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### **Qualitative analysis of some selected high value food products for adulterant: A value assessment**

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#### **ABSTRACT**

Adulteration is an addition of another substances to the items in order to increase the quantity of the food products in raw form or in prepared form , which may result in the loss of actual quality of food products. These substances may be either available food items or non-food items. Adulteration of food can either be intentional, unintentional or natural. Unintentional adulteration is a result of ignorance or the lack of facilities to maintain food quality. Adulteration in food is normally present in its most crude form. Adulterants may be intentionally added to more expensive substances to increase visible quantities and reduce manufacturing costs, or for some other deceptive or malicious purpose.

**KEY WORDS**-Adulterants, Metanilyellow, Brick powder, Agremon seeds, Gypsum, Honey.

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## **INTRODUCTION-**

Food is our source of energy and one the basis need for all living beings after water. Plants as an autotrophs fixes the sun energy in itself, from here it moves to consumer and then decomposers acts on that. There are around 2,000 plant species which are cultivated for food, and many have several distinct cultivars. Maize, wheat, and rice together account for 87% of all grain production worldwide<sup>1</sup>. Animals are also used as food either directly or indirectly by the products they produce. Food products produced by animals include milk , Cheese or butter etc. In addition, birds and other animals lay eggs, which are often eaten, and honey bees produces honey, which is a popular sweetener in many cultures.

Adulteration is an addition of another substances to the items in order to increase the quantity of the food products in raw form or in prepared form , which may result in the loss of actual quality of food products. These substances may be either available food items or non-food items. Among meat and meat products some of the items used to adulterate are water or ice, carcasses, or carcasses of animals other than the animal meant to be consumed<sup>2</sup>.

It is a wide spread illegitimate procedure involving contamination of food with chemical and physical substances. Chemical substances or simply adulterants may be internationally added to substances to reduce manufacturing costs, or for some deceptive or malicious purpose. When profit in business is more important than morality, then it is possible to add the poisoning contents to the foods and beverages. Food adulteration, a clear violation of human right.

In the earlier times, people used to cook food at home so that it was healthy, fresh and clean. But now days everybody is busy that they don't want to cook food at home and depends most of the time on instantly made items. These have different kinds of preservatives that are used to keep them in good condition for long time. Today almost all food items that you are getting in the market have some or kind of adulterant which may brings down the nutritional value and causes different types of health hazards.

Adulteration of food can either be intentional, unintentional or natural. Unintentional adulteration is a result of ignorance or the lack of facilities to maintain food quality. Intentional adulteration is a criminal act and punishable offense.

The addition of adulterants is called adulteration<sup>3</sup>. It is also a substance which also reduces the vital importance of food and causes some toxic effect to the human body. Adulterants when used in illicit drugs are called cutting agents, while deliberate addition of toxic adulterants to food or other products for human consumption is known as poisoning<sup>4</sup>. Adulteration in food is normally present in its most crude form. Adulterants may be intentionally added to more expensive substances to

increase visible quantities and reduce manufacturing costs, or for some other deceptive or malicious purpose. Adulterants may also be accidentally or unknowingly introduced into substances.

In India normally the contamination of in food is done either for financial gain or due to carelessness and lack in proper hygienic condition of processing, storing, transportation and marketing. This ultimately results that the consumer is either cheated or often become victim of diseases. Such types of adulteration are quite common in developing countries or backward countries.

The increasing number of food producers and the outstanding amount of import foodstuffs enables the producers to mislead and cheat consumers. To differentiate those who take advantage of legal rules from the ones who commit food adulteration is very difficult. The consciousness of consumers would be crucial. Ignorance and unfair market behavior may endanger consumer health and misleading can lead to poisoning. So we need simple screening, tests for their detection. In the past few decades, adulteration of food has become one of the serious problems. Consumption of adulterated food causes serious diseases like cancer, diarrhoea, asthma, ulcers, etc. Majority of fats, oils and butter are paraffin wax, castor oil and hydrocarbons. Red chilli powder is mixed with brick powder and pepper is mixed with dried papaya seeds. These adulterants can be easily identified by simple chemical tests. Some of the common adulterants are mineral oils, argemone oils, castor oils in edible oils; vanaspathi, mashed potato in ghee; invert sugar or jiggery in honey, kesari dal, lead chromate in pulses etc. which can leads to Epidemic dropsy, Glaucoma, Cardiac arrest, Lathyrism (crippling spastic paraplegia), Anaemia, abortion, paralysis, brain damage, cancer etc<sup>5</sup>.

