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THE STUDY OF TEMPERATURE EFEECT AND LENGTH OF PASTEURIZATION HEATING ON MILK QUALITY

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ABSTRACT

The aim of the study are to determine the influence of heating temperature and time of pasteurization on the number of bacteria, bacterial pathogens, levels of fat, protein and total solid non fat as well as to find the combination of heating temperature and effective time to kill pathogenic bacteria and pathogens and does not reduce the levels of fat, protein, and dry matter without fat. Fresh milk from Karangploso Village Cooperative Unit (VCU) and fresh milk from Pujon VCU in Malang respectively as much as 10 liters of pasteurized with temperature of 62°C, 67°C and 72°C respectively for 15 minutes, 30 minutes and 45 minutes. Before the temperature pasteurized, it is examined the situation and composition. Circumstances include: color, smell, cleanliness, degree of acid, alcohol, catalase, reduction, the number of bacteria and bacterial pathogens. The composition of milk include: severe type, the content of bacteria, bacterial pathogens, levels of fat, protein and solid non fat. Pasteurized milk is done by batch pasteurization using a water bath. Research using completely randomized factorial design: 3 x 3 x 2 with three replications and further test using Duncan's New Multiple Range Test. Temperature and time of heating is significant ($P < 0.01$) as well as their interactions to total bacteria. The number of bacteria in the milk that is pasteurized with temperature of 62°C for 15 minutes was 260.0 / ml, the number of bacteria decreases with increasing temperature or duration of heating. In the pasteurization temperature 72°C for 45 minutes the amount of bacteria in milk 41.7 / ml. treatment of various temperature and time of heating to kill> 99% of bacteria. Pasteurized milk with temperature 62°C for 30 minutes to kill all bacteria are suspected pathogen. Treatment temperature and time of heating is best used in the process of pasteurization is the temperature of 62°C for 30 minutes.

Keywords: Milk, temperature, time, pasteurization, bacteria.

INTRODUCTION

Milk is a food that has high nutritional value due to the complete nutrient content such as lactose, fat, protein, vitamins, minerals, enzymes and various other components. As a food product rich in nutrients and water content is high, milk is very easily damaged by microbial contamination. One of the potential hazards found in milk and other dairy products is the microbiological hazards, in particular the presence of pathogenic germs. Microbial pathogens can cause further damage to the milk and resulted in the emergence of food-borne diseases such as infections and food poisoning from dairy products (Robinson, 2002)

The problem that has to do with the quality of milk is milk post-harvest handling. How to prepare fresh milk can be milked so durable when stored and keep good quality to be consumed. The main factor that causes the milk can not be stored longer and quality are rapidly changing is the number of initial bacteria high enough and fast development. This can occur because of poor treatment of milking by farmers and poor treatment in restraining the growth of bacteria by collecting milk, milk dealers and milk dealers.

Handling fresh milk with a simple refrigeration, pasteurization and storage in a refrigerator adapted to tropical climate is a good way to maintain the quality of fresh milk remains good and extend the shelf life of milk. Special handling of fresh milk by pasteurization should consider the number of initial bacteria in milk. For the pasteurization temperature and the length of time to make pasteurization absolutely can not be transferred from pasteurization standards of European countries, Australia and America. The big difference in milking technology, equipment and differences in educational facilities and expertise of farmers and milk dealers in Indonesia and in developed countries resulted in fresh milk produced differently. Plus the difference in climate also influenced the development

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of microorganisms in milk. Temperature and heating time used for pasteurization in Indonesia adjusted the number and types of bacteria in milk (Adnan, 2004).
This study aims to determine the influence of temperature and time of heating in the pasteurization of milk to the number of bacteria, pathogenic bacteria, fat content, protein content and solid non fat in milk quality. It also aims to find the combination of temperature and time of heating the right and good in the process of milk pasteurization.

