Journal of the Nusantara Agriculture Science (JONAS)
p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

Analysis pH and Water Added of Cow Milk Raw Materials at PT Mazaraat Lokanatura Indonesia

Julia Ayu Lestari, Aprilia Fitriani
Department of Food Technology, Faculty of Industrial Technology, Universitas Ahmad Dahla, Ringroad Selatan Street, Daerah Istimewa Yogyakarta, Indonesia

*Correspondence Email: aprilia.fitriani@tp.uad.ac.id

ABSTRACT

PT Mazaraat Lokanatura Indonesia is one of the companies engaged in the production of cheese and creamery located in Yogyakarta. This Practical Work Report aims to analyze the pH value and water added to cow's milk, find out the factors causing differences in pH values and water added in each cheese production, and make suggestions for improvements to evaluate and improve the quality of cow's milk as the main raw material in cheese making at PT Mazaraat Lokanatura Indonesia. The analysis carried out on the pH value and water added to milk is using a control chart in the form of a P-Chart. The results obtained after the analysis using the P-chart control map show that the pH parameter for fresh cheese and aging cheese production is in a controlled condition (in-control) and the water added parameter for fresh cheese and aging cheese production is in an uncontrolled condition (out-control). The most dominant contributing factors affecting the pH and water added in cow's milk are the raw material factors and the human factors.

Keywords: *Milk, P-Chart , pH, Water Added*

Introduction

PT Mazaraat Lokanatura Indonesia is a company that operates in the field of cheese processing and creamery. The cheese products produced are divided into 2 types, namely fresh cheese and aging cheese. Cheese is a food product made from heated fresh milk with several additional ingredients added to support the cheese making process (Teply et al., 1958). Fresh cheese is a soft cheese made without the aging process and can be consumed immediately after the production process (Malaka et al., 2017). Aging cheese is a type of cheese that must go through a ripening process to be consumed. The aging process of aging cheese is carried out by placing the cheese at the appropriate temperature and humidit. The aging process in aging cheese contributes to the final texture of the cheese because its chemical and structural properties undergo changes that occur over time (Rogers et al., 2009) . Examples of soft or fresh cheese are mozzarella, cream cheese, quark, cottage, camembert and roquefort, and examples of aging cheese are cheddar, parmesan, pecorino and grana padano (Fatharani et al., 2018). The process of making cheese is influenced by several factors, namely

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

pH, temperature, water added levels and also the time to add bromelain enzyme extract, incubation time and starter inoculum (Hargrove et al., 1967).

The milk as the main raw material used by PT Mazaraat Lokanatura Indonesia comes from the Samesta Cooperative (Sapi Merapi Sejahtera), which is a combined milk from several local farmers, so the quality of each milk for each cheese production varies depending on the milk distributed to the company. Milk is the result of the secretion of mammalian mammary glands with its main function being to provide nutrition to its young. Examples of mammals are cows, buffalo, goats and sheep (Walstra et al., 2006). Milk is often described as a colloidal suspension containing emulsified fat globules, a heterogeneous family of major and minor proteins, the carbohydrate lactose, minerals, vitamins and enzymes. Cow's milk contains several ingredients in 100 grams, namely total solids 12.7%, fat 3.7%, protein 3.4%, lactose 4.8% and ash content 0.7% (Tamime, 2009). Milk is also an excellent substrate for the growth of various types of bacteria which can cause damage and spoilage to milk. Apart from that, the bacteria found in milk can also be obtained from pathogenic bacteria that originate when the animal is being milked (Nollet & Toldra, 2010).

Quality control is an active process that is useful for detecting defects in a product and for maintaining the quality of the product. Quality control is the most basic requirement for the continued quality of a product (Demirkaya, 2022). Quality control must include verification that the final product produced meets quality requirements using procedures, techniques and tools intended to detect any deviation or defect from established measurements (Rocha et al., 2023). Quality control is defined as a quality inspection process as approval of specifications so that a control department is devoted to checking product specifications through inspection and control techniques to prevent defective products from reaching consumers (Blanco-Encomienda et al., 2018). The quality control carried out by PT Mazaraat Lokanatura Indonesia for cow's milk raw materials is the examination of milk pH and the examination of water added to the milk.

