

FOOD ADULTERANTS AND THEIR DETECTION

E.G. SOMAPALA

*Senior Assistant Government Analyst,
Government Analyst's Department,
Colombo 7.*

The story of adulterated food is an old one. The relevant legislation on food enacted in Sri Lanka before the second world war i.e., Bread ordinance and Milk Regulations which related to the sale of Bread and Milk respectively. In 1949 Food and Drugs Act was introduced in Sri Lanka. The same was replaced in 1980 by the Food Act No: 26 of 1980. The present Food Act covers the manufacture, sale, distribution and import of Food and is applicable to the whole Island. A number of Regulations framed under this Act are being implemented to ensure the safe food for the consumers. The minimum quality requirements for most of the common foods are specified in these regulations. The sale of adulterated food is an offense and liable for heavy fines and/or imprisonment.

What is Food Adulteration? Eventhough there is no proper definition, but can be explained as follows. "The addition of foreign matter to any food to increase the bulk by which to get more profit". Also in certain cases it may be the removal of certain portion of a food eg. extraction fat from milk. We cannot exclude the "artificial" preparation of foods such as preparation of turmeric powder using wheat flour and artificial colouring matter i.e. 100 percent adulteration. The preparation of foods using artificial ingredients and label them as natural products could also be considered as Food Adulteration. By all these means the end result is an enhanced profit.

These adulterants may be harmless or harmful. eg. addition of flours to turmeric is harmless while the addition of paddy husk to chillie powder or the preparation of sugar/flour confectioneries using non permitted colouring matters such as Metanil Yellow (yellow) and Rhodamine B (red) are harmful to the human body.

A survey of different types of foods in Sri Lanka would reveal the various adulterants present in those foods.

1. Ground Spices

This includes mainly chillie powder, turmeric powder, condiment powder, pepper powder etc. The common type of adulterants are wheat flour, rice flour, corn flour, brick powder, powdered paddy husk, saw dust, and poonac.

The detection of these foreign substances are carried out by the determination of total ash content, Acid Insoluble Ash content and finally the microscopic examination. The addition of flours to any of these species will definitely bring down the total ash content proportionately as the flours do not contribute for the ash content. On the other hand the total ash and subsequently the acid insoluble ash content will be raised if the spices are adulterated with paddy husk, saw dust or brick powder.

The confirmation of the presence of these foreign matters as well as the spices is done by microscopic examination. Since all these are plant matters (except brick powder which is rich in Silica crystals) the characteristics tissues and other microscopic structures could be identified under the microscope. The values obtained for total ash content and acid insoluble ash content could be justified by microscopic estimation of the foreign matters.

2. Starch/flours

One of the common food items found to be adulterated in the local market is arrowroot. It has been reported that maize starch is the frequent adulterant. Less frequently Manioc starch (tapioca starch) has been

used to adulterate arrowroot. Of course the adulteration is the 100 percent and the detection of these foreign starches are only carried out by microscopic examination because the starch grain has its characteristic shape, size and hylum.

The rice flour found to be adulterated with wheat flour. Also it is reported that Kurakkan flour to contain rice flour and/or wheat flour. The detection of these foreign starches are only done by the microscopic examination.

3. Ground Coffee

The adulteration of ground coffee with roasted rice flour, roasted ground nut husks, roasted tamarine seeds are not new to the analyst. The detection of these foreign matters is done by the determination of total ash, water extractives and the caffeine content. The presence of rice flour will lower the total ash content while the presence of other vegetable matters will lead to the increase in the extract. Also it is accepted that the caffeined content of ground coffee should be not less than 1.25 percent. The addition of foreign matter will definitely lower this value and hence it is easily calculated the percent foreign matter. The final confirmation of the presence of coffee and other foreign matters will be carried out by microscopic examination.

4. Oils & Fats

The important oils in the Sri Lankan market are coconut oil, gingelly oil and less commonly ghee. The main adulterant in coconut oil is palm oil. On the other hand it is very common that the quality of coconut oil available for the consumers is far below the quality standard required by the Food Miscellaneous Regulations 1989. ie high free fatty acid content.

Lower quality coconut oil is the most common adulterant present in gingelly oil. Also it is known that the cotton seed oil has been used in the adulteration of gingelly oil. The occasions of use of paraffin oil as an adulterant have been reported. The detection of these foreign oils and other matters are carried out by the

determination of two important parameters namely saponification value and iodine value. Ofcourse the high free fatty acid content is detected by simple titration with a standard alkali after dissolving the oil in neutral alcohol. The Saponification value and Iodine value are characteristic of any oil.

	Coconut Oil	Gingelly Oil	Palm Oil
eg. Sap. Value (av)	255	200	200
Iodine Value (av)	8	100	50

If gingelly oil is adulterated with coconut oil the saponification value of the resultant mixture should be in between 255 and 200 depending on the proportions of each type of oil, ie. the higher the coconut oil content the higher the saponification value. On the other hand the Iodine value lies between 8 and 100. ie. the higher the gingelly oil content the higher the iodine value.

When only two oils are present the proportions of each type of oil could be calculated conveniently using saponification and Iodine values of the mixture. At the same time the qualitative tests to detect the presence of these oils are carried out.

