Standard	In a test tube wheat flour is diluted and a few drops of dilute hydrochloric acid is added.	Effervescence indicates the presence of chalk powder.	i) Not found	
	Maida	i)Standard	To the sample of Wheat flour and petroleum ether and add 13N NH2SO4 to the extract.	Appearance of red color which does not disappear with distilled water indicates adulteration.	i) Red color appeared	Poisonous (Venkatesh,2013) Skin rashes(Sajid,2011)
	Boric acid	i)Standard	Take a small amount of sample in a test tube, add some water and shake. Add a few drops of Hydrochloric acid. Dip a turmeric paper strip.	If it turns red, boric acid is present.	i)Red color was found	
REFINED WHEAT FLOUR	Chalk powder	i) Sub Standard	In a test tube wheat flour is diluted and a few drops of dilute hydrochloric acid is added	Effervescence indicates the presence of chalk powder.	i)Not foun	Poisonous (Venkatesh,2013) Skin rashes(Sajid,2011)
BAJRA	Ergot seeds	i) loose	Add some grains of Bajra in the glass containing 20% salt solution.	Ergot floats over the surface while sound grains settle down.	i)The seeds were floating	
PARBOILED RICE	Metanil Yellow	i)Standard ii) loose	Rub a few grains in the palms, yellow color would get reduced or disappear. Add a few drops of dilute Hydrochloric acid to a few rice grains mixed with little water.	presence of pink color indicates the presence of Metanil yellow	i)Not found ii)color appeared	
RED GRAM DHAL	Khesari Dhal	i) loose	Add 50 ml of dilute Hydrochloric acid to the sample and keep on simmering water for about 15 minutes.	The pink color developed indicates the presence of khesari dhal.	Color appeared	Stomach pain, ulcer, Lathyrism cancer (Venkatesh,2013), (Sajid,2011)
	Lead Chroamte	i) loose	Take 5grams of sample in 5ml of water. Add a few drops of hydrochloric acid.	Pink color indicates the presence of Lead Chromate.	i)Not found	
GREEN GRAM DHAL	Khesari Dhal	i) loose	Add 50 ml of dilute Hydrochloric acid to the sample and keep on simmering water for about 15 minutes.	The pink color developed indicates the presence of khesari dhal.	i)Color found	Stomach pain, ulcer, Lathyrism cancer. (Venkatesh,2013) (Sajid,2011)
	Metanil yellow	i) loose	Take 5 grams of the sample with 5 ml of water in a test tube and add a few drops of concentrated Hydrochloric acid.	A pink color shows the presence of Metanil yellow.	i)Not found	
	Lead Chroamte	i) loose	Take 5grams of sample in 5ml of water. Add a few drops of hydrochloric acid.	Pink color indicates the presence of Lead Chromate.	i)Not found	
ROASTED BENGAL GRAM DHAL	Khesari Dhal	i)Standard ii) loose	Add 50 ml of dilute Hydrochloric acid to the sample and keep on simmering water for about 15 minutes.	The pink color developed indicates the presence of khesari dhal.	i)Not found ii) Color was found	Stomach pain, ulcer, Lathyrism cancer (Venkatesh,2013) (Sajid,2011)
	Lead Chromate	i)Standard ii) loose	Take 5grams of sample in 5ml of water. Add a few drops of hydrochloric acid.	Pink color indicates the presence of Lead Chromate.	i)Not found ii)Not found	
BESAN FLOUR	Khesari dhal	i)loose	Add 50 ml of dilute Hydrochloric acid to 10 grams of the sample and keep on simmering water for about 15 minutes.	The pink color developed indicates the presence of khesari flour.	i)Not found	Stomach pain, ulcer, Lathyrism cancer (Venkatesh,2013) (Sajid,2011)
KHOA	Starch	i) loose	Take a sample of khoa and slow it to boil. Cool the sample and add a few drops of Iodine solution. Add tincture of iodine to the sample of Khoa.	Formation of blue color indicates the presence of starch.	i) Not found	Less nutritive value (Venkatesh,2013)
PANEER	Starch	i)Standard	Take a small portion of the product in a test tube add water and boil. Cool to room temperature. Add 1-2 drops Iodine solution.	Blue color indicates the presence of starch.	i) Not found	Less nutritive value (Venkatesh,2013)

MILK	Sodium Chloride	i)Standard ii)loose	Take 2 ml of milk in a test-tube and add 0.1ml of 5 percent potassium chromate solution and 2 ml of 0.1 N silver nitrate to it.	The appearance of a yellow color indicates the presence of added sodium chloride in the milk while the appearance of a brick red precipitate indicates the absence of added sodium chloride in the milk.	i)Light appearance of yellow color ii) Appearance of yellow color.	
