

Original Research Article

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Comparative Appraisal of Ghee and Palm Oil Adulterated Ghee on the basis of Chromogenic Test

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ABSTRACT

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It is very common in India that with low priced palm oil use to be adulterated with ghee. Though some techniques are present in market for ascertain the purity of ghee but all these techniques have their own limitations. Thus, simple and rapid test been preferred now a day to assess the quality of ghee in routine quality control analysis. Presently a DPPH based chromogenic assay been used to identify the presence of palm oil in ghee. The assay was involved using of 50 mg/ 100 ml (ethanol) DPPH solution. Specificity of this assay was tested across the pure ghee and palm oil. The protocol seems be sensitive to detect upto 5% level of palm oil adulteration in ghee. Designed protocol was efficient, robust and sensitive; therefore could be used as a platform test in routine quality analysis dairy food testing laboratory.

Introduction

Ghee the clarified milk fat and one of the most important product widely consumed in the Indian subcontinent, apart from food applications it is also been used in many religious customs. According to FSSAI (2011) "Ghee" means the pure clarified fat derived solely from milk or curd or from desi (cooking) butter or from cream to which no colouring matter or preservative has been added. Hazra *et al.*, (2017) reported that Ghee performs a major and essential function as carrier of four fat-soluble vitamins viz., A, D,

E, K and essential fatty-acids such as linolenic acid and arachidonic acid. From ancient time Ghee is been used for many health benefit including increasing mental power, curative of ulcers and eye-diseases (Rangappa and Achaya, 1974). Ghee is the second largest consumed dairy product after liquid milk and it is one of the costliest edible fat. India produces 900,000 tonnes of marketed ghee, valued at Rs 85,000 million (Gandhi *et al.*, 2018). Recently, the producers or the middlemen involved in the ghee trade, to their greed to have more money, tend to adulterate ghee with cheaper oils and fats like vegetable oils

such as palm oil, cotton oil and sometimes even the non-edible mineral oils, especially during lean season. In recent years, the problem of adulteration getting a serious problem in Indian dairy and food industry. Several reports have been appeared in the newspapers, indicating that rampant malpractices of ghee adulteration are going in the every parts of country. It is not known as to what extent these types of misconducts of adulteration are predominant in the ghee trade in our country and what quality of ghee is available to the consumers.

In order to ensure a genuine product to the consumer, the Government of India has prescribed the compositional standards for ghee, under FSSAI act (2011) and AGMARK rules (1981). However these standards are not comprehensive and can hardly establish the type, and the level of added adulterants. This may be because of wide variations in the physico-chemical makeup of milk fat owing to different factors like animal species, feeding practices and nutritional management etc.

Extensive survey of the literature reveals that in the past, several techniques have been employed to detect the adulterants in ghee (Rani *et al.*, 2013; Wasnik *et al.*, 2017; Hazra *et al.*, 2017 and Ayari *et al.*, 2018), however it is realized that they have their own limitations in establishing the type and the level of the adulterants.

The situation for adulteration of ghee supposed to be worst whenever Palm oil, which has similar fatty acids profile of ghee been adulterated. So the incident of palm oil adulteration been increasing and detection of palm oil in ghee is a tough task for quality control personnel.

Considering all the facts stated above, we have tried to develop simple rapid chromogenic test for detection of palm oil adulteration in ghee.

Materials and Methods

Collection of milk and preparation of ghee

Mix milk, was used for the preparation of ghee samples, was collected from the Amreli district's local dairy farmers. Samples of ghee was be prepared by creamery butter method (De, 2005).

Collection of oil

Palm oil was used as adulterants in the present investigation. Various brand of Palm oil was purchased from local market of Amreli.

Preparation of adulterated ghee samples

For the preparation of adulterated ghee samples, pure ghee samples was heated to 60-70°C for 10 min before adding and mixing of adulterants.

Palm oil was mixed in ghee @ 5%,10%,15% and 20% respectively. Every time a fresh lot of Palm oil was obtained along with the preparation of samples of pure ghee for analysis.

Preparation of DPPH(2, 2-diphenyl -1-picrylhydrazyl) solution-

DPPH (2, 2-diphenyl -1- picrylhydrazyl) solution was prepared by mixing 50 mg of DPPH in 100 ml of Ethanol. Thereafter the solution was stored in 100 ml volumetric flask.

Chromogenic test

1 ml of fat was taken in a clean dry testtube. There after 2 ml of DPPH solution was added in that test tube and kept it for 30 seconds; thereafter observe the colour. For checking the repeatability, the test was performed 50 times.

Results and Discussion

Standardization of the concentration of DPPH solution

During initial trials, we have tried different concentration (20, 40 and 50, 70 and 100 mg /100ml Ethanol) of DPPH solution and we observed that using 20 and 40 mg (100ml ethanol) DPPH solution respectively; the colour of pure ghee solution was becoming violet but within few second it turns to yellow and for palm oil the colour turns to yellow whenever DPPH. So it was difficult to differentiate between ghee and palm oil individually using 20 and 40 mg (100ml ethanol) DPPH solution respectively.

