International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.10 No.7, pp 611-615, 2017

Chemical and Microstructure Characteristics of Dangke at Various of Temperature Ripened

Syahriana Sabil[1]*, Ratmawati Malaka[2], Fatma Maruddin[2]

[1]Science and Technology of Animal Agriculture Study Program, Graduate School, Hasanuddin University, Jalan Perintis Kemerdekaan 10, Makassar 90245- Indonesia
[2]Department of Animal Agriculture, Faculty of Animal Agriculture, Hasanuddin University, Jalan Perintis Kemerdekaan 10, Makassar 90245-Indonesia

Abstract : The characteristics of dangke can be improved by ripening process using *Lactococcus lactis* bacteria (*L. lactis*). The purpose of this study was to analyze the effect of ripening temperature on chemical and microstructure characteristics of dangke with the addition *L. lactis*. The experiment was conducted experimentally using 1% of starter bacteria and ripened during 12 days at 5, 15 and 25ºC. The results showed that the ripening temperature of 5, 15 and 25ºC was significantly different to protein content, fat content and water content of dangke. The results of the microstructural features showed that each ripening temperature has a difference in protein density, fat distribution and presence of water in the dangke. The ripening temperature affects the growing activity of *L. lactis* thus determining the chemical and microstructure characteristics of dangke.
Keywords : dangke, ripening, temperature, *Lactococcus lactis*, chemical, microstructure.

Introduction

Milk is a source of animal protein that is easily damaged and degraded quality. Based on that, the milk needs to get special processing and handling to get to the consumer with good quality. One of the efforts made to maintain the quality is by diversifying milk into cheese. Cheese is a food made from clotting of milk casein separated by whey. The clotting process can generally use acid, heat, radiation, alcohol, or by adding protease enzymes (Susilorini and Sawitri, 2006).

Cheese is one of dairy products that are in great demand now. Cheese is very diverse in the market. The ripening process is one of the factors that determine the type of cheese available. Cheese that does not experience ripening and become a local product of South Sulawesi Selatan, Indonesia is dangke. Characteristics of dangke that formed less dense and high water content. The high water content and fat content of dangke cause long storage is fairly short.

The characteristics of dangke can be improved by ripening process using *Lactococcus lactis* bacteria (*L. lactis*). Ripening gives the opportunity to *L. lactis* to condense the milk proteins, break down the fat, release the water content so that the dangke structure will be denser and compact. *Lactococcus lactis* requires proper growth temperature to work properly. The growth temperature of *L. lactis* is 5-40°C and optimum at 37°C. Malaka (2010) states that cheese ripening can be done at 15-16ºC for 15-30 days or 5ºC for 2-4 weeks.

The exact ripening temperature should be known in order for *L. lactis* to work optimally to improve the characteristics of dangke ripening. *Lactococcus lactis* was fermentation carbohydrate to be produces lactic acid.

Total lactic acid decreases the acidity (pH) so that it will be koagulan of protein. Proteins koagulan will become denser during ripening.

Lactococcus lactis also has the ability to break down fat. Chemical activity in protein clumping and decomposition of fat will release the water content of the dangke. The release of moisture content will result in a harder and more durable dangke. The effects of the use and decomposition of nutrients will change the growing environment of *L. lactis* so that there is a change of microstructure dangke.

Ripening of dangke can be done at 5-40 ° C. The existence of diversity of ripening temperature so that we need to know the exact ripening temperature for *L. lactis* to be able to work optimum to improve chemical and microstructure characteristics of dangke. The purpose of this study was to analyze the effect of ripening temperature on chemical and microstructure characteristics of dangke with the addition of *L. lactis*.

Materials and Methods

This research used fresh and pure milk obtained from Sinjai Regency Dairy Farms South Sulawesi, papaya sap powder, culture of *Lactococccus latcis* Subsp. *Lactis* FNCC-0086 was obtained from the Center for Food and Nutrition Studies of Gadjah Mada University Yogyakarta, aquades, de Man Rugosa sharpe (MRS) agar (Merck), MRS Broth (Merck) and full cream of powder milk (Frisian flag), H_2SO_4, H_3BO_3, HCl and eosin hematoxylin staining. The tools used are incubator, pan, spatula, dangke cast (modification), CD-Shear Force (modification), analytical scale, thermometer, autoclave, oven, showcase and refrigerator.