pH is an instrument used to measure the acidity or alkalinity of an environment. pH can be measured at times 0 to 14 (Pakale, 1975). The pH of milk indicates whether the milk is acidic or alkaline and whether the milk is slightly acidic or close to neutral (Marouf & Elmhal, 2017) .The normal pH of fresh milk from healthy cow's milk is in the range of 6.6-6.7. Lower pH values can occur due to the growth of microorganisms that ferment lactose into lactic acid or extension lipolysis whereas higher pH values in milk can occur during physiological stress of the animal when the mineral balance of the milk is altered by changes in the permeability of the blood barrier and milk (e.g. in the late stages of the lactation cycle or during mastitis infections) (Tamime, 2009). The pH value of milk is between 6.5 up to 6.6 is a condition that very profitable for microorganisms as the pH approaches neutral (pH 6.5-7.5) is best for bacterial growth so that the milk will damaged easily. Partial milk spoilage largely due to activity microorganisms (Pazra & Wahyuningsih, 2022). The pH value is interpreted as a condition that is alkaline or acidic, and the pH test can be performed using a pH meter (Umar et al., 2014). In making cheese,

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

the pH of milk is deliberately made lower, namely in the pH range of 4.0-5.0, because at this pH lactic acid bacteria will grow and produce lactic acid which will inhibit the growth of many pathogenic bacteria and will ferment milk so that it can later become milk products such as yoghurt and cheese (Lu et al., 2013).

Milk is most frequently adulterated by the addition of water, which reduces its nutritional value and contaminates the milk, leading to health problems (Dangi, 2021). "Water added" refers to the intentional or unintentional addition of water to milk, which can reduce or even damage the obtained milk (Levowitz, 1960). Some factors that lead to the addition of water to milk are the gap between food demand and supply, as well as the desire to obtain additional profit (Dave & Bhatt, 2022). Milk that has been diluted with water will impact the contents within the milk, resulting in a reduction of fat, protein, and other components (Ystgaard et al., 1951). Checking for "water added" in milk is necessary before using the milk for the cheesemaking process. The higher the "water added" content in the milk, the lower the purity, which will affect the texture of the cheese and can even lead to cheese damage. "Water added" in milk will change the specific gravity of the milk and alter the natural color of the milk. To detect water in milk, a lactoscan can be used (Joy & Krishnakumar, 2017).

Research Method

This research uses 2 testing methods, namely pH and water added testing. pH testing is carried out by preparing a tool, namely a pH meter, pressing the on button on the pH meter, dipping the tip of the pH meter into the milk contained in the cheese vat. When the instrument is immersed, the number scale on the pH meter will move randomly, wait until the number becomes fixed and does not change (Agung et al., 2023).

Water added testing is carried out using a tool, namely a lactoscan. Lactoscan is a tool used to analyze the levels of lactose, fat, protein, water added, solid levels and density of the milk being tested. Prepare the lactoscan, take milk from each milk can using a sample tube, place the sample tube containing milk into the lactoscan, press the enter button then wait until the results of the water added level in the milk being tested come out, repeat the process above for the next milk can. After completing all the milk cans, the cleaning process is carried out and when finished, turn off the lactoscan by pressing the off button (Christi et al., 2022).

The data analysis method used in this research using the p-chart, p-Chart is a control chart that functions to see whether quality control in a production is under control or not. The control limits used are CL (Center Line) which is the middle line, UCL (Upper Control Limit) or upper limit line and LCL (Lower Control Limit) or lower limit line, if the data obtained exceeds the upper control limit or lower control limit which has been specified then the data was stated to be in an abnormal condition (Khomah & Siti Rahayu, 2015). According to (Khomah & Siti Rahayu, 2015) the formula used to analyze data using a p control chart is:

$$p = CL = \frac{\Sigma pi}{\Sigma n}$$

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

$$UCL = p + 3\sqrt{\frac{p\,(1-p)}{n}}$$

$$LCL = p - 3\sqrt{\frac{p\,(1-p)}{n}}$$

Where :

p = Center Line on Control

pi = Proportion of nonconformities

n = Lots of Samples

CL = Central Limit

UCL = Upper Control Limit

LCL = Lower Control Limit

Results and Discussion

1. Milk pH Control Limits for Fresh Cheese Production

The results of the calculations for the CL (Center Line), UCL (Upper Control Limit), and LCL (Lower Control Limit) for the milk pH parameter in the fresh cheese production at PT Mazaraat Lokanatura Indonesia can be seen in Table 1.

