ADULTERATION DETECTION OF COW GHEE WITH INFERIOR COMMODITIES

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Summary

Adulteration of cow's ghee with cheaper and easily available vegetable oils and animal fat became popular in commerce due to high demand. Amongst various testing methods, qualitative tests are cost-effective and the present study has selected suspected several market samples with original ghee prepared at the laboratory(S-01). Market samples were collected from central, southern, northern, and western provinces (S-02 to S-14). Modified Salkowski's reaction test was tested against those samples and observed the appearance of red colour. Pure ghee samples gave red colour because of the presence of cholesterol, whereas samples having plant steroids gave a reddish brown colour. Sample S-01, S-13, and S-14 gave red colour. From the results, it can be concluded that samples with an adulteration level of more than 5 % can be identified by using chromogenic tests as a cost-effective identification of ghee. In contrast, the furfural test is specific for the detection of sesame oil in ghee. Ghee samples adulterated with sesame oil gave a crimson red colour and samples S-03, S-05, and S-07 gave positive results.

Key words: adulteration, chromogenic, cow ghee, furfural, salkowski

Introduction

Cow ghee is a valuable dairy product which is produced from cow milk. It is mostly used for food industries as well as for local medicine and can store for a long time period. It is rich in nutrients and it's beneficial for children as well as old people. It generates good income in dairy industry and industries mostly tend to adulterate the pure cow ghee with cheaper

and easily available vegetable oils such as palm oil, coconut oil, mee oil (*Madhuca longifolia*), sunflower oil, sesame oil, peanut oil as well as rice bran oil and animal fat due to its higher price and the demand. Adulteration of cow ghee is hard to identify visually when the adulterants have similar colour and the combination of adulterants with similar chemical composition as pure cow ghee. Simple, rapid and cost-effective tests are essential for the detection of adulterants in cow ghee to facilitate the traders to purchase good quality cow ghee by saving the time and money. In this study aimed detect the adulteration using chromogenic tests. One sample (S-01) was prepared in the laboratory and thirteen market samples (S-02, S-03, S-04, S-05, S-06, S-07, S-08, S-09, S-10, S-11, S-12, S-13, and S-14) were purchased from Northern, Southern, Western and Central provinces. Colour tests are simple, rapid and cost-effective chromogenic tests which can be done by the layman who is purchasing the ghee to detect the adulteration.

Materials and Methodology

Preparation and sampling of Ghee

Pure ghee was prepared from the curd made in the laboratory from cow's milk. Fresh cow's milk (2 L) was purchased from a farm and boiled. After cooling, cow curd (1 table spoon) was added, stirred well and allowed to ferment for overnight. After the curd formed, distilled water (1.5 L) was added and stirred at 300 rpm using the overhead stirrer for 3 hours until the fat separated. The separated fat was collected, kept in the fridge for overnight, melted, and bottled (S-01). The samples from S-02 to S-14 were purchased from Northern, Southern, Western and Central Province randomly.

Modified Salkowski's test

Ghee sample (1 mL) was taken into test tubes. Petroleum ether (b.p: 40 – 60 $^{\circ}$c, 2 mL) was added to the sample and mixed well until clear solution obtained. Concentrated sulfuric acid (5-10 drops) were added and shaken well. This procedure was continued for samples prepared in the laboratory by adulterating pure cow ghee with palm oil, mee oil, sesame oil and vegetable ghee separately in 5 %, 10 %, 15 %, 25 % and 50 %.

Furfural test

Melted ghee (1 mL) was taken into test tubes and concentrated Hydrochloric acid (2 mL) was added to each sample separately and mixed well. Ethanolic furfural solution (2 %, 0.1 mL) was added to each sample and kept for 2 min. Furfural test procedure was continued for the sample prepared in the laboratory by adulterating pure ghee with sesame oil in 5 %, 10 %, 15 %, 25 % and 50 %.

Results and Discussions

Modified Salkowski's test

The ghee sample was dissolved in petroleum ether (b.p:40-60 °c) instead of chloroform until clear solution formed. The concentrated sulphuric acid was added dropwise and the colour change was observed within a minute. Red colour was observed for the pure ghee and the adulterated sample showed reddish brown to dark brown colour.

For further study, pure sample was adulterated with palm oil, mee oil, and sesame oil and vegetable ghee samples separately in 5 %, 10 %, 15 %, 25 % and 50 %. The colour change of adulterated ghee in modified salkowski's test is given below.