	Starch	i)Standard ii) loose	Take a small portion of the product in a test tube add water and boil. Cool to room temperature. Add 1-2 drops Iodine solution.	Blue color indicates the presence of starch.	i)Not found ii)Not found	Stomach disorder. (Venkatesh,2013) (Sajid,2011)
	Urea	i)Standard ii) loose	Take 5 ml of milk in a test tube and add 2 drops of bromothymol blue solution.	Development of blue color indicates the presence of urea.	i)Not found ii)Not found	
ICE CREAM	Metanil Yellow	i)loose	Take a sample of ice cream. Add few drops of concentrated Hydrochloric acid.	If magenta red colour develops the presence of Metanil yellow is indicated.	i)Not found	
CURD	Cane Sugar	i)loose	Add 0.1 ml of resorcinol and 1ml of conc. Hydrochloric acid to 10ml of the curd and boil.	A rose red color indicates the presence of cane sugar.	i)Not found	
GHEE	Vanaspati or Margrine	i)standard ii) Substandard	Take about one teaspoon full of melted sample of Ghee / Butter with equal quantity of concentrated Hydrochloric acid in a stoppered test tube and add to it a pinch of sugar. Shake well for one minute and let it stand for five minutes.	Appearance of crimson color in lower (acid) layer shows presence of Vanaspati or Margarine.	i)Not found ii) Color appeared	
	Mashed potatoes and starches	i)standard ii) Substandard	Take 5ml of ghee or butter in a test tube and add few drops of Iodine Solution.	When Iodine, which is brownish in color turns to blue then mashed potatoes / sweet potatoes or starches are present.	i)Not found ii)Not found	
	Coalter Dye	i)standard ii) Substandard	Dissolve 2gm of melted butter in ether. Then add 2ml of dilute Hydrochloric acid. Allow to settle.	Lower acid layer turning pink confirms the presence of coalter dye.	i)Not found ii)Not found	
	Rancid Stuff	i)standard ii) Substandard	Take one teaspoon of melted sample and 5 ml of Hydrochloric acid in a stoppered glass tube. Shake vigorously for 30 seconds. Add 5 ml of 0.1% of ether solution of Phloroglucinol. Restopper & shake for 30 seconds and allow standing for 10 minutes.	A pink or red color in the lower (acid layer) indicates rancidity.	i) Not found ii) Not found	
	Coloring matter	i)standard ii) Substandard	Take 2 grams of filtered fat dissolved in ether. Divide into 2 portions. Add 1 ml. of Hydrochloric acid to one tube. Add 1 ml. of 10% NaOH to the other tube. Shake well and allow to stand.	Presence of pink color in acidic solution or yellow color in alkaline solution indicates added coloring matter.	i) Not found ii) Not found	
SUNFLOWER OIL	Argemone oil	i)standard ii) Substandard	Take a small quantity of oil in a test tube. Add equal quantity of concentrated Nitric acid and shake carefully.	Red to reddish brown color in lower (acid) layer would indicate the presence of Argemone oil.	i) Color appeared. ii) Not found	Loss of eye sight, heart disease and tumors (Venkatesh,2013)
	Mineral oil	i)standard ii) Substandard	Take 2 ml of the oil sample and add an equal quantity of N/2 Alcoholic potash. Heat in boiling water bath (dip in boiling water) for about 15 minutes and add 10 ml of water.	Any turbidity shows presence of mineral oil.	i)Turbidity was found ii)Turbidity was found	Damage of liver, Carcinogenic effects. (Venkatesh,2013)
	Castor Oil	i)standard ii) Substandard	Take about 1 ml of the oil, add 10 ml of acidified petroleum ether and mix well. Add a few drops of ammonium molybdate reagent.	Immediate appearance of white turbidity indicates the presence of castor oil.	i)Not found ii)Not found	Stomach problem. (Venkatesh,2013) Intestinal problem. (Sajid,2011)