Table 1. Milk pH Control Limits for Fresh Cheese Production

Observation day -	pH	CL	UCL	LCL
1	6.64	6.60	6.70	6.50
2	6.61	6.60	6.70	6.50
3	6.66	6.60	6.70	6.50
4	6.65	6.60	6.70	6.50
5	6.67	6.60	6.70	6.50
6	6.65	6.60	6.70	6.50
7	6.64	6.60	6.70	6.50
8	6.65	6.60	6.70	6.50
9	6.66	6.60	6.70	6.50
10	6.68	6.60	6.70	6.50

The data obtained from the calculations for the milk pH control limits in fresh cheese production can be represented using a P-Chart control chart for the milk pH parameter in the fresh cheese production, as shown in Figure 1.

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

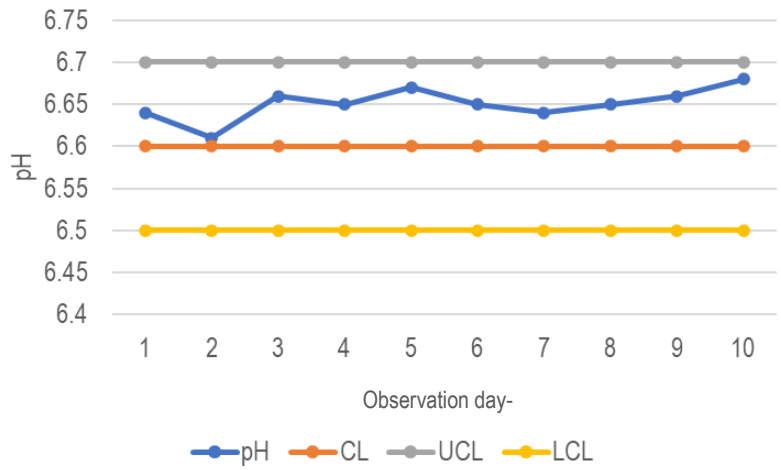

Figure 1. Milk pH P-Chart control chart for fresh cheese

Based on Figure 1, namely the P-chart control chart for milk pH parameters in making fresh cheese at PT Mazaraat Lokanatura Indonesia above, it can be seen that the milk pH data for fresh cheese shows that nothing has passed or exceeded the predetermined UCL and LCL limits, however There is pH data that almost exceeds the UCL limit, namely on day 10 which has a pH of 6.68. The number of bacteria in milk will affect the pH of the milk, the more bacteria there are, the more milk lactose will be converted into lactic acid so that the milk becomes sour. Several factors influence the number of bacteria and pH in milk, namely the milking environment, sanitation of the stall and milking equipment, milking time and diseases caused by milk bacteria or drugs (Pramesthi et al., 2015). The reference limit for milk pH set by PT Mazaraat Lokanatura Indonesia is in the range 6.5–6.7 (Mazaraat, 2015). According to (SNI, 2011) the normal pH range for fresh milk is in the range 6.3–6.8. Based on the pH reference limits for milk, it can be concluded that all milk pH data for fresh cheese production is in normal conditions.

2. Milk Water Added Control Limits for Fresh Cheese Production

The results of the calculations for the CL (Center Line), UCL (Upper Control Limit), and LCL (Lower Control Limit) for the milk water added parameter in the fresh cheese production at PT Mazaraat Lokanatura Indonesia can be seen in Table 2.

Table 2. Milk Water Added Control Limits for Fresh Cheese Production

Observation day -	*Water Added* (%)	CL	UCL	LCL
1	4.8	2.5	5	0
2	5.19	2.5	5	0
3	3.84	2.5	5	0
4	5.38	2.5	5	0
5	6.73	2.5	5	0
6	9.03	2.5	5	0
7	5.19	2.5	5	0
8	4.8	2.5	5	0

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

Observation day -	*Water Added* (%)	CL	UCL	LCL
9	3.84	2.5	5	0
10	4.8	2.5	5	0

The data obtained from the calculations for the milk water added control limits in fresh cheese production can be represented using a P-Chart control chart for the milk water added parameter in the fresh cheese production, as shown in Figure 2.