The Delaney clause, enacted in 1958, prohibits the FDA from approving food additives shown to cause cancer<sup>6</sup>. At the time passes of amendment, little awareness came about the carcinogenic propensities of a wide variety of additives<sup>7</sup>. Following the enactment of this amendment more and more substances were shown to be potentially carcinogenic, albeit in experiments wherein test animals were subjected to doses far in excess to the proportions which human were likely to consume. In 1982, the FDA responded to this trend by adopting a rule that a food additives would not be denied approval under Delaney clause unless the additives itself, and not just constituents chemicals used to make it, was shown in cause cancer<sup>8</sup>. This policy was later challenged in high court following FDA approval of food colouring manufactured with compound, known to be carcinogenic, after separate testing indicated that the food colouring itself did not cause cancer in test animals. The United States Court of Appeals for the Sixth Circuit upheld the FDAs approval of the food colouring<sup>9</sup>.

The Ministry of Health and Family Welfare is responsible for providing safe food to citizens. The Prevention of Food Adulteration Act, 1954, laid down guidelines to provide pure and

wholesome foods to consumers. The Act was last amended in 1986 to make punishments more stringent and to empower consumers further.

## **EXPERIMENTAL-**

Food adulteration is the addition or mixing of inferior, harmful, substandard, useless or unnecessary substances to foods. This spoils the nature and quality of food items and is considered food adulteration

## **MATERIALS-**

Some common food items in India <sup>10,11,12,13</sup> which used to be mix with cheap quality adulterant to get financial profits are-

**1.Wheat and Rice Flour-** The rice and wheat is a part of our staple food in India. The powdered rice and wheat is usually adulterated with chalk powder or excess Bran . This is done to thicken the cream and add the weight to the product.This added substance takes away the nutrition intended for the consumer leaving us under the illusion that our diet is perfect.

**2.Pulses-** These are mixed with khesari dal, which is highly carcinogenic in nature.

**3.Milk-**In India, which is the land of cows, large quantities of milk are adulterated. Milk adulteration involves adding water to milk and removing the beneficial fats from milk. Often milks are adulterated with starch, urea, formalin and detergent powders. Sometimes ammonium sulphate, is also added to milk to increase the lactometer readings. This makes the milk less nutritious and it results in milk being useless for the consumer. Formalin is generally added to enhance the life of milk but have very much adverse effect on us , it may leads to giddiness, respiration and stomach problems. Detergent powder is generally added to give more pure look to milk by soapy or foamy appearance. A 2012 study conducted by the FSSAI across 33 states and it was found that milk in India was altered with dilute water, detergent, fat and even urea. A 2014 report warned users of how the milk produced by Indian cows might be altered because they graze on garbage.

**4.Deshi ghee/Butter** - Deshi ghee/butter, which is a milk product is much costlier than vanaspatighee.So, deshi ghee is often adulterated with vanaspati ghee. Vanaspati ghee contains sesame oil or margarine which is not present in deshi ghee.

**5.Mustard Oil-**In Mustard seeds and mustard oil , the most common adulterant is argemone seeds which is used to add bulk and weight. The consumption of these could cause epidemic dropsy and severe glaucoma. Young children and senior citizens with poor immunity are more susceptible this.

**6.Turmeric powder-**is also adulterated with 'metanil yellow'. 'Metanil yellow' is produced with utilizing some raw materials like 'metanilic acid' and 'lead chromate'. The common people do not know the risk of consuming turmeric powder mixed with 'metanil yellow'. It is purely carcinogenic – means it is capable of causing cancer in living tissues.

**7.Chilli powder**–Chilli powder often adulterated with red are coloured lead salts in brick powders.

**8.Honey**-Honey is generally adulterated with water and table sugar, gypsum or starch to increase the bottle's quantity gypsum generally added to give more natural look to synthetic honey.

