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Quality Analysis of Fresh Milk Based on Specific Gravity Parameters at CV Cita Nasional in Central Java, Indonesia

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***Abstract*— In maintaining the quality of milk produced, it is necessary to supervise and control quality. One important aspect is controlling the specific gravity value of fresh milk. The specific gravity parameter of fresh milk is one of the determinants of whether the milk can be accepted or rejected as raw material. In addition, it is also a determining factor in determining the selling price of milk. To determine the quality control of the specific gravity of fresh milk, the control chart analysis method is used. The results of theanalysis that have been carried out from various KUDs obtained the average specific gravity of fresh milk from Capita Farm KUD which is 1.0295 g / mL; the average specificgravity of fresh milk from KUD Cepogo is 1.0265 g/mL; the average specific gravity of fresh milk from Andini KUD is 1.0266 g/mL; the average specific gravity of fresh milk from Getasan KUD is 1.0268 g/mL, and the average specific gravity of fresh milk from Boyolali Kota KUD is 1.0292 g/mL. The specific gravity value of fresh milk supplied from various KUD can be concluded that the specific gravity value meet the company's quality standards, SNI, and existing literature so it is said that the specific gravity of fresh milk in CV Cita Nasional is in control, and can be accepted as raw material for making pasteurized milk.**

***Index Terms*— fresh milk, raw material, specific gravity, quality**

I. INTRODUCTION

Milk is a white liquid containing nutrients in the form of fat, lactose, protein, and some vitamins and minerals, which are secreted by all adult female mammals as food for their young [1]. Milk is a food with complete and balanced natural nutrition with a perfect nutritional ratio so it is needed by humans. Some of the major components that make up dry milk include fats, carbohydrates, proteins, vitamins, and minerals [2]. Fresh milk has a high nutritional value, which makesit susceptible to bacterial growth and accelerates damage. The quality of fresh milk is very important because it can affect the quality of dairy products produced. Therefore, quality control of fresh milk startsfrom cattle farming to the processing process. You do thisby observing and controlling the properties of new milk from cattle farming to the handling system.

Quality control is the most important stage in the milk handling process which aims to control product quality and become the basis for product improvement and development. Quality control of fresh milk tested includes temperature tests, taste tests, alcohol tests, glucose tests, peroxide tests, pH tests, fat tests, carbonate tests, total solids tests, MBRT tests, antibiotic tests, and specificgravity tests. Each company implements a different qualitycontrol system, adjusted to the type of product produced and the company's internal policies. With effective quality control, it is expected that products can maintain high quality and increase their competitiveness. This will benefit the company through increased product sales, while consumers will feel satisfaction with the products that consumers buy.

KUD as a milk provider has been given quality standard guidelines that must be met so that fresh milk sentcan be used as raw material by the company. If fresh milk from the tested KUD does not meet the company's qualitystandards, the fresh milk will be rejected. One of these quality parameters is specific gravity. The specific gravity of milk is the ratio between the mass of milk and the mass of water in the same volume and the same temperature [3]. Specific gravity is influenced by milk volume, the higher the milk volume, the specific gravity of milk will decrease [4]. Several factors cause changes in milk-specific gravity, namely fat grains (globules), lactose, protein, and salt. Factors that affect the specific gravity of milk are the addition of water, the addition of fat, and temperature [5]. This breed weight has an important role in assessing the quality of milk.

The purpose of the specific gravity test is to detect the possibility of mixing or dilution of milk. The quality of milk is measured by its specific gravity. The higher the specific gravity, the better the quality of such milk. Conversely, if the specific gravity is low, it signifies poor milk quality, potentially affecting the purchase price of milk, which is usually determined based on milk quality. An increase in the specific gravity of milk occurs when the content of nonfat dry matter in milk also increases, while a decrease in the specific gravity of milk occurs when the fat content in milk increases [6]. The specific gravity parameter of this milk is one of the determinants of whether the milk can be accepted or rejected as raw material.