Table 1: Modified Salkowski's test results of adulterated ghee with palm oil

Sample	**Observation**
Pure Ghee	Red colour
Pure Ghee : Palm oil (95:5)	Reddish brown colour
Pure Ghee : Palm oil (90:10)	Reddish brown colour
Pure Ghee : Palm oil (85:15)	Brown colour
Pure Ghee : Palm oil (75:25)	Dark brown colour
Pure Ghee : Palm oil (50:50)	Dark brown colour

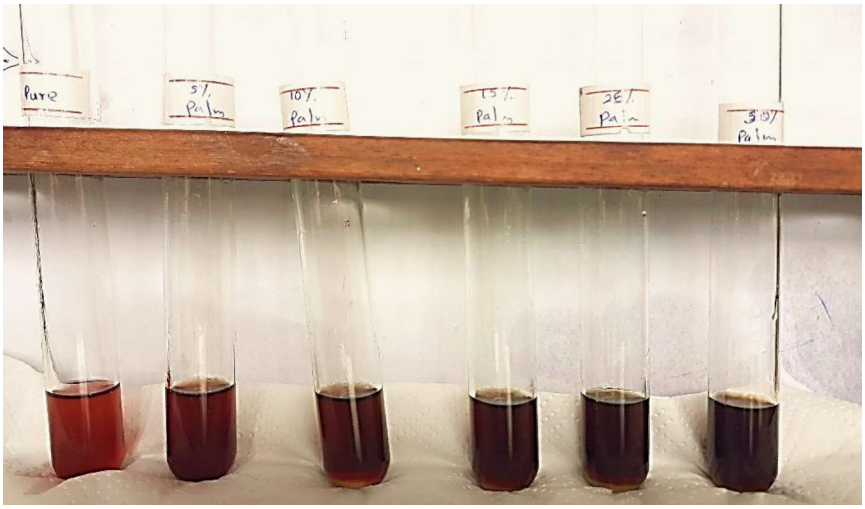

Figure 1: Modified Salkowski's test results of pure ghee adulterated with palm oil

Table 2: Modified Salkowski's test results of pure ghee adulterated with mee oil

Sample	**Observation**
Pure Ghee	Red colour
Pure Ghee : Mee oil (95:5)	Reddish brown colour
Pure Ghee : Mee oil (90:10)	Reddish brown colour
Pure Ghee : Mee oil (85:15)	Brown colour
Pure Ghee : Mee oil (75:25)	Dark brown colour
Pure Ghee : Mee oil (50:50)	Dark brown colour

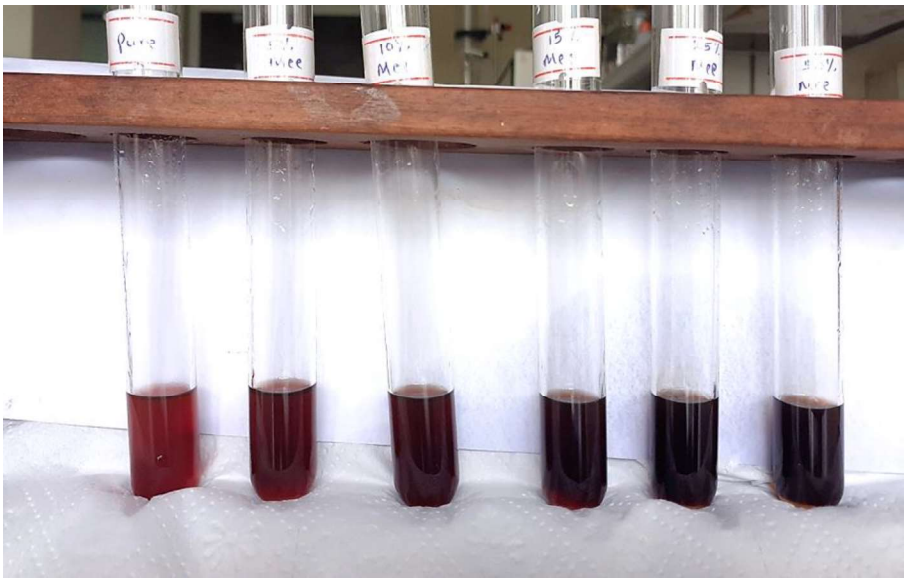

Figure 2: Modified Salkowski's test results of pure ghee adulterated with mee oil

Table 3: Modified Salkowski's test results of pure ghee adulterated with sesame oil

Sample	**Observation**
Pure Ghee	Red colour
Pure Ghee : Sesame oil (95:5)	Reddish brown colour
Pure Ghee : Sesame oil (90:10)	Reddish brown colour
Pure Ghee : Sesame oil (85:15)	Brown colour
Pure Ghee : Sesame oil (75:25)	Dark brown colour
Pure Ghee : Sesame oil (50:50)	Dark brown colour

Figure 3: Modified Salkowski's test results of pure ghee adulterated with sesame oil

Table 4: Modified Salkowski's test results of pure ghee adulterated with vegetable ghee (VG)