Antibiotics are found in honey because they are used in apiculture for treatment of bacterial diseases. Antibiotic residues originate mostly from the environment and improper beekeeping practices. There are several international reports of antibiotic residues in honey samples. Ox tetracycline and chloramphenicol residues have been found above the regulatory standards in honey<sup>14,15</sup>.According to a study carried out by the Centre for Science and Environment, most honey brands being sold in the country contain varying amounts of antibiotics and their consumption over time could induce resistance to antibiotics, lead to blood-related disorders and injury to the liver.

**9.Green Chilly and Green peas** – These are generally adulterated with Malachite green and agremon seeds, Which is carcinogenic in nature if consumed for long time.

**10.Sugar**- Chalk powder is a water insoluble substance which is often used as a common adulterant in sugar.Moreover sugar is usually contaminated with washing soda.

## **METHODOLOGY-**

### **Experiments for detection of adulterants in selected food items -**

To perform the experiment for the following food products , we have gone through different chemical test for pure sample and samples collected from super market<sup>16,17</sup>.

#### **1.Detection of chalk powder and excess of bran in wheat and rice flour-**

**Reagents**-Distilled water, Dilute HCl.

## **METHODOLOGY-**

**Excess Bran**- Sprinkle the wheat or rice flour on water surface. Bran will float on the surface.

**Chalk powder**- Shake the sample with dilute HCl, effervescence indicates the presence of chalk.

#### **2.Detection of khesari dal in pulses(dals)-**

**Reagents**- Dilute HCl, Water-bath.

## **METHODOLOGY**

Khesari dal has edged type appearance showing a slant on one side and quare appearance in contrast to other dals. To detect that we added dilute hydrochloric acid to the sample and keep it on waterbath for about 15 minutes.It developed into pink colour, which indicates the presence of Khesari dal into sample.

#### **3.Detection of starch ,urea, formalin, detergent powders and ammonium sulphate in milk**

##### **Sample-**

**Reagents**- Iodine solution, Toor-dal powder, Litmus paper, concentrated sulfuric acid, distilled water, 2% solution of NaOH and NaOCl and 5% solution of Phenol.

## **METHODOLOGY-**

**Starch-**For the detection of starch , we have added few drops of tincture Iodine or Iodine solution in the test tube containing milk sample, it formed blue colour with sample milk, it indicates the presence of starch in milk sample.

**Urea-** For the detection of Urea we took a teaspoon of milk in the test tube and added ½ spoon of toor dal powder and shaken it properly. After 5 minutes we have dipped red litmus paper in it. Change in colour from red to blue indicated the presence of urea in the milk sample.

**Formalin-** For the detection of Formalin ,we have added 5 ml of concentrated sulfuric acid to test tube from the side of wall, containing milk sample. A violet colour ring appears at the intersection of two layers, which indicate the presence of formalin in the milk sample.

**Detergent Powder-** For the detection of detergent powder in the milk sample , we have taken 15 ml of milk sample with 15 ml of distilled water and shake it for 2 minutes, excess amount of leather indicates the presence of detergent.

**Ammonium sulphate-**To test the presence of ammonium sulphate in milk we took different samples, 10 ml of milk in test tube ,add 2.5 ml of 2% sodium hydroxide, 2.5 ml of 2% Sodium Hypochlorite and 2.5 ml of 5% phenol solution , bluish colour appears . Heated the mixture for 20 seconds in boiling water bath. Blue colour of mixture turns into deep blue colour, indicate the presence of ammonium sulphate. While the pure sample turns pink colour.

### **4.Detection for Vanaspati oil in Deshi Ghee/ Butter-**

**Reagents-** Butter/ Ghee sample, sugar powder, Furfural solution, concentrated Hydrochloric acid.

**Methodology-** For the detection of Sudha ghee, we took a tea spoon sample of Ghee in a stoppered test tube and added 5 ml of concentrated HCl and a pinch of sugar/ furfural solution to it. Shake all for a minute and let it for a five minutes. Appearance of crimson red colour at the bottom of test tube , shows the presence of Margarine or Vanaspati oil.