GINGELLEY OIL	Argemone oil	i)standard ii) Substandard	Take a small quantity of oil in a test tube. Add equal quantity of concentrated Nitric acid and shake carefully.	Red to reddish brown color in lower (acid) layer would indicate the presence of Argemone oil.	i)Not found ii) Color appeared.	Loss of eye sight, heart disease and tumors (Venkatesh,2013)
	Mineral oil	i)standard ii) Substandard	Take 2 ml of the oil sample and add an equal quantity of N/2 Alcoholic potash. Heat in boiling water bath (dip in boiling water) for about 15 minutes and add 10 ml of water.	Any turbidity shows presence of mineral oil.	i)Not found ii)Not found	Damage of liver, Carcinogeninceffects. (Venkatesh,2013) (Sajid,2011)

	Castor Oil	i)standard ii) Substandard	Take about 1 ml of the oil, add 10 ml of acidified petroleum ether and mix well. Add a few drops of ammonium molybdate reagent.	Immediate appearance of white turbidity indicates the presence of castor oil.	i)Not found ii)Not found	Stomach problem. (Venkatesh,2013) Intestinal problem, (Sajid,2011)
MUSTARD OIL	Argemone Oil	i)Standard	Add 1 ml of nitric acid to the sample of mustard oil in a test tube.	Appearance of red color suggests that mustard oil is adulterated with Argemone oil.	i)Not found	Loss of eye sight, heart disease and tumors. (Venkatesh,2013)
PEPPER SEEDS	Papaya seeds	i)substandard	Papaya seeds can be separated out from pepper as they are shrunken, oval in shape and greenish brown or brownish black in color.		i) The shape was found	Stomach and liver problem. (Venkatesh,2013) (Sajid,2011)
	Light Black Berries	i)substandard	Take a few parets of pepper sample and make it to float in alcohol.	The mature black pepper berries sink while the papaya seeds and light black pepper float.	i)Berries was floating	
MUSTARD SEEDS	Argemone seeds	i)substandard	Mustard seeds have a smooth surface. The argemone seed have grainy and rough surface and is black and hence can be separated out by close examination.	When mustard seed is pressed, inside it is yellow while for Argemone seed it is white.	i) Not found	Epidemic dropsy and glaucoma. (Sajid,2011)
SAFFRON	Maize cobs	i)substandard	Take samples of saffron. Add it in water.	When maize cobs are present the color will dissolve and the saffron changes to white color.	i) Was found	
TEA LEAVES	Exhausted tea	i)standard 1 ii)standard 2 iii)loose	Take a filter paper and spread a few tea leaves. Sprinkle with water to wet the filter paper. If coal tar colour is present it would immediately stain the filter paper.	Wash the filter paper under tap water and observe the stains against light.	i) Color appeared ii)Not found iii)Not found	Liver disorder , Malnutrition in children. (Venkatesh,2013) (Sajid,2011)
VINEGAR	Mineral acid	i)substandard	Test take a sample of vinegar in a test tube. Dip the turmeric filter paper in the test tube.	If pink color is present then the vinegar is adulterated.	i)Not found	
TURMERIC POWDER	Metanil yellow	i)standard ii)substandard	Take a sample of turmeric powder. Add13N $H_2SO_4$to the extract.	Appearance of red color (which persists even upon adding little distilled water) indicates the presence of added colors. However, if the color disappears upon adding distilled water the sample is not adulterated	i) Not found ii) Not found	Carcinogenic, Brain tumour (Venkatesh,2013) (Sajid,2011)