MATERIALS AND METHODS

Materials

Materials used for the examination of the material under study are plate count gelatin, aquadest sterile and Na Cl to calculate the number of bacteria. Then for the isolation and identification of pathogenic bacteria in the milk used materials physiological Na Cl, aquadest sterile plate count gelatin, brilliant green gelatin, Mac Conkey gelatin, blood gelatin plates, tilted blood gelatin, for tilt, maltose salt gelatin, triple sugar iron, urea for oblique, Lowenstein gelatin, brain heart infusion, Selenite broth base, motility gelatin, broth alkalis, water Peptone, VP-MR broth, kosher citrate, glucose, maltose, mannitol, sucrose, media and paint OF grams. It also needed 0.25 n Na OH and phenolphthalein to test the degree of lactic acid, H_2O_2, 1% for testing catalase, methylene blue and paraffin liquidium to test reduction, 92% sulfuric acid, and amyl alcohol to test the fat content of milk, and H_2SO_4 (93-98% free of N), a mixture of Na_2SO_4-H_2O (20: 1), solution of Na OH - $Na_2S_2O_{22}$ and granulated zinc, boric acid, methyl red or blue, 0.02 n HCll and aquadest to test the protein content of milk.

Methods

The samples used were obtained from the milk of dairy farmer members of Karangploso Village Cooperative Unit (VCU) and fresh milk from Pujon VCU in Malang. The samples are stored in a refrigerator before it is time pasteurized. Bacterial examination of milk was done by isolation and identification with the method recommended by National Standard of Indonesia (SNI 2000). Pasteurization is done by batch pasteurization [1], and then determine the concentration of nonfat dry ingredients using a formula Fleischmann. Protein content of fresh milk and milk pasteurization conducted using Micro Kjeldahl method.
To know the effect of temperature and time of heating in the quality of milk pasteurization, used analysis of variance test patterns factorial (3 x 3 x 2) based on completely randomized design with three replications [2]. The research data were analyzed observations of each variable quality of milk.
Data were analyzed by using the "PASTA" (Statistical Package) Agriculture Research Program Factorial ANOVA three lanes [3]. When the effect of treatment factor showed significant differences ($P < 0.05$) performed significantly different test against Average treatment according to Duncan's New Multiple Range Test [2].

RESULTS AND DISCUSSION

Milk Conditions and the composition of milk

State inspection results and the composition of fresh milk from Karangploso VCU and fresh milk Pujon VCU listed in Table 1. The color and smell of milk that comes from both places there is no deviation from milk. Fresh milk normally has a variety of colors from bluish white to yellowish white [1]. Similarly, the smell, not smell sour, rancid and specific odor of a food ingredient or ingredients and other substances are mixed or blended into the milk. Fresh milk normally has a specific smell like the smell of milk. Results showed milk hygiene test of both the home clean enough.
Tests for alcohol in the milk of both place of origin gave negative results. Alcohol test results showed that the levels of acid present in milk have not been sufficient to cause persipitasi casein. This shows the activity of acid-forming bacteria in fresh milk from Karangploso VCU and fresh milk Pujon VCU has not so enterprising.
Fresh milk Karangploso VCU has acid degrees higher than the degree of acid fresh milk Pujon VCU, thereby acid levels in fresh milk Karangploso VCU higher too than the acid levels in fresh milk Pujon VCU. High acid levels can be attributed to more number of bacteria in the milk.
Limit the degree acid by the government are 4.5 - 70°SH. The degree of acid fresh milk Karangploso VCU and fresh milk Pujon VCU is 4.9°SH and 6.7°SH, which means still considered good because it is located within a predetermined limit government. Figures for fresh milk catalase Karangploso VCU and fresh milk catalase Pujon VCU 2.6 cc and 2.4 cc is still within he limits that have been set by the government, which is as high as 3 cc. Test results reductive Karangploso and Pujon VCU are 2.17 and 6.33, in compliance with government regulations in National Standard of Indonesia (SNI 2000). The quality of fresh milk Karangploso and Pujon VCU

determined based on milk quality. Determination of the quality of fresh milk listed in Table 2.