II. METHOD

Data analysis is carried out by qualitative methods including presenting data and making comparisons with literature. Data collection carried out includes various stages, namely:

1. Company physical data retrieval. Data collection derived from the company's physical data was carried out for approximately 1 month starting from September 1, 2023, to September 30, 2023. The physical data obtained is in

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the form of company documents made as company archives to improve production quality.

2. Interview. Interviews were conducted with quality control staff whose work part is related to testing fresh milk. Interviews were conducted in connection with tracing to get clearer information from the analysis of raw fresh milkmaterials into semi-finished products to final products.
3. Observation. Field observation to obtain important information by directly paying attention to various activities and circumstances that occur in an environment appropriate tothe subject of conversation.
4. Documentation. The documentation method is carried out privately bytaking pictures that have something to do with the topic tobe discussed.
5. Literature study. Literature studies are carried out to obtain information by investigating and analyzing literature relevant to the topic of the report, which aims to add the data needed to improve the report.

III. RESULTS AND DISCUSSION

Specific gravity is one of the critical parameters in the quality control of fresh milk. The quality of milk is measured by its specific gravity. The higher the specific gravity, the better the quality of such milk. Conversely, if the specific gravity is low, it signals poor milk quality, potentially affecting the purchase price of milk, which is usually determined based on milk quality.

The company conducts specific gravity testing of cow's milk using a lactodensimeter device, which has the trademark "Funke-Gerber Berlin". The testing process begins by adding the sample into a 1000 mL measuring cupto the brim. Next, the lactodensimeter is dipped in a measuring cup containing the fresh milk sample and let sit until the movement stops. Then, readings are taken on the temperature scale (°C) and the specific gravity scale (grams/ mL).

Specific gravity testing in the company refers to the company's internal quality standards. In the characteristicsof specific gravity testing, the company's standards are notas strict as SNI. The company determined that the minimum specific gravity for fresh milk is 1.0250 g/mL. By SNI [7], the optimal specific gravity forfresh cow's milk ranges from 1.0270-1.0350 g/mL. Another opinion [8] says that the normal specific gravity of milk is between 1.0270 - 1.0300 g/mL. A higher specific gravity value indicates a higher level of totalsolids, which indicates good milk quality. Specific gravity below 1.0200 g/mL indicates that KUD may add water to fresh milk to increase its volume [9]. Specific gravity is determined by calculating a scale that is read using a formula that has been set by the company as follows:

Specific gravity = ((20 - T) x 0,0002) – d..... (1)

where:
T = Indicated temperature scale
d = Specific gravity scale indicated

Data on the results of testing the specific gravity of fresh milk for 30 days in September can be found in Table 1.

Table 1. Results of specific gravity values of milk

Test Date	Specific gravity (g/mL)				
	Capita Farm	Cepogo	Andini	Getasan	Boyolali Kota
1-Sep-23	1.0296	1.0258	1.0256	1.0253	-
2-Sep-23	1.0298	-	-	-	1.0290
3-Sep-23	1.0294	1.0260	1.0253	1.0255	-
4-Sep-23	1.0298	1.0264	-	-	-
5-Sep-23	1.0296	1.0260	1.0272	-	1.0299
6-Sep-23	1.0296	1.0260	-	1.0268	-
7-Sep-23	1.0292	1.0274	1.0262	-	1.0280
8-Sep-23	1.0295	1.0268	-	1.0285	-
9-Sep-23	1.0304	1.0260	1.0296	-	1.0300
10-Sep-23	1.0296	1.0260	-	1.0266	-
11-Sep-23	1.0296	1.0254	1.0256	-	-
12-Sep-23	1.0298	1.0264	-	-	1.0293
13-Sep-23	1.0294	1.0260	1.0284	1.0265	-
14-Sep-23	1.0296	1.0262	-	-	1.0287
15-Sep-23	1.0292	1.0288	1.0258	1.0272	-
16-Sep-23	1.0293	-	-	-	1.0280
17-Sep-23	1.0295	1.0272	1.0262	-	-
18-Sep-23	1.0296	1.0280	-	-	-
19-Sep-23	1.0290	1.0262	1.0276	-	1.0275
20-Sep-23	1.0298	1.0264	-	1.0254	-
21-Sep-23	1.0298	1.0260	1.0254	-	1.0293
22-Sep-23	1.0296	1.0260	-	1.0270	-
23-Sep-23	1.0290	1.0260	1.0260	-	1.0290
24-Sep-23	1.0300	1.0260	-	1.0260	-
25-Sep-23	1.0294	1.0256	1.0224	-	-
26-Sep-23	1.0290	1.0282	-	-	1.0319
28-Sep-23	1.0293	1.0268	1.0286	1.0270	-
29-Sep-23	1.0296	1,0262	-	-	1.0300
30-Sep-23	1.0296	1.0264	1.0290	1.0300	-
Average	1.0295	1.0265	1.0266	1.0268	1.0292

