EXPERIMENT 5 STUDY OF SEPARATION OF CREAM

Structure

5.1 INTRODUCTION

Separation of cream is carried out to get cream from milk for manufacturing fat rich milk products such as butter, ghee. The cream so separated can also be used to standardize milk, ice-cream mix etc. as a rich source of fat. On the other hand, skimmed milk obtained is used for preparation of casein, whey protein, lactose etc.

Separation of cream is done by centrifugal method. Gravity method of separation is no longer used commercially. When milk is allowed to stand, the force of gravity affects both skim milk and fat particles, exerting a downward pull on each, which is proportional to its specific gravity. Since skim milk particles are heavier, they assume a position below the milk fat particles which rise to the top. In this way, rising of fat globule takes place and a cream layer is formed at the top of the milk. In centrifugal method, the gravitational force of separation is replaced by centrifugal force, increasing the rate of separation manifold.

5.2 OBJECTIVES

- identify the parts of a cream separator.
- understand separation of cream using the mechanical cream separator.

5.3 EXPERIMENT

i. Principle

The cream separator works on two principles. Firstly, on the difference in the densities of milk constituents and secondly, on centrifugal force. Specific gravity of milk fat is 0.93 and that of skim milk varies between 1.036 to 1.040. When centrifugal force acts on the fine film of milk in the sides of the bowl, the skim milk being heavier in weight is thrown towards the periphery and fat globules being lighter in weight are collected towards the axis of the bowl.

Mathematically, cream separation follows Stroke's law:

$V = 2.g.r.r(ds-df)/9h$

Where

v = velocity of movement of fat globules in cm/s

g = gravitational force as 981 cm/sq.s

ds = density of skim milk = 1.036 to 1.040 g/cu.cm

df = density of fat = 0.93 g/cu.cm

r = average radius of fat globules in cm

h = viscosity of milk in poise.

In case of centrifugal separation, milk is immediately subjected to tremendous centrifugal force, which ranges from 3000 to 6000 times the gravitational force (g). Stroke's law applied to centrifugal separator is:

V = r´r(ds-df).N.N.R.K./ h

Where

N = speed of bowl in r.p.s

R = distance of fat globule from the axis of rotation in cm

K = constant.

ii. Requirements

Cream separator, spanner set, screw driver, bowl wrench, disc transfer rod, separator oil, tray, milk cans, thermometer, rubber mat etc.

iii. Procedure

i) Assemble the parts of the cream separator bowl properly and tighten it with the bowl screw nut.

ii) Fix properly the assembled bowl into the spindle of the cream separator.

iii) Put the spouts of cream and skim milk over the bowl at the proper places.

iv) See the cream/skim milk screw is in normal position.

v) Pour about 5-10 litres of hot water (60°C) and flush it out through the separator when it is running at the maximum speed to observe whether there is any leak.

vi) After all the water has run out, pour the (warm) milk in the supply can after straining, maintain the rated speed of the bowl and start separation. Note time of separation started and stopped.

vii) Receive cream and skim milk separately in clean, dry cans of known weight.

viii) After separation of milk, pour about 1litre warm clean water slowly over the float (in order to rinse the inside of cream spout).

ix) Stop the separator. Find out the net weight of cream and skim milk obtained. Then take representative samples of both for fat test.

x) Dismantle the bowl.

xi) Clean and sanitize all parts properly and leave them to dry.

   a) dismantle the bowl and remove the slime etc. deposited inside. Weigh the quantity of slime obtained.

   b) Rinse all parts with tap or lukewarm water; wash thoroughly with warm cleaning solution, using good brush for scrubbing.

   c) Rinse with scalding water.

d) Drain out all adhering water and place the parts in clean rack for drying, leaving them there till used.

e) Before assembling the separator for re-use, immerse all parts in a chlorine solution containing 150 to 200 ppm available chlorine.

xvi) Determine per cent fat in milk, cream and skim milk and per cent acidity in milk.

iv. Observations

Record your observations and calculations:

1) Particulars of the cream separator

   a) Name of manufacture and model .....

   b) Hand or power operated .....

   c) Capacity and the other details .....

2) Particulars of milk

   a) Type ..... b) Quantity .....

   c) Fat % ..... d) Acidty % LA .....

3) Preparation of cream

   a) Temperature of milk ..... °C

   b) Starting time of operation ..... hours

   c) Finishing time of operation ..... hours

   d) Speed of the bowl ..... R.p.m.

   e) Rated capacity ..... Kgs/hr

   Given ..... observed .....

   f) Quantity of cream ..... kgs.

   g) Out turn of cream ..... %

   h) Quantity of skim milk ..... kgs

   i) Out turn of skim milk ..... %

   j) Quantity of separator slime ..... gm.

4) Efficiency of cream separation

   a) Fat in cream ..... %

   b) Total fat in cream ..... g.

   c) Fat in skim milk ..... %

   d) Total fat in skim milk ..... g.

   e) Total fat recovered in cream ..... %.

   f) Total fat lost in skim milk ..... %

   g) Fat losses = (Total fat in milk – Total fat recovered in cream) X 100 / Total fat in milk ..... %.

5) Results

   a) Fat losses in skim milk is ..... %

   b) Fat recovery is ..... %

5.4 PRECAUTIONS

i) The milk should be fresh and free from sediment as far as possible.

ii) The temperature of milk should be maintained between 33 to 40°C during separation.

iii) Check the lubricant level before use.

iv) Fix the bowl nut properly and tighten it with the help of a spanner.

v) Do not allow milk to pass into the bowl in the beginning.

vi) Do not disturb the cream screw.

vii) Fix the cream and skim milk spouts properly.

viii) Use a rubber mat for dismantling and assembling the bowl parts.