Table 1 The Result of the condition and composition of fresh milk from Karangploso VCU and farming of Pujon VCU

Kind of Examination	Examination Result	
	Karangploso VCU	Pujon VCU
I. Milk Conditions		
1. Smell and Color	Normal	Normal
2. Hygiene	Clean	Clean
3. Acid level (°SH)	4,9	6,7
4. Alcohol	Negative	Negative
5. Catalace	2,6	24
6. Reductance	3,17	6,33
7. Average bacterial colony per ml	2.093.333,33	946.333,30
II. Chemical Milk Composition		
1. Specific gravity	1,0217	1,0276
2. Fat content (%)	2,2500	3,2250
3. Protein content (%)	2,1914	3,0742
4. SNF content (%)	6,2812	8,0119

Description: °SH = Sochlet Henkel Content
SNF = Solid Non Fat

Table 2 Assessment of quality of fresh milk Karangploso VCU and fresh milk Pujon VCU

Components	Karangploso VCU		Pujon VCU	
	Test Result	Value *	Test Result	Value*
Fat content	2,2500	2	3,2500	7
SNF	6,2812	0	8,0119	3
Acid level	4,900	4	6,700	8
Hygiene	Clean	8	Clean	8
Total qualification		**14**		**26**

Description: Using District standard assessment

The Effect of Heating Temperature and Length to Total Bacteria

The result of the number of bacteria in milk is pasteurized by heating temperature and time combinations shown in Table 3. Results of variance analysis showed the temperature, heating time, location and interaction of temperature with heating time significant ($P < 0.01$) to total bacterial content in milk. Pasteurized at different temperatures will produce a total Average of different bacteria. The higher temperatures will result in lower bacterial Average. Similarly, a different time heating will also result in a total Average of different bacteria, in which the longer warming will kill more and more bacteria. Results in Table 5 are in accordance with the opinion of Adnan (2004) that long heating time close relations with the death of bacteria. The more natural bacteria heated at a certain temperature, the more the dead.

Table 3 The percentage of deaths Bacteria in Milk of Karangploso VCU and Pujon VCU which is pasteurized at various temperature and time of heating combinations.

Time for Heating	Origin Place of Milk	Temperature of Pasteurization (°C)		
		62	67	72
15 minutes	Karangploso VCU	99,987	99,994	99,997
	Pujon VCU	99,973	99,992	99,995
30 minutes	Karangploso VCU	99,987	99,996	99,997
	Pujon VCU	99,983	99,993	99,997
45 minutes	Karangploso VCU	99,994	99,997	99,997
	Pujon VCU	99,993	99,993	99,997

The occurrence of death of bacteria in the pasteurized milk is not only caused by the high and low temperatures for short or long heating time, but due to the existence of cooperation between the two. Cooperation and long time heating temperature in the pasteurization process is called interaction. That milk pasteurization 62°C number of bacteria in the milk which is heated with the addition of long

heating every 15 minutes there will be a very real reduction.

In the pasteurization temperature 72°C amount of bacteria heated for 15 minutes, 30 minutes and 45 minutes were not significantly different. As with pasteurized at temperature 67°C, pasteurized milk at temperature 72°C for 15 minutes is very effective to kill bacteria milk. The addition of long time heating at temperature 72°C pasteurization is not required.

A change in physical and chemical properties of milk that may occur in the milk is heated at temperature 67°C and 72°C in this experiment was not investigated. Thus the temperature 67°C and 72°C, each combined with time 15 minutes, 30 minutes and 45 minutes used in the process of milk pasteurization has not been able to guarantee the quality of milk produced. According to [1] temperature and time of heating is best used in the process of pasteurization is heating temperature of 62°C and 30 minutes. At this heating rate does not change the properties of milk or any milk.

Table 4 Average levels of fats in the milk that is pasteurized by Various Combination Temperature and Duration of Heating (%).

B = Time for Heating (in the minutes)	A = Temperature for Heating (°C)			Average B
	62	67	72	
15	2,746	2,758	2,750	2,751
30	2,742	2,779	2,754	0,758
45	2,750	2,767	2,763	2,760
Average A:	2,746	2,768	2,647	

B = Length Warming (in minutes)
A = Temperature for Heating (° C)

Table 5. Average Levels of Fat in the Milk Pasteurization of Karangploso VCU and Pujon VCU (%).