To find out the quality control of fresh milk, a control chart is used. A control chart is a control map used to see changes in a process over time, represented in a time sequence. The control map has three horizontal lines, namely the center line shows the middle or average value of the observed quality characteristics, the Upper Control Limit (UCL) is the upper limit of the control, and the Lower Control Limit (LCL) is the lower limit of the control [10]. Control charts provide certain limits to assess whether the measurement results are still qualified or not. When the measurement results are outside these limits, it indicates a problem with the size standard. In the calculation of the control chart diagram, the x-chart formula is used as follows:

Average (X-bar)

$$\bar{X} = \frac{\sum X}{n} \quad \text{.....(2)}$$

Upper Control Limits (UCL)

UCL = $\bar{X}$ + + 3 x standard deviation..... (3)

Lower Control Limits (LCL)

LCL = $\bar{X}$ + - 3 x standard deviation..... (4)

where:
$\bar{X}$ = Sample average
$\sum X$ = The sum of all values in the sample
n = Total number of samples

Calculates the upper control limit (UCL) and lower control limit (LCL) using the sample standard deviation, which is calculated by the formula:

$$S = \sqrt{\frac{\sum(Xi - \bar{X})^2}{n-1}} \quad \text{..... (5)}$$

where:
S = Standard deviation
Xi = Individual values in the sample
$\bar{X}$ = Sample average
n = Total number of samples

The following are the results of observations of the specific gravity of fresh milk in each KUD.

A. Analysis of specific gravity of fresh milk KUD Capita Farm

Based on specific gravity data of fresh milk from Capita Farm KUD shown in Fig. 1.

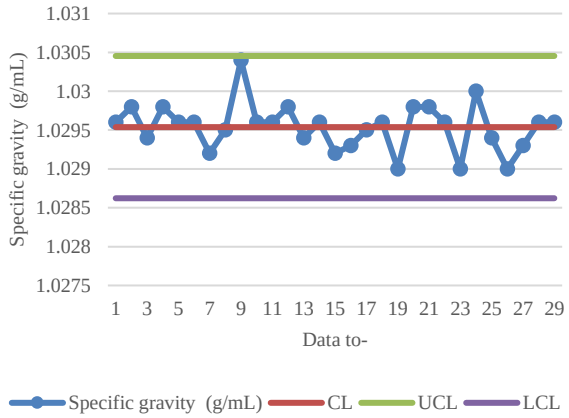


Fig.1. Control chart of specific gravity of fresh milk from KUD Capita Farm

It can be concluded that the average specific gravity of milk is still within the upper control limit and the lower control limit. This milk still meets quality standards by milk-specific gravity standards that have been set in the company, SNI, and existing literature.

B. Analysis of specific gravity of fresh milk KUD Cepogo

Based on specific gravity data of fresh milk from Cepogo KUD shown in Fig. 2.