The experiment was conducted experimentally using bacterial starter 1% with 12 days of ripening at 5, 15 and 25°C. The stages of making a culture starter were modified from Malaka and Sulmiyati research (2010). Full cream milk is reconstituted 10% (w/v) and sterilized at 105°C for 5 minutes. After a mixture cold at 40°C was inoculated 3% of culture and subsequently incubated at 37 ° C. for 36 hours. Activation is done 2 times before used as starter in making dangke ripened. The stage of making the papain solution is the freeze papaya sap and then dried using freezedryer for 50 hours (Fatma et al., 2012). The crude papain to be used is first diluted with sterile aquades ratio 1: 100 (w/v).

Stages of making dangke modified from Irfan research (2016). Fresh milk 500 mlwas heated to 40°C and added 0.2% papain solution. The heating temperature of the mixture was increased to 95°C maintained for 5 minutes. The curd filtration process for 5 minutes is carried out after the temperature reaches 70°C. Curd formed molded and pressed 2 kg for 3 minutes, when it was also done the process of whey expenditure. Curd dangke is left in the mold for 20 minutes to maximize whey expenditure.

Starter Giving modified from Malaka and Sulmiyati (2010). Dangke injected starter as much as 1% (v/w) of dangke weight. Injection volume is spread on 5 sides of dangke. Dangke is subjected to 5, 15 and 25ºC for 12 days each. The parameters observed were protein content, fat content, water content and microstructure of dangke (AOAC, 2005).

Chemical data obtained were processed statistically by using variance analysis. The treatment that has significant effect will be tested further by using the smallest real difference test (Gasperz, 1994). The microstructural data were processed by description (Ohashi et al., 1978; Ohashi et al, 1983 modified by Malaka (1997).

Results and Discussion

The results of chemical characteristics (Table 1) showed that the treatment of ripened temperatures (5,15 and 25ºC) was significantly effect ($P<0.01$) on protein content, fat content and water content of dangke. Further test results showed that the ripening temperatures (5,15 and 25ºC) was significantly different ($P<0.05$) on protein content, fat content and water content of dangke.

Table 1: Chemical characteristic of dangke

Chemical characteristics	Temperatures of ripened		
	5ºC	15ºC	25ºC
Protein content (%)	24.98±0.07[a]	19.70±0.02[b]	14.30±0.01[c]
Fat content (%)	2.26±0.07[a]	16.72±0.05[b]	11.00±0.08[c]
Water content (%)	51.15±0.04[a]	57.25±0.07[b]	65.27±0.02[c]

Note: Means in the same rows with different [abc]superscripts differ significantly (P<0.05).

The results of the microstructural picture (Fig. 2.) showed that the temperature of each ripened has a degree of difference in protein density, fat distribution and presence of water in the dangke peram. The high ripened temperature indicates a wider cross section and unexplained fatty globules. The lower ripening temperature has a denser protein matrix, smaller cross sections and fatty globules are evenly spread out.