Time for Heating	Origin Place of Milk	Temperature of Pasteurization (°C)		
		62	67	72
15 minutes	Karangploso VCU	2,258	2,266	2,266
	Pujon VCU	3,233	3,250	3,233
30 minutes	Karangploso VCU	2,258	2,266	2,266
	Pujon VCU	3,225	3,283	3,242
45 minutes	Karangploso VCU	2,258	2,266	2,266
	Pujon VCU	3,242	3,266	3,242

Description: All Average on their respective places of origin were not significantly different milk

Pasteurized milk with temperature 62°C for 15 minutes can not be recommended for use because there are pathogens like coliform bacteria in it, and the bacteria *streptococcus sp* unknown identity. Similarly, pasteurized at temperature 62°C with 45 minutes heating time can not be recommended its use because of damage or change the properties of milk that might occur on a recent warming has not been studied. For the pasteurized milk free from pathogenic germs and does not change the properties of milk, it should be pasteurized at temperature 62°C for 30 minutes. Average total bacteria in milk pasteurized milk according to the location or origin are listed in Table 6. From Table 6 Average total number of bacteria found in milk Karangploso VCU who is pasteurized ($P < 0.01$) with Average total bacteria in milk Pujon VCU that has been pasteurized. In the fresh state the number of bacteria in milk Karangploso VCU differs from the number of bacteria in raw milk Pujon VCU.

A bacterium found in milk that is pasteurized is a bacterium that is resistant to heat treatment [4]. Adnan [5] said the bacteria that are resistant to pasteurization can be classified as acid-forming bacteria, alkaline forming, which can hold peptonisation and the inert. The number of bacteria in the milk of Karangploso VCU that have been pasteurized is more than the number of bacteria in the milk of Pujon VCU. It shows in the milk of Karangploso VCU there are more bacteria resistant to heat treatment. Table 7 contains the results of Duncan's Test Average number of bacteria in pasteurized milk from respective places showed the least amount of bacteria present in milk that is pasteurized to 72°C for 45 minutes. The number of bacteria was in the milk of Pujon VCU that has been pasteurized on various temperatures and time of heating combinations. Percentage of mortality of bacteria in milk of Karangploso VCU and Pujon VCU that has been pasteurized at various temperature and time of heating combinations, are listed in Table 8. Table 8 shows that the death of bacteria in the milk of Karangploso VCU that have been pasteurized with various temperatures and time

of heating combinations is more than 99%. Similarly, the death of bacteria in milk of Pujon VCU which is pasteurized with various temperatures and time of heating combinations is more than 99%. It shows all the temperature and time of heating combinations used in the pasteurization process of milk in this study is quite effective to kill bacteria.

Table 6 Average Levels of Protein in the Milk Pasteurization of Karangploso VCU and Pujon VCU (%).

Time for Heating	Place origin of Milk	Temperature of Pasteurization (°C)		
		62	67	72
15 minutes	Karangploso VCU	2,2030	2,1969	2,2149
	Pujon VCU	3,0790	3,0705	3,0752
30 minutes	Karangploso VCU	2,2250	2,2108	2,2015
	Pujon VCU	3,2009	3,0615	3,0693
45 minutes	Karangploso VCU	2,2073	2,2320	2,2528
	Pujon VCU	3,1046	3,0255	3,0679

Description: All Average In Place of Origin of Each Milk not significantly different (P> 0.05).

Table 7 Average Levels of SNF without Inside The pasteurized milk Combination With Various Heating Temperature And Old.

B = Time for Heating (in the minutes)	A = temperature of heating°C)			Average B
	62	67	72	
15	7,178	7,229	7,249	7,219
30	7,203	7,221	2,206	7,210
45	7,240	7,252	7,290	7,261
Average A :	7,207	7,234	7,248	

B = time heating (in minutes)
A = temperature of heating (° C)

Table 8 Average without SNF Concentration in the Milk Pasteurization Karangploso VCU and Pujon VCU (%).