	Yellow clay	i)standard ii)substandard	Take sample of turmeric powder with water and allow to stand for some time.	The yellow clay will settle down at the bottom leaving turmeric on the top.	i)Not found ii)Not found	
RED CHILLY POWDER	Water soluble coal tar color	i)substandard ii)standard-1 iii)standard-2 iv)standard-3 v)standard-4	Take a glass full of water. Sprinkle the chilli powder to the glass tumbler.	The water soluble color will immediately start descending in color streaks.	i)Was found ii)Was found iii)Was found iv)Was found v) Was found	Stomach problem (Venkatesh,2013)
	Oil soluble coal tar color	i)substandard ii)standard-1 iii)standard-2 iii)standard-3 iv)standard-4	Take 2 grams of the sample in a test tube, add few ml of solvent ether and shake. Decant ether layer into a test tube containing 2 ml of dilute Hydrochloric acid (1 ml HCL plus 1 ml of water). Shake it.	The lower acid layer will be colored distinct pink to red indicating presence of oil soluble color.	i)Not found ii)Not found iii)Not found iv)Not found	Cancer, Stomach disorder (Venkatesh,2013) (Sajid,2011)
	Rhodamine B	i)substandard ii)standard-1 iii)standard-2 iii)standard-3 iv)standard-4	Take 2 grams sample in a test tube, add 5 ml of acetone.	Immediate appearance of red color indicates presence of rhodamine.	i)Not found ii)Not found iii)Not found iv)Not found	
CORIANDER POWDER	Dung powder	i) Standard ii) Loose	Take 5 gms of coriander powder and add it to water.	Dung will float and can be easily detected by its foul smell.	i) Not found ii) Not found	
	Common salt	i)Standard	To 5 ml of sample add a few drops of silver nitrate.	White precipitate indicates adulteration.	i)Not found	

RED CHILLY	Rhodamine B	i)loose	Soak a bit of cotton in liquid paraffin and rub on chillies.	Cotton will become red in color as a adulterated sample.	i)Not found	
ASAFOETIDIA	Soap stone	i)standard	Take 2 grams of sample and Shake the powdered sample with water.	Soap stone or other earthy matter will settle at the bottom.	i)Soap stone appeared	Dysentry (Venkatesh,2013)
	Other resins	i) Standard	Take asafetida it in a test-tube. Add one teaspoon of water. Mix thoroughly by shaking.	Milky white solution with no sediments represents pure asafoetida.	i)Not found	
		ii) Standard	Take 1 g of asafoetida, powder it thoroughly and trike it in a test-tube. Add some rectified spirit and filter/ decant the solution. Take 5 ml of filtrate and add few drops of ferric chloride soIution.	Olive green colour shows the presence of adulteration with other resins.	i) Not found	
COFFEE	Chicory	i)Standard	Take a glass full of water and add coffee powder to it. The coffee floats over the water but chicory begins to sink down within a few seconds.	The falling chicory powder particles leave behind them a trail of color, due to large amount of caramel.	i) Was found	Diarrhoea, (Venkatesh,2013)
		ii)loose			ii) Was found	Coma ,(Sajid,2011)
	Starch	i)Standard	Make decoloration of the coffee, decolorize it by adding potassium permanganate and then add drop of iodine solution.	Blue color indicates the presence of starch.	i)Not found	
		ii)loose			ii)Not found	
COMMON SALT	White Powdered stone	i)Standard	Take a spoonful of sample of salt in a glass of water.	The presence of chalk will make solution white and other insoluble impurities will settle down.	i)Not found	
		ii)loose			ii)Not found	
SUGAR	Chalk powder	i)Standard	Take 10 gms ofsugar in a glass of water, allow it to settle.	Chalk will settle down at the bottom.	i)Not found	Stomach disorder (Sajid,2011)