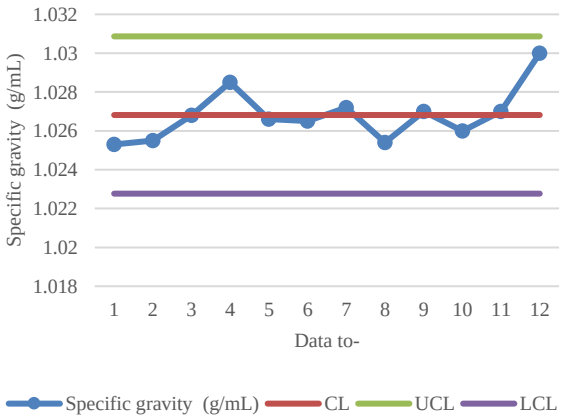


Fig. 2. Control chart of specific gravity of fresh milk from KUD Cepogo

It can be concluded that the average specific gravity of milk is still within the upper control limit and the lower control limit. This milkstill meets quality standards by milk-specific gravity standards that have been set in the company, SNI, and existing literature.

C. Analysis of specific gravity of fresh milk KUD Andini

Based on the specific gravity data of fresh milk from Andini KUD shown in Fig. 3.

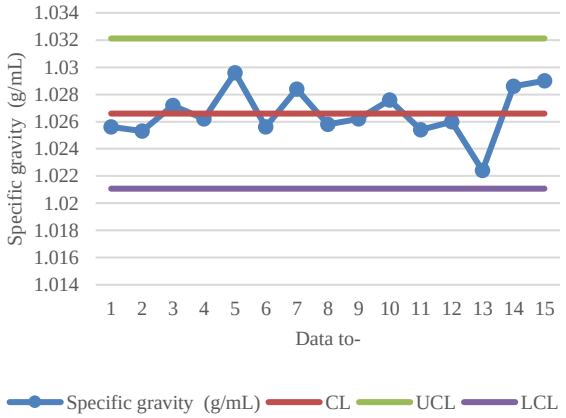


Fig.3. Control chart of specific gravity of fresh milk from KUD Andini

It can be concluded that the average specific gravity of milk is still within the upper control limit and the lower control limit. This milkstill meets quality standards by milk-specific gravity standards that have been set in the company, SNI, and existing literature.

D. Analysis of specific gravity of fresh milk KUD Getasan

Based on specific gravity data of fresh milk from Getasan KUD shown in Fig. 4.

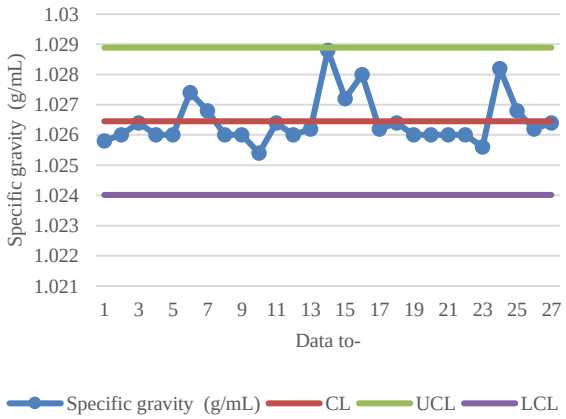


Fig. 4. Control chart of specific gravity of fresh milk from KUD Getasan

It can be concluded that the average specific gravity of milk is still within the upper control limit and the lower control limit. This milkstill meets quality standards by milk-specific gravity standards that have been set in the company, SNI, and existing literature.

E. Analysis of specific gravity of fresh milk KUD Boyolali Kota

Based on specific gravity data of fresh milk from Boyolali KUD city shown in Fig. 5.