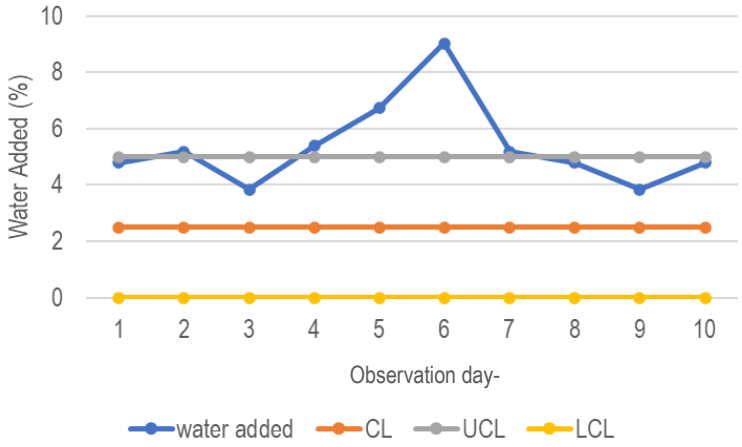

Figure 2. Milk water added P-Chart control chart for fresh cheese

Figure 2 above is a P-chart control map for water added milk parameters in fresh cheese production at PT Mazaraat Lokanatura Indonesia. The data above shows that there is some data that exceeds the predetermined control limits. This is not in accordance with the reference limits for water added levels set by PT Mazaraat Lokanatura Indonesia so that milk for making fresh cheese does not meet the criteria. The reference limit for water added content in milk set by PT Mazaraat Lokanatura Indonesia is in the range of 0–3% (Mazaraat, 2015). According to (Panahzadeh et al., 2016) the addition of water to milk will certainly affect the quality of the milk, adding water to milk is usually used to increase the volume of milk which will reduce the nutritional value of milk and is followed by nutritional disorders in humans where if contaminated it will poses a health risk, especially for sensitive people.

3. Milk pH Control Limits for Aging Cheese Production

The results of the calculations for the CL (Center Line), UCL (Upper Control Limit), and LCL (Lower Control Limit) for the milk pH parameter in the aging cheese production at PT Mazaraat Lokanatura Indonesia can be seen in Table 3.

Table 3. Milk pH Control Limits for Aging Cheese Production

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

Obervation day -	pH	CL	UCL	LCL
1	6.65	6.60	6.70	6.50
2	6.65	6.60	6.70	6.50
3	6.65	6.60	6.70	6.50
4	6.58	6.60	6.70	6.50
5	6.64	6.60	6.70	6.50
6	6.6	6.60	6.70	6.50
7	6.65	6.60	6.70	6.50
8	6.65	6.60	6.70	6.50
9	6.68	6.60	6.70	6.50
10	6.57	6.60	6.70	6.50

The data obtained from the calculations for the milk pH control limits in aging cheese production can be represented using a P-Chart control chart for the milk pH parameter in the aging cheese production, as shown in Figure 3.