### **5.Detection of agremone seeds in Mustard oil –**

**Reagents-** Mustard oil sample, Diluted nitric acid.

**Methodology-** Mixture of mustard oil sample 5 ml and 5 ml nitric acid has been mixed and heated for 2-3 minutes . Sample turns into red colour , shows the presence of agremone seed in mustard oil sample.

### **6.Detection of metanil yellow and lead chromate in turmeric powder-**

**Reagents-** Sample turmeric powder, Concentrated HCl/ CH<sub>3</sub>COOH, Lukewarm water, 1% Diphenyl carbazide in rectified spirit.

## **METHODOLOGY-**

**Metanil Yellow**-We have taken 1 teaspoon of turmeric powder in test tube and added 20 ml of lukewarm water and 4-5 drops of acetic acid. While shaking, text mix converted into purple color, showing the presence of Metanil yellow.

**Lead chromate**- 1 tea spoon of the turmeric powder sample is taken in a test tube and 5ml of concentrated HCL is added to it. The mixture is shaken thoroughly. Now 1ml of 1% diphenyl crbazide reagent is added to it , Appearance of pink to red colour indicates the presence of lead chromate,  $PbCrO_4$ , in the sample.

### **7.Detection of brick powder and lead salts in chilly powder-**

**Reagents**-dilute  $HNO_3$ ,KI .

**Methodology**- We have taken the 1 tea spoon of chilly powder sample in test tube and mixed it with 10 ml of dilute nitric acid. The solution is filtered and a few drops of potassium iodide solution is added to the filtrate. Appearance of yellow colour precipitate indicates the presence of lead salts in chilli powder and insoluble substances indicates the presence of brick powder in the sample.

### **8.Detection of sugar, gypsum and starch in Honey-**

**Reagents**-Distilled water, sample honey, vinegar, iodine solution.

## **METHODOLOGY-**

**Water Test for sugar**- We took a tea spoon of honey in glass beaker full with water . One sample was dissolved and created turbid solution, while the other pure one was having more dense texture has settled down at the bottom of the beaker.

**Gypsum**- Take 1 teaspoon of honey in test tube and add 10 ml of distilled water. Then place 4-5 drops of vinegar into the solution and shake it. If it turns into foamy, the honey might have adulterated with Gypsum.

**Starch and flour**- We took 1 teaspoon of honey in test tube mix with 10 ml of distilled water and add few drops of iodine to it. Shake it properly, if solution turns violet colour, shows that honey, is adulterated with starch or wheat flour.

### **9.Detection of Malachite Green and artificial colours in Green Chilly and Green peas-**

**Reagents**-Parrafin oils, distilled water

## **METHODOLOGY-**

**Malachite green or other artificial colour dye** - To test the presence of malachite green in green chilly or on green pea, we took cotton dipped in par Mohammad Sayej . and Q. Al Maqashah\*affins oil and rub it on green pea or chilly surface , appearance of green colour on cotton showing that sample is adulterated with malachite green or other artificial dyes.

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## **10.Detection of insoluble substances, chalk powder and washing soda in Sugar-**

**Reagents**-concentrated H<sub>2</sub>SO<sub>4</sub>,alcoholic solution of  $\alpha$ -naphthol, dilute HCl.

### **METHODOLOGY-**

**Insoluble substances** -A small amount of sugar is taken in a test tube and is shake it with little water. Pure sugar dissolves in water but insoluble impurities do not dissolve and appear at the bottom of the test tube.

**Chalk powder, Washing soda-** we took a pinch of sugar in a test tube and few drops of dilute HCl is added and shake it well , brisk effervescence of CO<sub>2</sub> , shows the presence of chalk powder or washing soda in the sample.

### **CONCLUSION-**

The economic adulteration of products means profits, unfair competition, consumer fraud and a potential source of industry-wide economic damage. This paper has attempted to increase awareness of the issues surrounding the economic adulteration of high-value food products. I hope the paper will encourage the development among academics , government agencies and food industry leaders , to improve regulations , monitoring and analysis of economic adulteration.

I have studied , different types of chemical reactions to go through the process of detection In different food items. All the experiments were performed for the purpose of detecting various adulterants present in common food. Experiments have been done by common laboratory methods.

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