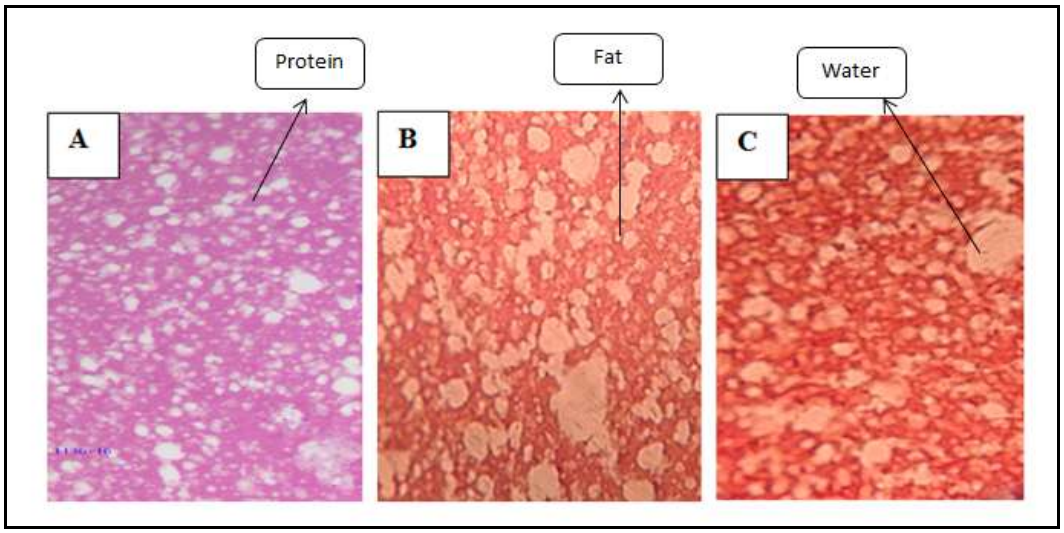

Fig 1. Microstructure characteristics of dangke, A) temperature ripened 5ºC, B) temperature ripened 15ºC and C) temperature ripened 25ºC

Chemical characteristics of dangke can be determined based on protein, fat content and water content that will be envisaged in microstructure. The ripened provides an opportunity for *L. lactis* to undertake the breakdown proteins of dangke, fat and water released. The ripened temperature determines the growing ability of *L. lactis* to performed chemical processes of food. *Lactococcus lactis* more rapided reaches adaptation phase but also faster experienced death at high ripened temperature (approaching optimum growth temperature). The low ripened temperature (5°C) inhibits the activity of *L. lactis* so that it takes longer to died.

Perotein content of dangke was strongly influenced by the nutritional content of dangke and the activity of *L. lactis*. As reported by Rahman et al. (1992), that insoluble proteins will dissolve at the time of ripenied because has enzyme and microbial activity. The protein content of dangke was determined by the nature of protein coagulation and the body structure of the bacteria. The protein content of dangke at 5°C ripened was the highest protein content (24,98%). The protein content of dangke can be said to meet the standards for the cheese classes. This is consistent with the reported by Kusnandar (2010), the cheddar cheeses had 24.9% protein content.

The calculated protein content was derived from the dangke protein coagulation and from body of *L. lactis*. Gaman and Sherrington (1992) reperted, that microorganisms had a high protein content and potency as a valuable protein source. The presence of protein content of milk and body of *L. lactis* so that the protein content of dangke can decrease and increase in accordance with bacterial activity. Bacterial activity also affects the fat content of dangke.

Milk fat can be broken down by bacteria resulted in hydrolysis. The reaction of fat hydrolysis to fatty acids and glycerol by lipase enzymes. The enzyme is derived from *L. lactis* and is naturally present in milk. Bachrudin et al. (2000) reported, that *L. lactis's* role in cheese maked was to produced acids and flavors, aiding

the formation of curds and producing important lipolytic and proteolytic enzymes in cheese ripened. Ripened reduces fat content because had enzyme decomposition. Rahman et al. (1992) reported, that ripened allows the breakdown of fat to form a distinctive, specific flavor, texture and appearance in cheese.

The lowest fat content was at the 5°C (2.26%) and will be higher as the ripened temperature increased. The low ripened temperature inhibits the growth of *L. lactis* so that the resulted overhaul activity was lessed. The factor growth activity of *Lactococcus lactis* determines the ability to produced enzymes and performs fatty hydrolysis. Besides influenced by hydrolysis process, fat content can also be influenced by fat content of raw milk raw material (3,8%). Decomposition of fat and protein will released the water content of dangke.

Chemical reactions had the involved water content was polymerization reactions and hydrolysis of macromolecule components such as carbohydrates, fats and proteins. Kusnandar (2010) reported, that any reaction of bond formation of one monomer with another monomer will free one water molecule. During the ripened wolud form gelatinisasi or coagulation protein dangke and fat reshuffle so that will occur release of water content. Chemical reactions that occur affect the microstructure dangke.