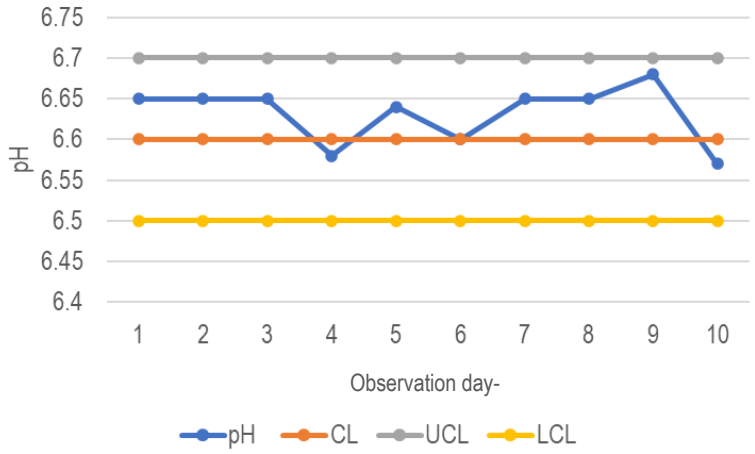

Figure 3. Milk pH P-Chart control chart for aging cheese

Figure 3 shows data on milk pH parameters in aging cheese production at PT Mazaraat Lokanatura Indonesia. The milk pH data above is still in normal conditions in accordance with the standards set by the Indonesian National Standard (SNI, 2011) which states the pH range for fresh milk is 6.3–6.8. The pH value in fresh milk is generally in the range of 6.5–6.7, if the pH of the milk is >6.7 it can mean that you have mastitis and if the pH of the milk is <6 it indicates the presence of colostrum or the presence of bacteria in the milk (Umar et al., 2014). According to (Pramesthi et al., 2015) the number of bacteria in milk will affect the pH of the milk, the more bacteria there are, the more milk lactose will be converted into lactic acid so that the milk becomes sour. Several factors influence the number of bacteria and pH in milk, namely the milking environment, sanitation of the stall and milking equipment, milking time and diseases caused by milk bacteria or drugs.

4. Milk Water Added Control Limits for Aging Cheese Production

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

The results of the calculations for the CL (Center Line), UCL (Upper Control Limit), and LCL (Lower Control Limit) for the milk water added parameter in the aging cheese production at PT Mazaraat Lokanatura Indonesia can be seen in Table 4.

Table 4. Milk Water Added Control Limits for Aging Cheese Production

Observation day -	*Water Added* (%)	CL	UCL	LCL
1	3.26	2.5	5	0
2	2.88	2.5	5	0
3	5.57	2.5	5	0
4	8.46	2.5	5	0
5	5.19	2.5	5	0
6	5.38	2.5	5	0
7	7.63	2.5	5	0
8	5.76	2.5	5	0
9	3.26	2.5	5	0
10	5.38	2.5	5	0

The data obtained from the calculations for the milk water added control limits in aging cheese production can be represented using a P-Chart control chart for the milk water added parameter in the aging cheese production, as shown in Figure 4.

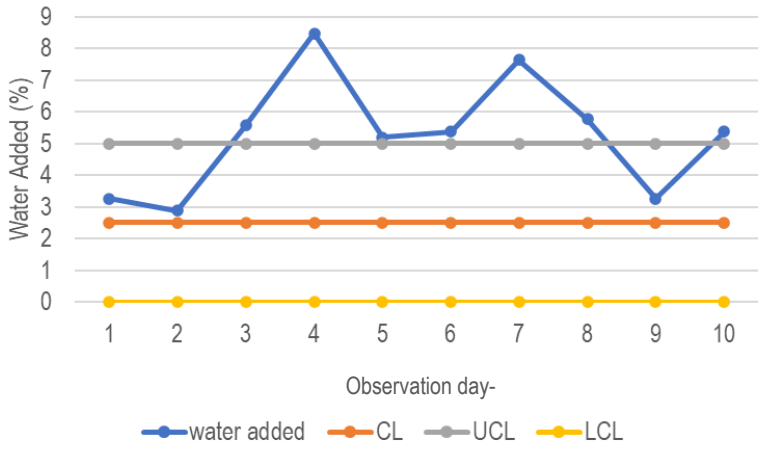

Figure 4. Milk water added P-Chart control chart for aging cheese

Figure 4 above is a P-chart control map for water added parameters in aging cheese production at PT Mazaraat Lokanatura Indonesia. The data contained in the chart above shows that there is some data that exceeds the predetermined control limits. This is not in accordance with the water added reference limit set by PT Mazaraat Lokanatura Indonesia, so milk for aging cheese production does not meet the criteria. The reference limit for water added content in milk set by PT Mazaraat Lokanatura Indonesia is in the range of 0–3% (Mazaraat, 2015). According to (Dangi, 2021) there are several factors that cause the addition of water to milk, namely increasing consumer demand and the farmer's intention to gain double profits. If a farmer adds 25% water to milk, the fat and protein concentration decreases by 25% (Rendevski et al., 2017).

p-ISSN: 3031-1128; e-ISSN: 3031-7630
https://e-jurnal.lkpdci.com/index.php/JONAS
Vol. (1), No (2): 53 -64, 2024

