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Review Article

## Unlocking the Hidden Potential: Innovative Uses for Ghee Residue

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### Introduction

Ghee residue is a by-product of ghee manufacturing industry and is produced in large quantity in India. The solids not fat (SNF) in cream or butter that precipitate during the ghee-making process called ghee-residue. During the manufacture of ghee, the solids not fat (SNF) present in cream or butter appear in the form of small particles known as 'ghee-residue'. It is obtained as moist brownish sediment after molten ghee has been strained out. The yield of ghee residue is governed by the method used to produce ghee. It has been reported that the yield of ghee residues was highest (12%) when ghee was prepared using direct cream method followed by creamery butter and desi butter method.

### Extraction of ghee residue from ghee

According to Janghu *et al.* (2014), ghee preparation yielded 131.60 g and 49.60 g of ghee residue using 1 kg of cream and creamery butter, respectively, corresponding to yields of 13.16 and 4.90 %. In dairy plants, attempt has been made to recover as much ghee as possible from ghee residue. Two methods of recovery of ghee from ghee-residue have been developed.

**I. Pressure technique:** This consists of subjecting the heated ghee-residue (65- 70°C) to a limited pressure in hand screw or hydraulic press. This method gives a yield of about 45% (extraction efficiency of about 67%). This method has been recommended for adoption as



it is simple, efficient, more practical, economical and requires no electricity or sophisticated equipment.

- II. Centrifugal process:** This consists of heating ghee residue in water (65°C) so as to transfer the occluded ghee of the residue to water. Ghee is subsequently recovered by centrifuging the water-fat phase. The method yields 25% ghee (46% efficiency).

### **Properties of Ghee residue**

#### **1. Physical properties**

Ghee residue is moist brownish sediment. On average, particle diameter of ghee residue is about 115  $\mu$ m and density is 1.14 g/cm<sup>3</sup>.

#### **2. Nutritional properties**

Ghee residue is a rich source of protein and fat apart from containing considerable amounts of minerals and can be used as human dietary supplement. However, the nutritional value of ghee-residue protein is low due to the damage of some essential amino acids during preparation of ghee at high temperature.

#### **3. Antioxidant Properties**

Ghee-residue is a rich source of natural antioxidants and its antioxidant properties are due to its constituents affected by various technological parameters. Ghee residue can be used as a source of natural antioxidants for improving the shelf life of food products including dairy products where use of synthetic antioxidants is generally not preferred because of their toxic effects.

Phospholipids show the maximum antioxidant activity followed by  $\alpha$ -tocopherol and vitamin A. Among the various phospholipid fractions, cephalin shows the greatest antioxidant activity.

Among the non-lipid constituents, the amino acid proline, lysine, cysteine hydrochloride and tryptophane show the antioxidant properties. The contribution of proline as antioxidant is maximum, though less than BHA at 0.02% level.

#### **1. Flavoring properties**

Ghee residue is also a rich and natural source of flavour compounds viz. FFA, carbonyls and lactones. The level of free fatty acids, carbonyls and lactones in ghee-residue are respectively 11, 10 and 132 times than in ghee. Ghee flavour can be induced in vanaspati and butter oil etc. by adding 10% ghee-residue. This treatment also enhances their keeping quality because of the antioxidant property of ghee residue.

### **Utilization of ghee residue**

Due to the lack of awareness of proper utilization of ghee residue, most of the industrially produced ghee residue is often discarded to drainage.



### **1. Preparation of confections**

Higher concentration of free fatty acids, lactones and carbonyls results in enhanced flavour properties in ghee residue which benefits in producing products with enhanced flavour. It contains the major constituents in suitable proportion and possesses fine texture that imparts requisite body to such products.

### **2. Preparation of candy**

Ghee residue candies were prepared by using ghee residue, sugar and coconut powder. Sugar syrup (50% Sucrose) was made and processed. Ghee-residue was thoroughly mixed into it with the help of suitable ladle. The mixture was heated on a low flame with continuous stirring to evaporate moisture. When the mass became sufficiently sticky, coconut powder was added. The candy was evenly spread on a plate and cooled (5-10°C) for about an hour and cut into small cubes. Ananthakumar *et al.* (2016) prepared orange flavoured GR candy using the orange peel of orange juice industry and GR of ghee plant. The authors utilized the aqueous extract of orange peel and reported that increasing the extract level resulted into an increase in the anti-oxidant activity in the product. This indicates that GR can be utilized for preparation of various heated delicacies, however its application is limited to the dark color and intense flavour of GR. Higher amount of GR addition results into a more-dark product with grainy texture, which may decrease the acceptance of the final product.

### **3. Preparation of burfi-type sweets**

Processed ghee-residue is mixed with khoa in equal amount and heated with sugar. By using suitable proportion of sugar and chocolate with ghee residue and khoa, burfi like sweets are prepared.

### **4. Preparation of bakery products**

Biscuits, cookies and sponge cake can be prepared from processed ghee-residue obtained from ripened cream. 30 and 20% part of vanaspati fat used in preparation of cookies and sponge cake, respectively is replaced by ghee-residue fat. Use of ghee-residue enriches both the bakery products in protein content. Bakery products preparation involves a high heat treatment (150-180 °C for 30-45 minutes) during the baking process. During this process, heat treatment results into moisture removal, dough expansion and development of sensory profile, specifically color and flavour. The dark color and heated flavour of these products makes them an ideal candidate for GR application Ranjan *et al.* (2020) utilized GR for preparation of cake and muffin, by replacing the refined wheat flour with GR from 10 to 40 % in the formulation. The authors reported that increasing the GR level resulted into a corresponding increase in the sensory acceptability, protein and calcium content, and decrease in the cost of the raw material for preparation of both the products. Optimized formulation for both, cake and muffin had 40



% of refined wheat flour replaced with GR.

## **5. Broiler/animal feeds**

Ghee-residue because of its nutritional value is used as broiler feeds up to 20% in broilers diet. It can also be served as feed to animals with combination with other feeds.

## **Conclusion**

The flavour potential of ghee residue was greater than ghee and thus, can be utilized for flavouring bland fats and also to enhance their keeping quality. The ghee recovery was higher in creamery butter method than direct cream method, whereas higher recovery of ghee residue was observed in direct cream method in comparison to creamery butter method. Presence of high amount of nutrients, flavouring and antioxidant compounds has led to the application of GR in various food products. This includes application in traditional dairy products, confectionary and bakery products. However, this is restricted because of its dark colour and unique flavour profile.

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