Adulteration of Fats and its Prevention

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ADULTERATION is the addition of cheaper products to the more expensive ones with the express purpose of simulating the original. Products ranging from tea, coffee, to the important drugs may be largely adulterated. Adulteration must not be confused with "blending", in which the added products are clearly mentioned on the labels the products carry.

The practice of adulteration gives rise to several problems of social, moral, economic and scientific nature.

In no industry are these problems more important than in the food industry. "And in no department of analytical chemistry, is greater difficulty experienced than in that which deals with the examination of natural food products. Of these food products, perhaps, none presents so much diversity in natural composition as do the oils and fats. This diversity of character, combined with a marked similarity of constitution, and in consequence, bearing with it the greatest difficulty of resolution, has made the analysis of oils and fats both prolific of method and uncertain in result."

The fatty oils consist essentially of triglycerides i.e. compounds of glycerol and fatty-acids. One fat differs from another chemically in its fatty-acid composition, and physically in its glyceride structure. It is on account of this unity of constitution in the midst of diversity of composition that a certain amount of uncertainty prevails in the interpretation of the results of an analysis of an adulterated sample.

In the oil and fat industry the adulteration is effected by admixture of cheaper oils with the costlier ones and this is very easy because of their complete miscibility. The characteristics of an adulterated oil are not markedly altered and, therefore visible detection is very difficult.

The usual adulterants are fatty oils themselves or mineral oils. The practice of adultering one edible oil with another may be less objectionable since the adulterant has no harmful effect on the health. Thus, sesame (til) oil may be adulterated with ground-nut oil, and both oils being edible no untoward effects result. However, when the adulterant has deleterious effects on the human system, this problem reaches serious proportions.

Cases of ill-effects on account of the consumption of adulterated oils are rare; however, they are, by no means absent. Of the diseases caused by food-poisoning due to the adulteration of oils, epidemic dropsy stands foremost and is caused by the indigestion of edible oils which have been contaminated with argemone oil. The latter is derived from the seeds of *Argemone mexicana* known in Sanskrit as "Brahmadani" and in the Deccan as "Daruri". These seeds are small, round and black in colour and very similar to the dark coloured mustard seeds, and may be mixed up with the latter by design or accident in the manufacture of mustard oil. The disease is encountered periodically in Bengal, an important consuming centre of mustard oil; but very recently there was an outbreak in Nadiad District (Bombay State), resulting in several fatalities. It has been stated[3] that the toxic agent in argemone oil is the alkaloid sanguinarine. Argemone oil can be detected by the ferric chloride test as developed by Sarkar.

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Mineral oil is a common adulterant for vegetable oils. It is a petroleum product, easily available, cheap, tasteless, and almost colourless and therefore, an attractive adulterant. Its continued indigestion interferes seriously with absorption of fat soluble vitamins, and of calcium and phosphorus. Experiments have shown that 50% of vitamin A and carotene may be lost in this way.

Mineral oil in a vegetable oil can be detected by Holde's test and estimated by isolating the unsaponifiable matter.

"In the sphere of analysis of natural products, such as oils and fats, it will certainly be the case that no analytical method is infallible in its results. When mixtures of two or more fatty substances are under examination, the interpretation of results must be regarded as careful and systematic scientific guess-work in which the experience of the analyst plays as great a part as does his analytical skill".

The tests that are generally applied for assessing the freedom from adulteration of an oil or fat are of three kinds—physical constants, chemical constants and certain specific colour, solubility or microscopic tests.

However, all these tests are beyond the reach of the lay consumer and hence, he is left without any detective aid.

Amongst the fats, butter fat occupies a prominent position, especially in point of value. In India, ghee has formed an important article of diet because of its attractive taste, texture, flavour, fair keeping quality and recognised nutritive value. With the rapid increase in population, the supply of genuine ghee has fallen far short of the demand. It is not surprising, therefore, that ghee as sold in the market is largely adulterated.

Recent reports (1955) of the Central Food Technological Research Institute, Mysore, have shown that 33% of the samples of ghee analysed was not ghee at all, while nearly all samples were adulterated to greater than 50%.

The possible adulterants for ghee are:—

1. Animal fats, e.g. tallow.
2. Vegetable fats and oils e.g. coconut oil, sesame oil, ground-nut oil, etc.
3. Hydrogenated products e.g. vanaspati.

The examination of butter presents the most difficult problem which the analyst has to face. The detection of the presence of an adulterant in butter fat (ghee) is made difficult by the fact that there is a great variation in the physical and chemical properties of ghee, and it is not always possible to distinguish between genuine ghee and adulterated products even by routine chemical methods. This is further accentuated by the fact that the ordinary consumer must rely on his sight to detect adulteration.

In all cases where butter fat is suspected of having been adulterated with vegetable oil or fat the Phyto-sterol acetate test (P.A.Test) becomes the final criterion. The Phyto-sterol acetates have melting-points varying according to their origin from approximately 123—133°C.

For the easy detection of vanaspati in ghee, several suggestions have been made from time to time. The chief among them are:—

(a) Addition of 5-10% sesame oil to vanaspati.
(b) Colouring the vanaspati.
(c) Addition of starch.

According to the Government of India specifications, vanaspati "shall contain raw or refined sesame (til) oil not less than 5% by weight, but sufficient so that when the vegetable oil product is mixed with refined ground-nut oil in the proportion of 20:80 the red colour produced by Baudouin test shall not be lighter than 2.0 Red units on 1 cc. on a Lovibond scale ".

This test may not be valid under all conditions. Certain authors state that the chromogenetic bodies giving the Baudouin reaction, pass with the milk fat of cattle, fed on sesame cake. This is also true in the case of cattle, fed on cotton-seed cake as it has been found that the body and milk fats give a positive Halphen test. This is usually slight, but nevertheless care is necessary in interpreting the analysis of sample where such a reaction has been found.

Although heating to high temperatures, and treating the vanaspati with adulterants do impair the detection of adulteration the colour giving principles (sesamin and sesamoline) cannot be completely destroyed even after hydrogenation and deodourisation. However, the only disadvantage of this is that adulteration cannot be visually detected.

Various colouring matters have been proposed, but none of them is suitable. The colour should be attractive, very distinct from that of ghee, non-toxic, fairly stable to heat, light and adsorbents, and should not impart any foreign taste and odour to the vanaspati. However, no dye is yet known to satisfy all the above conditions and hence, adulteration in this field is rampant.

The advantage of starch, as a detection aid consists not only in that it is a cheap product which does not in any way influence the quality of vanaspati, but furthermore, its presence can be detected by two independent methods, mainly by their iodine test and by microscopical examination so that the latter is a reliable confirmatory test.

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