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Detection of Adulteration in Ghee - A Spoonful of Yellow Magic

Subhash Yadav Nagalla[1], Jyoti Prakash Sahoo[1*], Kailash Chandra Samal[1] and Smrutilekha Sahoo[2]

[1]Dept. of Agricultural Biotechnology, OUAT, Surya Nagar, Bhubaneswar, Odisha (751 003), India

[2]Dept. of Occupational Therapy, NILD, Bonhooghly, Kolkata, West Bengal (700 090), India

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Corresponding Author

Jyoti Prakash Sahoo

e-mail: jyotiprakashsahoo2010@gmail.com

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Abstract

Food, either animal or plant origin is very essential for survival and provide nutritional support. For good health it is necessary to consume safe and quality food. Adulteration is adding unwanted materials or substances that can be mixed and cannot be noticed by the customer during purchase. To get profits in illegally or to improve the storage period, food is being adulterated. Almost all the foods we consume, from vegetables to vegetable oils, from milk to milk products, from fruits to jams, etc., that we buy from markets constitutes minor or major adulterants. Consuming this kind of foods causes severe health problems. So, we should buy these foods from only certified sellers and by careful checking by ourselves. There are so many methods through which we can identify the adulterants in a product, particularly the milk products such as ghee.

Introduction

Ghee also known as clarified butter is a regularly used ingredient in the Indian kitchen, and is considered to be a symbol of wealth and prosperity of a family. However, there have been several cases around adulteration of ghee. Rancid ghee also known as *vanaspati* is often sold in the name of ghee, this is simply because of the similar colour and texture. According to Ayurveda, ghee is an important ingredient used for Ayurvedic medicines as it is promoting good health and helps in growth. Apart from this, it detoxifies the whole body and provides nutrition. The market price of ghee is almost 3 times more than the price of edible vegetable oils/ fats. The supply of ghee is also far short of its demand. These gaps between price and availability lead to several malpractices. Adulteration of ghee is more common malpractice in India because it will fetch more profit to the traders and also result into increased supply and it can start at the stage of milk itself.

Common Adulterants in Ghee and Their Rapid Detection Methods

Cow ghee is a carrier of fat-soluble vitamins including A, D, E and K, which our bodies need in very small quantities but can't make for itself. These vitamins perform many essential functions. Some 11 regular selling brands of cow ghee are listed in Figure 1. Ghee is an important dairy product that enters inter-state trade too. The cost of ghee is very high and also the demand. So, the ghee is being adulterated to gain high profits. Due to variation in its composition from region to region and season to season and also because it depends on the type of animal and the feed given, the establishment of its purity often involves elaborate analysis, as well as tests for its keeping quality. The common adulterants in ghee are:

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E-mail: *bioticapublications@gmail.com*

potato startch and other starches, coal tar dyes, *vanaspati* and vegetable and other oils.

Figure 1: Regular selling brands of cow ghee (Adopted from: https://consumeraffairs.nic.in/)

Detection of Starches (potato, sweet potato, other starches)

This method is done by using tincture of iodine. Half a spoon of ghee is taken and two to three drops of tincture of iodine is added, if the ghee is adulterated with starch then is gives blue colour.

Detection of Palm Oil in Ghee

This method is done using chemicals (Ferric Chloride 0.008 M and Potassium fericyanide 0.03 M); for 2 ml of ghee taken add 1 ml Ferric chloride and 0.3 ml Potassium fericyanide, for pure ghee colour is green and for adulterated ghee the colour changes to blue.

Detection of Coal Tar Dyes

This method is done using diluted sulphuric acid. Take 5 ml dil. sulphuric acid to one tea spoon full of melted ghee sample. Pink colour indicates presence of coal tar dyes.

Detection of Vanaspathy or Margarine in Ghee

In this method conc. sulphuric acid is used for detection. Take a tea spoon full of melted ghee in a test tube and add equal quantity of conc. sulphuric acid and add a little amount of sugar. Shake for a minute and leave aside for 5 mins. If colour changes to crimpson it is due to presence of *vanaspati*/ margarine.

