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RESEARCH ARTICLE

STUDY OF QUALITY TESTING OF MILK POWDER IN STERLING AGRO INDUSTRIES LIMITED – NOVA

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ABSTRACT

Quality assurance of food items is very important parameter of acceptability of as per food safety standards at international level. This study is focused on testing of various milk powders produced at Sterling Agro Industries Limited, Gwalior (India). In this paper, we have presented and analyzed various tests of milk powder for quality control. We performed fat percentage test, moisture percentage test, acidity test, bulk density test, sediment test and maltose test. We observed through standard quality assurance test that in dairy whitener fat was found 6.8% (in ideal case it is upto 20% max.), the moisture contents were found 3.53% (in ideal case it is between 3-4%), acidity test was found 80% successful, bulk density was found 0.625 g/cm^3 (in ideal case it is 0.44-0.88 g/cm^3), sediment test was found 92% successful (2% A-grade, 90 % B-grade, and 8% rejected) and, maltose test was found 98% successful. Germer centrifuge was used to determine the fat content of the sample, Precisa moisture balance was used to determine moisture content of the sample. Sediment tester was used to determine the sediments in the sample.

KEYWORDS

Dairy products, quality assurance, skimmed milk powder, bulk density, maltose test.

1. INTRODUCTION

The history of preservation of and testing pf milk and its products is very ancient. Milk a white liquid produced by the mammary glands of mammals, is the primary source of nutrition for infant mammals (including humans who breastfeed) before they are able to digest other types of food [1]. Early-lactation milk contains colostrum, which carries the mother's antibodies to its young and can reduce the risk of many diseases. It contains many other nutrients including protein and lactose.
As an agricultural product, milk is extracted from non-human mammals during or soon after pregnancy. Dairy farms produced about 730 million tons of milk in 2011, from 260 million dairy cows. India is the world's largest producer of milk and is the leading exporter of skimmed milk powder, yet it exports few other milk products [2]. The ever-increasing rise in domestic demand for dairy products and a large demand-supply gap could lead to India being a net importer of dairy products in the future. The United States, India, China and Brazil are the world's largest exporters of milk and milk products. China and Russia were the world's largest importers of milk and milk products until 2016 when both countries became self-sufficient, contributing to a worldwide glut of milk [3]. The figure 1 shows the process to dry the milk.

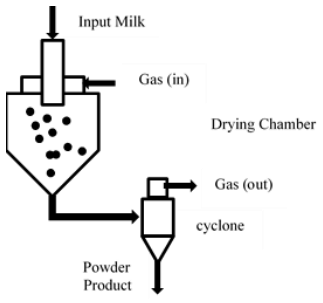

Figure 1: Overview of spray dryer for powder manufacturing

Powdered milk or dried milk is manufactured dairy product made by evaporating milk to dryness. One purpose of drying milk is to preserve it; milk powder has a far longer life than liquid milk and does not need to be refrigerated, due to its low moisture content. Another purpose is to reduce its bulk for economy of transportation. Powdered milk and dairy products include such items as dry whole milk, nonfat (skimmed) dry milk, dry buttermilk, dry whey products and dry dairy blends. Two kinds of milk powders are manufactured.

(i) Whole milk powder (contain Minimum 26% fat)
(ii) Skimmed milk powder (contain Maximum 0.5% fat)

2.RELATED WORK

Spink and Moyer discussed that the food risk is gaining recognition and concern as it is causing a threat to public health on a large scale worldwide [4]. In a study also, researchers discussed Processing and Storage Stability of Skim Milk Powder in broad way [5]. To obtain a better understanding of the impact of processing on the progression of the reaction, three different drying techniques were studied and compared on pilot scale: freeze-drying, spray-drying and drum-drying. They studied the extent of the reaction during prolonged storage for 200 days, by considering three storage variables: temperature, relative humidity (RH) and time.

Based on the Food and Agriculture Organization of the United Nations, FAO, discussed that the production of SMP increased by 2.8% in 2016, compared with the previous year, and reached 2.3 million tons [6]. The largest producer was the European Union, with an annual production of 700,000 tons. The perfect moisture in skimmed milk powder is an important aspect. Singh and Heldman discussed that Spray-drying is a process that converts liquid milk into powder by atomization, during which the milk is sprayed into a drying chamber using an atomizing device (nozzle) [7]. The droplets formed come into contact with hot air in the chamber and after only a few seconds they are converted to solid particles.