Time for Heating	Place Origin of Milk	Temperature of Heating		
		62	67	72
15 minutes	Karangploso VCU	6,2916	6,4150	6,4235
	Pujon VCU	8,0651	8,0433	8,0736
30 minutes	Karangploso VCU	6,3437	6,3648	6,3367
	Pujon VCU	8,0632	8,0766	8,0756
45 minutes	Karangploso VCU	6,4042	6,4235	6,3367
	Pujon VCU	8,0756	8,0813	8,1183

The effect of Temperature and Duration of Heat Treatment on pathogenic bacteria

That both from Karangploso VCU and from Pujon VCU, at pasteurization temperature 62°C for 15 minutes, there are still bacteria in some samples. While heating at 62°C for 30 minutes was not found again these germs.

Coliform and *streptococcus sp* Germs found this include the type of pathogen or apathogen. E. Coli O_{124} is one type of coliform species that are pathogens in humans. Similarly, Streptococcus pyogenes and Streptococcus aqalactiae a streptococcal species are pathogens in humans. To kill pathogenic bacteria contained in the milk needed 62°C temperature for 30 minutes [6].

The discovery of coliform bacteria and streptococcus sp in milk on heating 62°C for 15 minutes showed that the combination of temperature and time of this warming can not kill all bacteria. Robinson [4] states the type of bacteria present in pasteurized milk depends on the number of bacteria before pasteurized milk. All types of bacteria found in fresh milk, not found again after the pasteurized milk with temperature 62°C for 30 minutes to release the milk from the suspect bacterial pathogens.

Table 9 The comparison of Quality of Fresh Milk Pasteurization Karangploso VCU and Pujon VCU.

Quality Variable	Fresh Milk	Pasteurization (62°C/30 minutes)
I. Karangploso VCU		
1. Total bacterial/ml Milk	2.083.33,3	229,3
2. Suspected Bacterial of Pathogen	*Coliform*	-
	Streptococcus sp	-
	Stafilococcus sp	-
3. Fat content (%)	2,250	2,2580
4. Protein content (%)	2,1914	6,2250
5. SNF content (%)	6,2821	6,3427
II. Pujon VCU		
1. Total bacterial/ml Milk	946.333,3	-
2. Suspected Bacterial of Pathogen	*Coliform*	-
	Streptococcus sp	-
	Stafilococcus sp	-
3. Fat content (%)	3,2250	2,2250
4. Protein content (%)	3,0742	3,2009
5. SNF content (%)	8,0119	8,0632

Description: SNF = Total Solid Non Fat

The Effect of Temperature and Duration of Heat Treatment on Milk Quality
Fat content

Results Analysis of variance showed that the heating temperature and time used in the process of milk pasteurization did not affect milk fat content. However, the location factors significant (P <0.01) on milk fat content. The interaction of each factor A, factor B and factor C has no effect on milk fat content. In the form of figures there is little difference in levels of fat in the milk that is pasteurized in any combination and heating duration. This difference may be due to differences in homogeneity of each sample of milk examined. Although milk is homogenized prior to review by stirring, but the milk is really difficult to obtain perfectly homogeneous.

Results Analysis of variance in Table 11 shows that the heating temperature and time used in the process of milk pasteurization did not affect milk fat content. However, the location factors significant (P <0.01) on milk fat content. In Table 12 looks at the fat content of pasteurized milk to 72 ° C for 15 minutes, 30 minutes and 45 minutes was not significantly different (P <0.05) with fat content in milk is pasteurized at temperature 67 ° C and 62 ° C min each for 15 minutes, 30 minutes and 45 minutes.