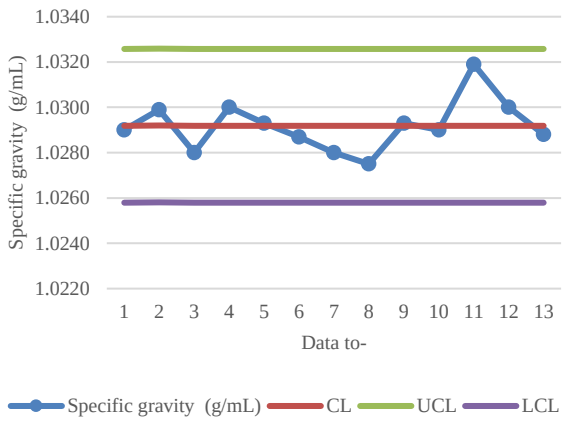


Fig. 5. Control chart of specific gravity of fresh milk from KUD Boyolali Kota

It can be concluded that the average specific gravity of milk is still within the upper control limit and the lower control limit. This milk still meets quality standards by milk-specific gravity standards that have been set in the company, SNI, and existing literature.

Based on the specific gravity analysis of fresh milk that has been carried out from various KUDs including Capita Farm KUD, Cepogo KUD, Andini KUD, GetasanKUD, and Boyolali City KUD, the average result of Capita Farm KUD is 1.0295 g/mL; the average of the Cepogo KUD is 1.0265 g/mL; the average of Andini KUD is 1.0266 g/mL; the average of Getasan KUD is 1.0268 g/mL, and the average of Boyolali Kota KUD is 1.0292 g/mL. The specific gravity of milk measured is also influenced by the temperature conversion of milk at the time of measurement. In CV Cita Nasional, the temperature conversion of milk is 20 ° C, while in SNI standards it is 27.5 ° C. At a milk temperature of 20 ° C, the specific gravity of fresh milk should range from 1.0260 -1.0340 g/mL. So when viewed from the average specific gravity of fresh milk obtained from the various KUDs, it can be said that the quality of fresh milk raw materials used in CV Cita Nasional meets quality standards.

There are differences in the specific gravity value of fresh milk between milking in various KUD, although the difference in values is not too significant. A possible cause is that changes in the composition of dry matter in milk, including carbohydrates, fats, proteins, vitamins, and minerals, greatly affect the specific gravity value of milk [11]. The addition of water to milk can reduce the specific gravity of milk. This is often done because it is to pursuethe quantity of milk supplied. Different types of milk weight values can also be influenced by the period of birthof the first cow and subsequent periods [12]. Accordingto the report [13], different types of feed can also affect differences in the specific gravity value of milk, and the time gap between morning and evening milking usually produces different nutrients. High milk production is often related to its nutritional qualities. The specific gravity of milk is influenced by fat as its main componentbecause the specific gravity of fat is lower than the specific gravity of water.

Carbon dioxide and nitrogen gases contained in milk can increase its specific gravity after the milking process [14]. Specific gravity testing of milk is carried out after 3 hours from the time of milkingto ensure that the milk temperature remains stable in the range of 25-30°C. If the test is done less than 3 hours aftermilking, the specific gravity value of fresh milk can be low because gases such as CO_2 and N_2 present in the milkhave just been released [15]. The specific gravity parameter of this milk is one of the determinants ofwhether the milk can be accepted or rejected as rawmaterial. Because it will affect the quality of dairy products that will be produced. In addition, the specific gravity value of milk is also a determining factor indetermining the selling price of milk.

V. CONCLUSION

The specific gravity value of fresh milk supplied from Capita Farm KUD, Cepogo KUD, Andini KUD, Getasan KUD, and Boyolali City KUD meets quality standards according to milk-specific gravity standards in the company, SNI, and existing literature so that it is said thatthe specific gravity of fresh milk in CV Cita Nasional from various KUD is in-control. So fresh milk supplied from various KUDs can be accepted as raw material for making pasteurized and homogenized milk in CV Cita Nasional.

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