3. MILK TESTING AT STERLING AGRO INDUSTRIES

3.1. Milk Testing and Quality Control

Milk testing and quality control is an essential component of any milk processing industry whether small, medium or large scale. Milk being made up of 87% water is prone to adulteration by unscrupulous middlemen and unfaithful farm workers. Moreover, its high nutritive value makes it an ideal medium for the rapid multiplication of bacteria, particularly under unhygienic production and storage at ambient temperatures. We know that, in order for any processor to make good dairy products, good quality raw materials are essential. A milk processor or handler will only be assured of the quality of raw milk if certain basic quality tests are carried out at various stages of transportation of milk from the producer to the processor and finally to the consumer as shown in figure 2.

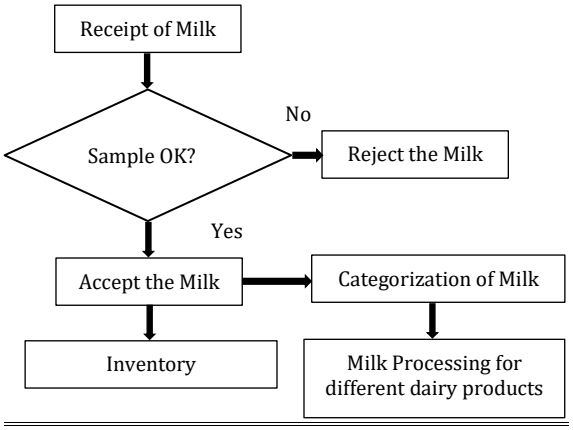

Figure 2: System Flow Chart

3.2. Milk Quality Control

Milk quality control is the use of approved tests to ensure the application of approved practices, standards and regulations concerning the milk and milk products. The tests are designed to ensure that milk products meet accepted standards for chemical composition and purity as well as levels of different micro-organisms.

3.3. Why Quality Control

Testing milk and milk products for quality and monitoring that milk products, processors and marketing agencies adhere to accepted codes of practices costs money. There must be good reasons why we have to have a quality control system for the dairy industry. The reasons are :

(i) To the Milk Producer: The milk producer expects a fair price in accordance with the quality of milk she/he produces.
(ii) The Milk Processor: The milk processor who pays the producer must assure himself/herself that the milk received for processing is of normal composition and is suitable for processing into various dairy products.
(iii) The Consumer: The consumer expects to pay a fair price for milk and milk products of acceptable to excellent quality.
(iv) The Public and Government Agencies: These have to ensure that the health and nutritional status of the people is protected from consumption of contaminated and sub-standard foodstuffs and that prices paid are fair to the milk producers, the milk processor and the final consumer.

All the above, are only possible through institution of a workable quality testing and assurance system conforms to national or internationally acceptable standards. After performing all necessary samplings and testing, the Quality Control department gives acceptance of particular product so that production of that product can be carried on without any objection and non-compliance of standards. The process takes place in the way as shown in figure 3.

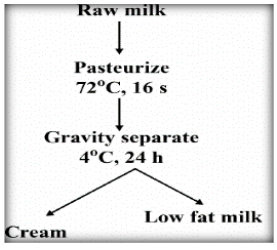

Figure 3: Milk Separation for different products

After the separation process the Cream is sent for butter production, low fat milk sent is for milk powder production like dairy whitener and skimmed milk powder.

4. THE TESTING PROCESS

4.1. Fat Contents

To determine the Fat content in the milk powder, centrifuge method is applied. The apparatus required for testing of milk powder sample are - butyrometer, gerber centrifuge, amyl alcohol, and sulphuric acid. The Procedure for the same has following steps:

Step 1: A sample of 2 gm milk powder is dissolved in 10 ml of sulphuric acid in butryometer.
Step 2: 1ml amyl alcohol is added and taken to Gerber centrifuge where it centrifuged at 1200 rpm for 5 minutes.
Step 3: Then a thin film is appeared at neck of butyrometer and its reading is noted.
Fat %= Reading×11.25/sample wt.
Result: On the basis of 200 samples, the average fat % in sample (dairy whitener) was found 4%.