Looked fat content of milk has not changed despite heated at 72 ° C for 15 minutes, 30 minutes and 45 minutes. That milk fat composition will not change when heated to the boiling point. Chemical changes occur when fat is heated at high temperature [7]

A level of fat in the milk that is pasteurized is slightly higher than levels of fat contained in fresh milk. This is caused by the evaporation of some components of milk during the pasteurization process. The effect of temperature and time of heating on milk fat content Karangploso VCU and on milk fat content of Pujon VCU can be seen in Table 5. That Average levels of fat aws in the tribe Karangploso VCU who is pasteurized with various temperature and time of heating combinations from one another is not statistically significantly different (P> 0.05). Similarly, Average levels of fat in the milk have been pasteurized of Pujon VCU with various temperatures and time of heating combinations from one another is not statistically significantly different. Average fat content in milk of Karangploso VCU and Pujon VCU that has been pasteurized by various temperatures 62˚C, 67˚C and 72˚C respectively for 15 minutes, 30 minutes and 45 minutes in the form of numbers- figures differ from one another. Average difference was found in relatively small numbers. Sources of differences may come from less homogeny samples of pasteurized milk and evaporation that occurs during the process of pasteurization.

The results presented above indicate that the treatment temperature and time of heating has no effect on milk fat content, either on milk fat content of Karangploso VCU or milk fat content of Pujon VCU. Average levels of fat in the milk pasteurized milk according to the location or origin are listed in Table 5.

Protein levels

The results analysis of variance in Table 6 indicate that the milk and the long heating used in the process of milk pasteurization did not affect milk protein content. However, the location factors significant (P <0.01) on milk protein content. The interaction of each factor A, factor AB and C factor has no effect on milk protein content.

In Table 6 visible levels of protein in the milk that is pasteurized with temperature 72 ˚ C for 15 minutes, 30 minutes and 45 minutes was not significantly different (P> 0.05) with protein content in the milk that is pasteurized with temperature 67 ˚ C and 62 ˚ C respectively for 15 minutes, 30 minutes and 45 minutes here seems unchanged milk protein content, although milk is heated at 72 ˚ C for 15 minutes, 30 minutes and 45 minutes. Adnan (2004) said that casein will not experience denaturation when heated at boiling temperature for 12 hours or at temperature 130 ˚ C for one hour. Denaturation is opening the folds of the protein structure. In the further denaturation of polymer structure can be folded back into the natural structure but advanced to the denaturation of the protein polymer structure changes. Goff and Hill [1] said the effects of heat on the second new protein are visible, when the temperature is heated at 80 ˚ C for 30 minutes. The effect of temperature and time of heating on milk protein content Karangploso VCU and Pujon VCU can be seen in Table 6.

The average protein content in milk Karangploso VCU who is pasteurized with various temperature and time of heating combinations from one another statistically is not significantly different (P> 0.05). Similarly, levels of protein in the milk of Pujon VCU that have been pasteurized with various temperatures and time of heating combinations from one another statistically is not significantly different (P> 0.05). However, Average protein in the milk Karangploso VCU who is pasteurized with temperature 62 ˚ C, 67 ˚ C and 72 ˚ C respectively for 15 minutes, 30 minutes and 45 minutes in the form of the figures differ from one another. Similarly Average protein content in milk that has been pasteurized of Pujon VCU with temperatures 62 ˚ C and 72 ˚ C respectively for 15 minutes, 30 minutes and 45 minutes in the form of the figures differ from one another. Difference Average protein content was found in the numbers relatively small. The source of the differences that can come from less homogeny samples of pasteurized milk and evaporation that occurs during the process pasteurization. In Table 6, Average levels of protein in the milk that have been pasteurized Karangploso VCU 2.216% is significantly different (P <0.01) with Average levels of protein in the milk that have been pasteurized of Pujon VCU is 3.084

Solid non fat (SNF)

Results Analysis of variance in Table 7 above is show that the temperature and time of heating in the process of milk pasteurization did not affect the material content of SNF. However, the location factors significant (P <0.01) toward the content of SNF. The interaction of each factor A, factor B and factor C has no effect SNF without fat milk.