Detection of Vegetable Oils

Some ghee is melted and sugar is added and shakes it by closing container. If colour changes to red colour it shows the presence of vegetable oils. The feeding of various oil cakes or oilseeds and even starvation (under feeding) can also alter the individual analytical characteristics of ghee as to bring perfectly genuine (pure) samples under suspicion of adulteration. Those vegetable oils/ fats whose analytical constants are close to ghee and butter oil cannot be detected visually are preferred for adulteration. Coconut oil approaches closest to ghee as far as analytical characteristics (high polenske value and low saponification value, iodine value and butyro refractometer reading). In respect of physical resemblance, hydrogenated fats (edible *vanaspati*), particularly groundnut, is most preferred. Its melting point is slightly below 37 °C, has solid to semisolid consistency and even the characteristic granular appearance of ghee.

Adulteration with Animal Body Fat

Adulteration of ghee with animal body fat is not so common as with vegetable oil/ fats. Tallow or other animal body fats obtained from slaughter houses are mixed with ghee in different proportions. The animal body fat being hard cannot be detected visually. The chemical characteristics of ghee adulterated with animal body fat falls within normal range of pure ghee, hence their detection is difficult. It is found that ghee prepared from buffaloes fed with cotton seeds acquire analytical constants similar to those samples adulterated with animal body fat.

FSSAI Recommended Novel Method to Detect Adulteration in Ghee with Veg Oils

According to a report on Saturday, 30 March, 2019 by Ashwani Maindola, New Delhi, FSSAI (Food Safety and Standards Authority of India), the country's apex food regulator, has released a new method of detection of adulteration in ghee (clarified milk fat) with vegetable oils. This method was approved by the scientific committee; scientific panel on methods of sampling and analysis and the food authority collectively after deliberations. The method is much simpler and easy to follow, as it is based on the detection of cholesterol and ß-sitosterol as markers in the unsaponifiable matter (USM) of pure ghee and adulteration ghee samples. The presence of ß-sitosterol in ghee denotes adulteration with vegetable fats. The Furfural and Baudouin tests are standard methods that were implemented by the labs to ensure purity of ghee. The adulteration of ghee with sesame oil is detected by the Furfural test, whereas the Baudouin test detects presence of *vanaspati,* hydrogenated fat, refined vegetable oil, and animal fats in ghee. According to FSSAI, this manual shall act as a guideline on implementing new methods of detecting vegetable oil adulteration. This method has to be followed by all testing laboratories, leading to uniformity in the results.

Popular Media Articles of TOI on the Purity of Ghee Assessment

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the name of ghee, this is simply because of the similar colour and texture. According to a report of the Times of India (TOI) on Sep 18, 2018, there are some rapid and easy ghee purity detection techniques are indexed in Table 1.

Table 1: Some popular methods for purity assessment of ghee reported in news media (TOI)

SL. No.	Ghee Purity Detection Methods (Credits – TOI)	
1	Heating a tea-spoon of ghee in a vessel. If ghee melts immediately and turns dark brownish in colour, then it is pure ghee. If it takes time to melt and turns into light yellow in colour, then it is adulterated.	
2	Melt some ghee in a glass jar using the double-boiler method and pour into the glass jar, put this jar in the fridge. If ghee and the coconut oil will solidify in separate layers, then the ghee is adulterated else the ghee you are using is pure. (Adulteration with coconut oil)	
3	Heat a tablespoon of ghee in a test tube, and add an equal amount of concentrated HCl with a pinch of sugar. Shake well. The appearance of pink or red colour in the lower layer shows the sample is adulterated with rancid ghee.	
4	Pour a tea-spoon of ghee in your palm, if it starts to melt by itself than it is pure else the ghee you are using is adulterated.	
5	Just add iodine solution in a small quality of melted ghee. If the iodine solution, which is brown in colour, turns purple in colour then the ghee is adulterated with starch.	

Conclusion

Food adulteration and particularly the ghee adulteration, is a serious problem in recent times, that doesn't even spare the food of infants. A report states that 80 percent of premature deaths are caused by contaminated water and food. Governments should take strict actions against the ones who practice this inhuman thing. The lack of awareness of this adulteration in people is the chance for person who does adulteration, so the public should also be aware. Eat healthy foods and live long.

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