4.2. Bulk Density

To determine the bulk density of the samples, the apparatus used is measuring cylinder. The samples are tested with the defined procedure having steps:

Step 1: A sample of 25 gm milk powder taken into measuring cylinder.
Step 2: Then QC person shakes it 25 times.
Step 3: Its volume rises upto 40gm on scale.
Step 4: The bulk density expressed by initial reading divided by final reading as

Bulk Density = Milk Sample (in Gm) / Rise in Volume

Result: On the basis of 200 samples, the average Bulk density of sample was 0.625.

4.3. Moisture Test

To determine the moisture test of the samples, the apparatus used is precisa moisture balance. The samples are tested with the defined procedure having steps:

Step 1: This test is done by precisa moisture balance.
Step 2: A 2 gm sample of milk powder is kept in machine for 7 minutes.
Step 3: After 7 minutes, accurate moisture content recorded.

Result: On the basis of 200 samples, the average moisture content of sample was 3.53%.

4.4. Sediment Test

To determine the Sediment test of the samples, the apparatus used are

sediment tester, sediment disc along with chemical amyl alcohol. The
Step 1: 25 gm milk powder (sample) mixed with 250 ml distilled water.
Step 2: Then it is dissolved for 1 minute in 500 ml beaker
Step 3: Then, about 1 ml amyl alcohol is added to remove haziness.
Step 4: Then this solution pass through sediment tester where solution is passed through sediment disc.
Step 5: If disk is clear then sample is acceptable and grades are given according to clearance either 'A', 'B' or rejected.

Result: On the basis of 200 samples, as disc was totally clear so 'A' grade was marked to 180 samples, 'B' to 4 samples and 16 samples were rejected.

4.5. Acidity Test

To determine the Acidity test of the samples, the apparatus used are test tube and phenopthlene along with chemical NaOH solution and distilled water. The samples are tested with the defined procedure having steps:

Step 1: A quantity of 90 ml distilled water (40°C) is taken in which 10 gm powder is mixed.
Step 2: Then, 5 ml of this solution is filled in a test tube.
Step 3: Then,1 gm powder and 10 ml distilled water is added.
Step 4: Then phenopthlene about 4-5 drops is added and the solution is titrated with 0.1N NaOH solution.
Resulting reading is multiplied by 0.09 to obtain acidity.

Result: On the basis of 200 samples, the pH value 6.6 to 6.7 was recorded from 160 samples and pH value 6.8 to 6.9 from 40 samples.

4.6. Maltose Test

To determine the Acidity test of the samples, the samples are tested with the defined procedure having steps:

Step 1: A sample of 25 ml milk powder (dissolved with distilled water) is heated up to (80-85°C).
Step 2: Then,10% citric acid solution is added about 4-5 drops for curding.
Step 3: Then 5 ml solution is filtered by filter paper to obtain whey.
Step 4: Then iodine indicator (3 drops) is added to test tube.
Step 5: If yellow color is appeared then no maltose is present and if chocolaty color appears then maltose is present.

Result: In a collection of 200 samples, yellow color appeared in 196 samples and 4 samples were colored chocolaty.

All these tests were conducted batch-wise, on successful pass QC department approves the final product.

5. CIP (Clean in Place)

CIP is principally concerned with soil removal. The soil could be anything that should not be present in a clean vessel. It can be visible (foreign bodies,) or invisible in the form of bacteria, such as E Coli, or Yeast spores. samples are tested with the defined procedure having steps:
The time needed to remove soil is at least 15 minutes using a suitable chemical at temperatures above 50 degrees C, but no greater than 75 degrees C because there is no advantage to be gained above this temperature.

Commonly used chemicals for soil removal include Caustic Soda, Phosphoric and Nitric acids, Sodium Hypochlorite (Hypo) and Peracetic Acid (PAA). Caustic Soda is an alkali typically used at 0.5% - 2% volume. It reacts with the fats in the soil and softens it for removal. The major cleaning objectives include:

- Physical cleanliness – removal of all visible dirt from the surface.
- Chemical cleanliness – removing not only of all visible dirt but also of microscopic residues that can be detected by taste or smell but are not visible to the naked eye.
- Bacteriological cleanliness – attained by disinfection.
- Sterile cleanliness – destruction of all microorganisms

6. CONCLUSION

The practices at Sterling Agro Industries Ltd. are as per the international standard for production of milk products. The company ensures to receive very good quality of milk for production of different milk products. Good quality milk is essential for production of good quality dairy products, taste and flavor, free from pathogens and long keeping quality. This study of Sterling Agro Industries Ltd. will help a lot to maintain the standard quality milk products in future and will help other dairy companies too.

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