In the form of the numbers of slight differences of SNF without fat content of milk in the milk that is pasteurized in any combination of temperature and time of heating (Table 7) This difference is most likely caused by differences in homogeneity of each sample of milk examined. Although milk is homogenized prior to review by stirring, but the milk is really difficult to obtain perfectly homogeneous. In table 19 looks SNF without fat in the milk that is pasteurized with temperatures 72 ˚ C for 15 minutes, 30 minutes and 45 minutes was not significantly different (P> 0.05) with SNF without fat in the milk that has been pasteurized with temperature 62 ˚ C and 67 ˚ C respectively for 15 minutes, 30 minutes and 45 minutes. Levels of SNF without fat content of milk are the number of constituent components subtract water and milk fat content [6]. The main components of SNF constituent materials are proteins, lactose, minerals and vitamins. Protein content was not influenced by heat treatment given as described in the protein. Lactose did not change when the heated temperature of 100˚ C [1]. The effect of heating temperature and time on SNF without fat dairy milk from two places of origin can be seen in Table 8.

Average SNF without fat in the milk Karangploso VCU who is pasteurized with various temperature and time of heating combinations from one another is not statistically significantly different (P> 0.05). Similarly, SNF without fat in the milk that have been pasteurized of Pujon VCU with various temperature and time of heating combinations from one another is not statistically significantly different (P> 0.05).

Average protein content in milk Karangploso VCU that is already pasteurized with temperatures 62 ˚ C, 67 ˚ C and 72 ˚ C are respectively for 15 minutes, 30 minutes and 45 minutes in the form of the figures differ from one another. Similarly Average protein content in milk that has been pasteurized Pujon VCU with temperatures 62 ˚ C, 67 ˚ C and 72 ˚ C respectively for 15 minutes, 30 minutes and 45

minutes in the form of the figures differ from one another. Difference Average protein content was found in the numbers relatively small. The source of the differences that can come from less homogeny samples of pasteurized milk and evaporation that occurs during the process of pasteurization. Based on the results presented above indicate that the treatment temperature and time of heating has no effect on SNF without fat milk, either on SNF without SNF Karangploso VCU or on Pujon VCU.

The Comparison of the Quality of Fresh Milk and Milk Pasteurization

Comparative quality of fresh milk and pasteurized milk that comes from Karangploso VCU and Pujon VCU can be seen in Table 9. Pasteurized milk is milk that is heated at 62 ˚ C for 30 minutes. The combination of temperature 62 ˚ C for 30 minutes of heating used for pasteurized milk in this study, a combination of temperature and time of heating is most effective to kill bacteria suspected pathogens, reducing more than 99% of bacteria and does not damage the milk fat content, protein and materials nonfat dry.

Another reason that can support the use of temperature 62 ˚ C for 30 minutes in the process of pasteurization is to report [1] who said pasteurization temperature of 61.7 ˚ C for 30 minutes either heating used in the pasteurization process as it can kill 90.99% bacteria, inactive enzymes, maintains flavor and power of the formation of cream. In the fresh milk Karangploso VCU and Pujon VCU contained coliform bacteria, streptococcus sp and Staphylococcus sp.

CONCLUSION

The heating temperature, 67°C and 72°C are each combined with the time warm 15 minutes, 30 minutes and 45 minutes in the process of pasteurization significantly affect the number of bacteria. The highest temperatures as few remain bacteria in the milk. Pasteurization at temperatures 62°C for 15 minutes is producing the number of bacteria largely. Pasteurization temperature 72°C for 45 minutes produces the least amount of bacteria. Each combination of temperature and time of heating is used in the pasteurization process to kill more than 99% of bacteria.

Pasteurized milk at temperature 62°C for 15 minutes has not been able to free milk from suspected bacterial pathogen as in the milk was found coliform bacteria and streptococcus sp unknown pathogen species or apathogen. Heating milk at temperature 62°C for 30 minutes can release the suspect milk from bacterial pathogens.

The temperature of 62°C, 67°C, and 72°C each of which combined with long heating 15 minutes, 30 minutes and 45 minutes in the pasteurization process does not affect the levels of fat, protein and SNF.

Pasteurization temperature 62°C with 30-minute long heating temperature and time of heating is better used to reduce> 99% of bacteria, killing all bacteria and does not damage the suspect pathogen and reduce levels of fat, protein and SNF. Based on the results obtained and the results of previous research experts, the use temperature of 62°C for 30 minutes in the process of pasteurization can be recommended.

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