Using 70 and 90 mg (100ml ethanol) DPPH solution respectively the colour for both pure ghee and palm oil turned to violet but further the it takes almost 12 and 17 minutes to be turned into yellow for palm oil containing DPPH solution 70 and 90 mg respectively (no colour change for ghee violet colour remain same).

It was observed in plate(I) that using 50mg of DPPH/100ml(Ethanol) solution the best results was obtained, for pure ghee the colour was remain violet after addition of 50mg of DPPH/100ml(Ethanol) but for pure palm oil the color was turned to yellow from violet

color after 30 seconds so this concentration was selected for further study.

DPPH (2, 2-diphenyl -1- picrylhydrazyl), is a dark-colored crystalline powder of stable free radical molecules, when accepting an electron or a free radical species, which results in a visually noticeable discoloration (Liu *et al.*, 2014) and colour use to change from violet colour to pale yellow colour complex due to presence of picryl group (Joshi, 2015).Palm oil is a very good source natural antioxidant agents like vitamin E, carotene, phytosterol, phenolic compound and phospholipid (Aliaga and Lissi, 2000) and those natural antioxidants able to ghee donate free electrons. Hence colour of pure palm oil turned violet to pale yellow colour with reaction to DPPH. In case of pure ghee, due to lack of natural anti-oxidants no colour been changed readily.

Detection of palm oil adulteration

It was observed in plate (II) that the reaction with DPPH solution; the colour of pure ghee remained violet but in case of ghee adulterated with palm oil, the colour turned violet to yellow, hence even 5% addition of palm oil in ghee the color turned to pale yellow. It was also observed that however concentration of palm oil increased hence the intensity of yellow colour been increased.

Plate.1 DPPH reaction of pure ghee and palm oil

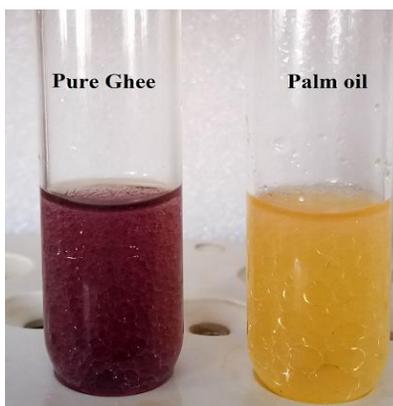
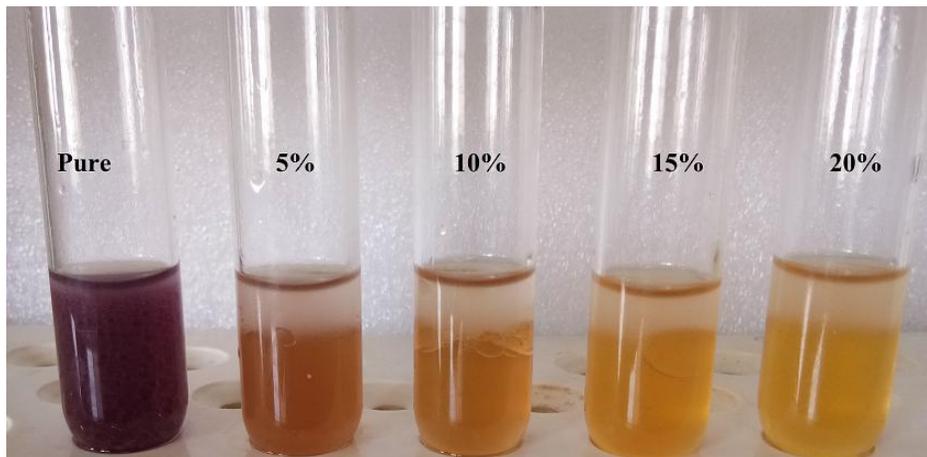


Plate.2 DPPH reaction of pure ghee and ghee adulterated with palm oil (5%, 10%, 15% and 20%)



Previously different researchers (Kumar, 2008 and Gandhi *et al.*, 2018) used different physico-chemical parameters (B.R reading, R.M value, P. Value etc) analysis for detection of palm oil adulteration in ghee. However all those protocols are time consuming as well as tedious so not possible to carry out in field level day to day analysis.

DPPH, assay mainly use for antioxidant study but in this present study; we have exploited this property for detection of palm oil adulteration in ghee; by using this method even up-to 5% level of palm oil could be detected. Same results were observed after 50 trials (replications).

The present study was conducted to develop a simplex DPPH based chromogenic test to detect the presence of low price palm oil adulteration in ghee. The assay involved 50 mg/ 100 ml (ethanol) DPPH solution, leading to the detection of even up to 5% level of palm oil adulteration in ghee. The developed protocol for detection of palm oil adulteration in ghee was rapid and sensitive enough to use for routine quality control analysis and this said methodology could be recommended to dairy product testing laboratories to ascertain the purity of ghee.

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