Problems regarding the pH value and water added levels in milk can have negative impacts if not handled or corrected properly. According to (Zuhrotusy & Ardan, 2023), there are several factors that cause problems, namely raw materials, humans, machines and methods. Raw materials are the first and most important causal factor. The first reason that the quality of milk raw materials is not good is because the milk has been in transit for too long so that a decrease in the pH of the milk can occur. The travel time from the cooperative to the PT Mazaraat Lokanatura Indonesia production house is 30 minutes, this makes it very possible for the milk to decrease in pH. Humans are also the main factor influencing milk quality. Lack of accuracy, the milker's lack of focus in the milking process and the cleanliness of employee clothing can cause a decrease in the quality of the milk produced. There are also farmers who deliberately add water to milk, causing impurity in the milk supplied to production houses. The occurrence of damage or error conditions in the machine used for the milking process can result in the milking process being less than optimal and affecting the results of the milk obtained. Apart from that, the cleanliness of the machine used must also be considered. The method of checking milk quality using a tool, namely a lactoscan, sometimes causes errors or process imperfections, especially when it rains. When it rains, the inspection remains outside the production room in conditions that are less than sterile and sometimes the milk is exposed to rainwater, causing contamination between the rainwater and the milk. The production process also sometimes takes longer than the specified time due to a lack of communication between one employee and another, causing errors to occur that are not in accordance with the standards set by the company.

Suggestions for improvements that must be made by the company to improve the quality handling process and production process of fresh cheese and aging cheese. Improvement steps that must be taken by PT Mazaraat Lokanatura Indonesia are ensuring the quality of all raw materials is in accordance with the standards set by the company and facilitating a cooling system during the process of sending milk from the cooperative to the production house, taking milk raw materials from only one farmer, so that the quality of the milk obtained tends not to be too different from each other, improve communication between employees to avoid miscommunication which can cause errors during the production process, carry out routine checks on production machines at least once a month to ensure whether or not there is damage or errors. happens to the machine. If there is damage to the machine, immediately clean, repair or replace the machine so that it does not disrupt the production process.

Conclusion

Based on the analysis that has been carried out on the differences in pH and water added levels in milk as raw material for making fresh cheese and aging cheese at PT Mazaraat Lokanatura Indonesia, the conclusion obtained is that the results of the P-Chart control chart analysis can be concluded that the pH parameter of cow's milk for the production of fresh cheese and aging cheese is in controlled conditions (in-control) and the water

added content parameters of cow's milk for the production of fresh cheese and aging cheese are in uncontrolled conditions (out-control). The results of the analysis of factors causing differences in pH and water added levels in milk are as follows. Raw materials for making fresh cheese and aging cheese show that there are two most dominant causes, namely raw material factors and human factors. Suggestions for improvements that need to be made to improve the quality of cow's milk used as raw material for making fresh cheese and aging cheese are that the milk must be properly processed. ensuring that it complies with the standards set by the company, collecting milk from only one farmer, tightening checks on the quality and purity of milk, controlling the cleanliness of production machines and increasing coordination between employees.

Acknowledgement

The author would like to thank Mr. Jamie Najmi and Mrs. Nieta Pricillia Puspitasari as the founders of PT Mazaraat Lokanatura Indonesia who have allowed the author to carry out practical work and collect data at PT Mazaraat Lokanatura Indonesia. The author also thanks all the staff and staff who have helped the author a lot during his practical work at PT Mazaraat Lokanatura Indonesia.

References

Agung, A. V., Wanniatie, V., Erwanto, E., & Fathul, F. (2023). Pengaruh Substitusi Silase Daun Singkong Dengan Silase Rumput Pakchong Terhadap Kualitas Fisik Susu Kambing Peranakan Etawah. *Jurnal Riset Dan Inovasi Peternakan*, *7*(3), 321–327.