Microstructure is an overview of microscopic dangke components. The lower of ripened temperature was the more formed compact structure. The ripened would form a more compact cheese structure characterized by the incorporation of casein molecules into clear three-dimensional structures between casein, fat globules and water.

A collection of solid matrices connected globules was a protein matrix. Anderson and Mistry (1993) reported, the typical microstructural feature of cheese was structured filled with most of the protein matrix with a small amount of fat globules dispersed within the matrix. The cheddar cheese was had a compact protein matrix state and was fat globules are more evenly distributed.

Conclusion

The ripened temperature affects the growing activity of *L. lactis* in determining the chemical characteristics of dangke through the process of protein coagulation, fat reshufflied and the discharge water content of dangke. The ripened temperature provides an overview the microstructure characteristics of dangke on the protein density, the spread of fat globules and the water cross-sectional.

References

1. Anderson D.L. and Mastry V.V., Reduce fat Cheddar Cheese from condensed milk, The South Dakota Agricultural Experiment Station, South Dakota, 1993.
2. AOAC, Official Methods of Analysis of The Association of Analytical Chemists, Benyamin Franklin Station, Washington D.C., 2005.
3. Bachrudin Z., Astuti and Dewi Y.S., Isolasi dan Seleksi Mikroba Penghasil Laktat dan Aplikasinya pada Fermentasi Limbah Industri Tahu, Makalah disampaikan pada Seminar Nasional Industri Enzim dan Bioteknologi, 2005.
4. Fatma, Soeparno, Nurliyani, Hidayat C. and Taufik M., Karakteristik limbah whey dangke dan potensinya sebagai produk minuman dengan menggunakan *Lactobacillus acidophilus* FNCC 0051, Journal Agritech, 2012, 32(4), 352-361.
5. Gaman P.M and Sherrington K.B., Ilmu Pangan: Pengantar Ilmu Pangan, Nutrisi dan Mikrobiologi Edisi Kedua. Gadjah Mada University Press, Yogyakarta, 1992, 75-106.
6. Gaspersz V., Metode Rancangan Percobaan, C.V. Arminco, Bandung, 1994.
7. Irfan M., The Quality of Microbiologic and Microstructur of Dangke in Dry Papaya Latex and Different Heating Temperature, Makassar, Universitas Hasanuddin, 2016, 47-65.
8. Kusnandar F., Kimia Pangan: Komponen Makro. PT. Dian Rakyat, Jakarta, 2010, 33-130.
9. Malaka R., Effect of Curdlan, A. Bacteria Pollysacharide On The physical Fermentation, Japan: Faculty of Agriculture Miyazaki University, 1997.
10. Malaka R., Pengantar Teknologi Susu, Penerbit Masagena Press, Makassar, 2010, 59-70.
11. Malaka R. dan Sulimiyati, 2010. Physical and Organoleptic Characteristics of Markisa Cheese at Various Levels of Starter and Storage Time. Jurnal Ilmu dan Teknolgi Peternakan UNHAS Makassar

(JITP), 2010, 824-831.
12. Ohashi T., Nagai S., Masaoka K., Haga S., Yamauchi K. and Olson N.F., Physical properties and microstructure of cream cheese, Nippon Shokugin Kogyo Gakkaishi, 1978, 30(5), 303–307.
13. Ohashi T., Haga S., Yamauchi K. and Olson N.F., Scanning electron microscopy of casein micelle network in milk rennet curd, J. Zootech Sci., 1983, 54(8), 479 – 481.
14. Rahman A., Fardiaz S., Rahayu W.P. and Nurwitri C.C, Teknologi Fermentasi Susu. Departemen Pendidikan dan Kebudayaan Direktorat Jenderal Pendidikan Tinggi Pusat Antar Universitas Pangan dan Gizi, Institut Pertanian Bogor, Bogor, 1992, 25-76.
15. Susilorini T.E. and Sawitri E.M., Produk Olahan Susu, Penebar Swadaya, Jakarta, 2006, 68-96.

*****