Sample	**Observation**
Pure Ghee	Red colour
Pure Ghee : VG (95:5)	Reddish brown colour
Pure Ghee : VG (90:10)	Reddish brown colour
Pure Ghee : VG (85:15)	Brown colour
Pure Ghee : VG (75:25)	Dark brown colour
Pure Ghee : VG (50:50)	Dark brown colour

Figure 4: Modified Salkowski's test results of pure ghee adulterated with vegetable ghee (VG)

Modified Salkowski's test gives positive results for cholesterol and plant steroids (phytosterols) also. The natural pure ghee contains cholesterol, but the vegetable oil contains phytosterols. Pure ghee gave red colour due to the presence of cholesterol. When pure ghee was adulterated with vegetable oil, due to the presence of phytosterols it gave reddish brown colour and the colour turned to brown when the amount of phytosterols increased.

Sample S-01, S-13 and S-14 gave red colour only but other samples gave reddish brown to brown colour. The colour different from red colour indicated that the samples from S-02 to S-12 were adulterated with vegetable oils. Sample S-08, S-09 and S-10 showed reddish brown colour indicated that they were adulterated with 5-10 % of vegetable oils.

Furfural test

Furfural test was mainly done for the ghee adulterated with sesame oil (vanaspathi ghee). Sesame oil contains sesamolin which breakes into sesamol and oxonium ion when concentrated hydrochloric acid added. This sesamol reacted with furfural and produced crimson red colour. If pure ghee adulterated with sesame oil, it gives crimson red colour.

Furfural test was done for 1ml of pure ghee sample adulterated with sesame oil in different percentages. The colour intensity increased when the sesame oil percentage increased.

Table 5: Furfural test results of pure ghee adulterated with sesame oil

Sample	Observation
Pure Ghee	Colourless
Pure Ghee : Sesame oil (95:5)	Light pink colour
Pure Ghee : Sesame oil (90:10)	Light crimson red colour
Pure Ghee : Sesame oil (85:15)	Light crimson red colour
Pure Ghee : Sesame oil (75:25)	Crimson red colour
Pure Ghee : Sesame oil (50:50)	Crimson red colour

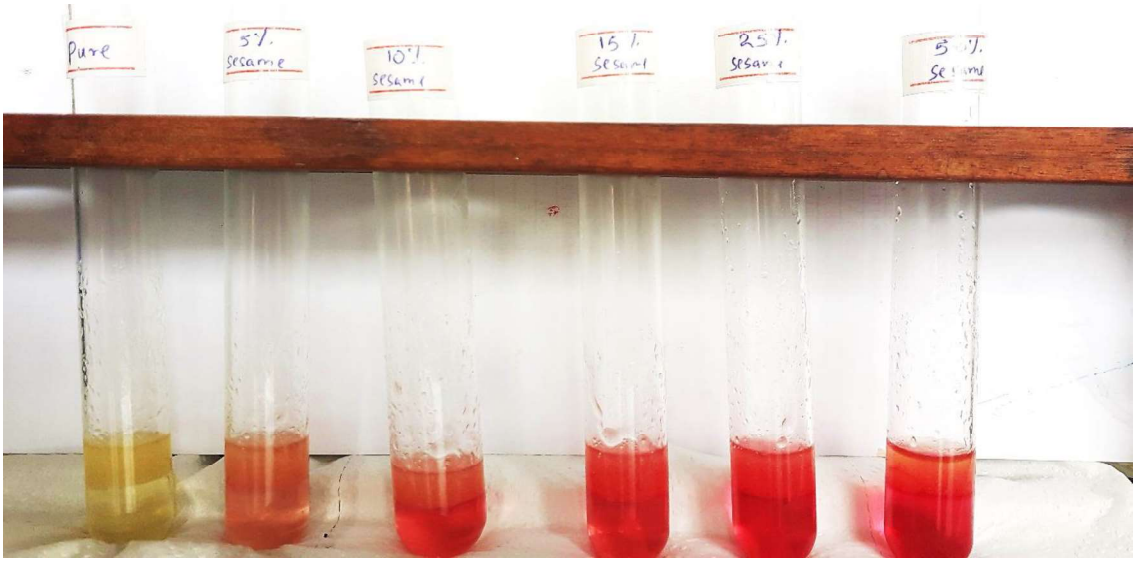

Figure 5: Furfural test results of pure ghee sample adulterated with sesame oil

Sample S-03 and S-05 gave light pink colour and S-07 had light red colour. Therefore, those samples were adulterated with sesame oil. Rest of the samples were not showed crimson red colour.

Conclusion

According to the results obtained in modified salkowski's test for ghee, pure cow ghee obtained a red colour and adulterated samples gave reddish brown to dark brown colour. Furfural test for cow's ghee indicated crimson red colour for adulterated samples with sesame oil.

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