Blanco-Encomienda, F. J., Rosillo-Díaz, E., & Muñoz-Rosas, J. F. (2018). Importance of Quality Control Implementation in the Production Process of a Company. *European Journal of Economics and Business Studies*, *10*(1), 248. https://doi.org/10.26417/ejes.v10i1.p248-252

Christi, R. F., Sudrajat, A., Widjaja, N., & Yuniarti, E. (2022). PERBANDINGAN LEMAK, PROTEIN, LAKTOSA DAN pH SUSU SAPI FRIESIAN HOLSTEIN PADA PEMERAHAN PAGI DAN SORE DI CV BEN BUANA SEJAHTERA SUMEDANG. *Agrivet : Jurnal Ilmu-Ilmu Pertanian Dan Peternakan (Journal of Agricultural Sciences and Veteriner)*, *10*(1), 19–24. https://doi.org/10.31949/agrivet.v10i1.2609

Dangi, S. (2021). Common milk adulterants in developing country Nepal: A mini- review. *Aceh Journal of Animal Science (Online)*, *6*(3), 91–96. https://doi.org/10.13170/ajas.6.3.20356

Dave, J., & Bhatt, C. (2022). Milk Adulteration Detection for Added Water by Conductivity. *International Journal of Food and Nutritional Sciences*, *11*(6), 150–155. https://doi.org/10.4103/ijfans

Demirkaya, F. (2022). ARCHIVES OF ENGINEERING KNOWLEDGE The Quality Control Tools used for Sustainability of Quality. *Archives of Engineering Knowledge*, *7*(1), 21–26. www.qpij.pl

Fatharani, A., Hidayat, B., & Darana, S. (2018). Deteksi Kualitas Keju Dengan Metode Gabor Wavelet Dan Klasifikasi Learning Vector Quantization (LVQ) Berbasis Android Quality. *E-Proceeding of Engineering*,

5(3), 4691–4698.

Hargrove, R. E., McDonough, F. E., & Tittsler, R. P. (1967). Factors Affecting Characteristics, Composition, and Quality of Skimmilk Cheese. *Journal of Dairy Science*, *50*(2), 160–166. https://doi.org/10.3168/jds.S0022-0302(67)87382-X

Joy, J. K., & Krishnakumar, K. (2017). MILK ADULTERATION – A REVIEW Justin K Joy 1 , K. Krishnakumar 2 1 2. *Journal of Pharmaceutical Research*, *7*(04), 7–9. https://doi.org/10.4172/2157-7064.1000212.www.iajpr.com

Khomah, I., & Siti Rahayu, E. (2015). Aplikasi Peta Kendali p sebagai Pengendalian Kualitas Karet di PTPN IX Batujamus/Kerjoarum. *AGRARIS: Journal of Agribusiness and Rural Development Research*, *1*(1), 12–24. https://doi.org/10.18196/agr.113

Levowitz, D. (1960). the Problem of Added Water in Milk, and Its Detection1. *Journal of Milk and Food Technology*, *23*(2), 40–42. https://doi.org/10.4315/0022-2747-23.2.40

Lu, M., Shiau, Y., Wong, J., Lin, R., Kravis, H., Blackmon, T., Pakzad, T., Jen, T., Cheng, A., Chang, J., Ong, E., Sarfaraz, N., & Wang, N. S. (2013). Milk Spoilage: Methods and Practices of Detecting Milk Quality. *Food and Nutrition Sciences*, *04*(07), 113–123. https://doi.org/10.4236/fns.2013.47a014

Malaka, R., Hatta, W., & Baco, S. (2017). Properties and Microstructure of Dangke Fresh Cheese Made with Passion Fruits Juice as Coagulant. *International Journal of Agriculture Innovations and Research*, *5*(4), 602–606.

Marouf, A. A. S., & Elmhal, S. I. (2017). Monitoring pH During Pasteurization of Raw Cow's Milk using Nd:YAG Laser. *International Journal of Advanced Research in Physical Science*, *4*(12), 1–4. https://doi.org/10.20431/IJARPS.2017.4.12.2

Mazaraat, L. I. (2015). *Standar Mutu Susu PT Mazaraat Lokanatura Indonesia*. *24*, 55132.