	Washing soda	i)Standard	Take small quantity of sugar, dissolve it in water and add few drops of Hydrochloric acid.	effervescence (gives off bubbles) will indicate the presence of washing soda.	i)Not found	
SUGAR POWDER	Chalk powder	i)Standard	Take 10 gms ofsugar powder in a glass of water, allow it to settle.	Chalk will settle down at the bottom.	i)Not found	
	Washing soda	i)Standard	Take small quantity of sugar powder, dissolve it in water and add few drops of Hydrochloric acid.	effervescence (gives off bubbles) will indicate the presence of washing soda.	i)Not found	
JAGGERY	Chalk powder	i)loose	Take about half tea spoon of sugar in a test-tube and add few drops of 1:1 hydrochloric acid.	The immediate appearance of small bubbles (effervescence) indicates the presence of washing soda in sugar.	i)Not found	Vomiting and diarrhoea (Sajid,2011) Venkatesh,(2013)
HONEY	Sugar solution or water	i)standard	A cotton wick dipped in pure honey when lighted with a match stick burns and shows the purity of honey.	If adulterated, the presence of water will not allow the honey to burn. If it does, it will produce a cracking sound.	i) Not found	
		ii)loose			ii) Was found	
	Invert sugar or Jaggery	i)standard	*Fiehe's Test:*Add 5 ml of solvent ether to 5 ml of honey. Shake well and decant the ether layer in a Petri dish. Evaporate completely by blowing the ether layer. Add 2 to 3 ml of resorcinol (1 gm. Of resorcinol resublimed in 5 ml of conc. Hydrochloric acid).	Appearance of cherry red color indicates presence of sugar/jaggery	i) Not found	
		ii)loose			ii) Not found	
		i)standard	*Aniline Chloride Test:* Take 5 ml of honey in a porcelain dish. Add Aniline Chloride solution (3 ml of Aniline and 7 ml. Of 1:3 HCl) and stir well.	Orange red color indicates presence of sugar.	i) Not found	
		ii)loose			ii) Not found	
GREEN PEAS	Artificially colored	i)loose	Take a little amount of green peas in a 250ml beaker add water to it and mix well. Let it stand for half an hour.	Clear separation of colour in water indicates adulteration.	i)Not found	
Mangoes	pesticides	i)loose	Take a whole mango and soak it in methanol-e-propane.	If the mango floats in the chemical then it indicates the mango is adulterated.	i)was found	
Watermelon	Erythrosin color	i)loose	Wipe the watermelon with a piece of cotton.	When the red color appears in the cotton it shows the fruit is adulterated	i)was found	

CONCLUSION

Adulteration is commonly practiced in both branded and unbranded foods in daily life. From local market to the hyper market adulteration is prevalent everywhere. But when compared to the previous days/years, today the extent/percentage of adulteration has reduced. Majority of adulteration in India is Intentional adulteration and it affects the people of all the age group. Even today many people in India are unaware about adulteration and its harmful effects. Even if they know, they seldom take steps to stop adulteration. The carelessness of the buyers makes/encourages the traders to add unpermitted additives. And hence awareness/training was given to the participants in Coimbatore as a part of the study and their awareness recorded after the study revealed that it was effective.

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How to cite this article:

Abhirami S. and R.Radha., Detection Of Food Adulteration In Selected Food Items Procured By Homemaker. *International Journal of Recent Scientific Research Vol. 6, Issue, 8, pp.5938-5943, August, 2015*

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