It has been reported that Ghee (mostly used as an Ayurvedic ingredient) is adulterated with palm oil, lard tallow or paraffin wax. There were occasions of the artificial preparations of ghee using palm oil (specially stearing portion) and non permitted colouring matter-metanol yellow. The purity of ghee is assessed by the determination of the special parameters called Reichert, Polenske and Kirshner values. (The definition of these values are beyond the context of this text). These values are characteristics of ghee and the deviation from these values will show the presence of foreign matters.

eg. If butter is adulterated with margarine by the determination of the above three values it is possible to calculate the percent butter fat in the sample.

The presence of paraffin wax is detected by Holder's test and the unsaponifiable matters (wax) could be estimated.

Other than these classical methods it is possible to determine the purity of these oils & fats using the Gas Liquid Chromatography.

6. Vinegar

Food Regulations requires Vinegar to contain a minimum of 4 percent acetic acid. Vinegar could be prepared either naturally from the fermentation of coconut today (or malt) or artificially by the dilution of acetic acid.

Obviously the most common adulterant is water. The acetic acid percentage is obtained by a simple titration with standard alkali solution. By labelling the artificial products as natural vinegars or by using a label with pictorial representations of coconut trees etc. to imply the product is natural is not uncommon in Sri Lanka. This is an indirect way of adulteration by which the consumer is misled. The secondary constituents such as ketones, aldehydes and ester etc. which are the by-products of the natural fermentation process are useful indicators in the differentiation of the natural and artificial vinegars. The alkaline oxidation value, Acid oxidation Value, Ester Value and Iodine Value, of vinegar are used to differentiate between the two types.

The use of formic acid in the manufacture of Vinegar has been detected. Even the mineral acids may be present in vinegars. The qualitative tests are carried out to determine the type of acid present in the vinegars. ie. Acetic, formic & mineral acids.

7. Honey

Honey is another ingredient for Ayurvedic preparations. The most common adulterant is sugar syrup. One can differentiate the natural honey and sugar by the determination of dextrose / fructose ratio.

Also the presence of sugar syrup is detected by identifying HMF which is only present in sugar syrups.

8. Sugar and Flour confectioneries

Eventhough these food items are not adulterated, it is useful to consider the non permitted colouring matters

present. The two non permitted colouring matters used in these industries are

1. Metanil Yellow (yellow colour)
2. Rhodamine B (Red Colour)

The detection and identification of these colouring matters are done by the extraction, followed by paper chromatographic separation.

Metanil yellow can be detected by the addition of few drops of dilute mineral acid (such as hydrochloric acid or Sulphuric acid - Battery acid) to the food. The change of colour from yellow to pink shows the presence of this colouring matter.

9. Milk and Milk Products

Milk is a liquid obtained from the complete emptying of the udder of a lactating cow. The main constituent of milk is water (87.5 percent) while protein, fat, carbohydrate (lactose), minerals and vitamins are other ingredients. According to the Food (Standards) Regulations 1989 the cows milk should contain a minimum of 3.5 percent fat and 8.5 percent of Milk Solids other than fat.

There are number of types of liquid milks available in the market with different minimum levels of fat and milk solids other than fat.

It is well known that the milk is adulterated with the addition of water. On the other hand the extraction of fat from milk is also an adulteration. The adulteration of milk can be detected quantitatively by the determination of fat and total solid content.

10. Ready to drink beverages and cordials

According to Food (miscellaneous) Regulations 1986 ready to drink beverages prepared with fruits should contain a minimum of 5% fruit juice, and cordials should contain not less than 25% fruit juice. On the other hand it is also possible to prepare these two drinks artificially using water, sugar colouring matters

and artificial flavours. But they should be labelled as 'artificial'

It has been found that the artificial preparations are labeled as natural or use labels with pictorial representations of fruits of fruits to imply them as natural products. This is misleading the consumer. It could be considered as adulteration because the consumer is not getting what he wanted.

By the addition of more water the fruit content will be lowered, hence the product is adulterated. The detection of the fruit content is carried out by the determination of the Potassium and Phosphorus content. By comparing these figures with the recorded levels one can calculate the percent fruit juices present in a particular product. Also it is possible to detect the natural and artificial flavours by gas liquid chromatography.

The other problems with these two types of drinks is the use of saccharin as an artificial sweetener. According to Food (Non - nutritive Sweeteners in Food) Regulations 1990 saccharin is not allowed in any food. The sweetening power of saccharin is 550 times that of sucrose.

So the use saccharin is profitable, and it has been found saccharin in some of the ready to drink beverages specially in certain "drink packets". The quantitative detection of Saccharin is done by extraction with diethyl ether followed by titration with standard al-

kali using bromothymol blue as an indicator. The qualitative tests are carried out to confirm the identity of extracted saccharin.

Adulterated food in the Sri Lankan market is not very uncommon. The above given is a brief outline of certain common food items. Under the Food Act No: 26 of 1980 a number of Regulations are framed and they are in effect now. The consumers must be vigilant against the food adulteration. The chairman of the local body, Medical Officer of Health of the area, the Public Health Inspector are the Authorised officers under the Food Act. Any complain regarding any food should bring to their notice without any delay.

However the legal action alone cannot eradicate such malpractices. The consumer as well as the producer must be given a knowledge on the food standards etc. This could be done through the media such as news papers, Radio and Television. Audio visual programmes are the most successful in the education of public. Which is lacking in Sri Lanka. This knowledge could also be given to the school children by way of conducting seminars, public lectures etc. The public awareness on the quality of foods is of greater importance. This will lead to the manufacture of quality foods. It should be born in mind of every citizen that every one is a consumer.

The legal action against the food adulterations and the consumer / producer education would lead to guaranteed quality foods to the people.