Nollet, L. M. L., & Toldra, F. (2010). Handbook of Dairy Foods Analysis. In *Handbook of Dairy Foods Analysis*. CRC Press Taylor & Francis Group. https://doi.org/10.1201/9781420046328-42

Pakale, A. A. (1975). Digital pH meter. *South African Medical Journal*, *49*(38), 1575. https://doi.org/10.1016/s0026-0576(04)90035-9

Panahzadeh, M., Ghajarbeygi, P., & Mahmoudi, R. (2016). Detection of adulteration in raw cow milk supplied in the Qazvin province, Iran, during (2015-2016). *Carpathian Journal of Food Science and Technology*, *8*(4), 26–32.

Pazra, D. F., & Wahyuningsih, W. (2022). Kualitas Fisik, Kimia, Mikrobiologi Susu Sapi pada Peternakan Sapi Perah di Kecamatan Caringin Kabupaten Bogor. *Jurnal Agroekoteknologi Dan Agribisnis*, *6*(1), 1–16. https://doi.org/10.51852/jaa.v6i1.532

Pramesthi, R., Suprayogi, T. H., & Sudjatmogo. (2015). Total Bakteri dan pH Susu Segar Sapi Perah Friesian

Holstein Di Unit Pelaksana Teknis Daerah dan Pembibitan Ternak Unggul Mulyorejo Tengaran Semarang. *Animal Agriculture Journal*, *4*(1), 51–66. http://repositorio.unan.edu.ni/2986/1/5624.pdf%0Ahttp://fiskal.kemenkeu.go.id/ejournal%0Ahttp://dx.doi.org/10.1016/j.cirp.2016.06.001%0Ahttp://dx.doi.org/10.1016/j.powtec.2016.12.055%0Ahttps://doi.org/10.1016/j.ijfatigue.2019.02.006%0Ahttps://doi.org/10.1

Rendevski, S., Alkhanbouli, A. S. A. A., Shaabi, K. S. M. A. Al, & Ahmed, S. A. A. (2017). Testing For Added Water in Milk with Handheld LCR Meter. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, *11*(05), 23–30. https://doi.org/10.9790/2402-1105012330

Rocha, A., Romero, F., Miranda, D., Amorim, M., & Lima, R. M. (2023). Quality management practices to direct and control the accomplishment of project objectives in R&D units. *Procedia Computer Science*, *219*, 36–43. https://doi.org/10.1016/j.procs.2023.01.261

Rogers, N. R., Drake, M. A., Daubert, C. R., McMahon, D. J., Bletsch, T. K., & Foegeding, E. A. (2009). The effect of aging on low-fat, reduced-fat, and full-fat Cheddar cheese texture. *Journal of Dairy Science*, *92*(10), 4756–4772. https://doi.org/10.3168/jds.2009-2156

SNI. (2011). *Standar Nasional Indonesia (SNI)-3141-1-2011: Susu Segar*.

Tamime, A. Y. (2009). Milk Processing and Quality Management. In *Milk Processing and Quality Management*. Wiley Blackwell. https://doi.org/10.1002/9781444301649

Teply, L. J., Derse, P. H., & Price, W. V. (1958). Composition and Nutritive Value of Cheese Produced from Milk Treated with Hydrogen Peroxide and Catalase. *Journal of Dairy Science*, *41*(5), 593–605. https://doi.org/10.3168/jds.S0022-0302(58)90971-8

Umar, Razali, & Novita, A. (2014). pH Degrees and Reductation Scores of Pasteurization Cow's Milk in Different Time of Storaging. *Jurnal Medika Veterinaria*, *8*(1), 43–46. https://doi.org/10.21157/j.med.vet..v8i1.3334

Walstra, P., Wouters, J. T. M., & Geurts, T. J. (2006). Dairy Science and Technology. In *CRC Press*. CRC Press Taylor & Francis Group. https://doi.org/10.4324/9781032676340-8

Ystgaard, O. M., Homeyer, P. G., & Bird, E. W. (1951). Detection of Adulteration of Milk by Lactometric and Freezing Point Methods. *Journal of Dairy Science*, *34*(7), 680–688. https://doi.org/10.3168/jds.S0022-0302(51)91765-1

Zuhrotusy, S. Q., & Ardan, M. (2023). Analisis Fishbone sebagai Implementasi Solusi Penggunaan Tempat Tidur Belum Ideal Rumah Sakit. *Jurnal Pengabdian Kepada Masyarakat Nusantara (JPkMN)*, *4*(2), 775–782.