Could Calcium Silicate Powder Prevent Mastitis in Dairy Farm?

Arman Deskiharto
Center for Tropical Animal Studies - IPB University
Bogor, Indonesia
rayschwarz@ymail.com

Asep Rakhmat
Center for Tropical Animal Studies - IPB University
Bogor, Indonesia
asepr40@gmail.com

Deddy Cahyadi Sutarman
Center for Tropical Animal Studies - IPB University
Bogor, Indonesia

Eko Sugeng Pribadi
Department of Infectious Diseases and Veterinary Public Health
Faculty of Veterinary Medicine - IPB University
Bogor, Indonesia

***Abstract*—Mastitis is still a serious problem in dairy cows industry because mastitis cause farmers will decrease milk production. This paper described the Calcium Silicate (CaSi) powder application as dairy cow bedding and their impact to dairy cow health. Indirect somatic cell count test (IPB-1 test) has applied to inform the prevalence of mastitis in dairy cow population on farm and to diagnose mastitis in experimental dairy cows. Experimental dairy cows were average 5 year-old and in 3rd lactation. The results showed that manure moisture on flour cage was reduced significantly with application of 500 gram CaSi powder on flour cage, but milk production was not. Mastitis prevalence in farm is 54.29% and 8 from 9 experimental dairy cows was diagnosed mastitis. Experimental dairy cows with application of 500 gram CaSi powder on flour cage showed fewer dairy cows were diagnosed mastitis. The conclusion is the application of CaSi powder can reduce water in manure so that it interferes the growth of pathogenic microorganisms that can cause udder inflammation.**

Keywords—Calcium Silicate, dairy cow, bedding, mastitis

I. INTRODUCTION

Milk production growth in Indonesia at 2017 is 920.09 ton of milk, which is increase of 0,81% from 2016 (Agustina, 2016). Milk consumption in 2017 was 977.67 ton and consumption demand is forecasted at 2021 will be at 1.13 million tons of milk (Agustina, 2016). Thus, there is still lacked between domestic milk supply around 2% per year and milk consumption growth more than 5% per year (Agustina, 2016). Dairy cows in Indonesia at 2017 was 544.790 heads. East Java have largest dairy cow population by 252.680 heads or 49.66% of dairy cow population in Indonesia and West Java have dairy cow population by 126.690 heads or 24.9% of dairy cow population in Indonesia (Agustina, 2016). National milk demand mostly is provided by import more than 90% which is increase of 2.83% per year at 2012-2016 (Agustina, 2016). With this total population, Indonesia will not be able to provide national's demand on dairy milk, it is needed to increase amount of dairy cows in Indonesia. Besides add more population, also needed technology and better management to increase total dairy milk supply.

Tropical country like Indonesia can be a very good environment for bacteria to grow (Ahmad 2011). Bacteria can infect its host and cause a disease. The host can be human or animals. Dairy cows in lactating phase can be perfect host for bacteria such as *Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus dysgalactiae, Streptococcus agalactiae dan Streptococcus uberis, Streptococcus dysgalactiae, Escherichia coli* (Nurhayati 2014). All of these bacteria cause mastitis disease. Besides bacteria, environment, management and feed also known as factor that may cause mastitis disease (Nurhayati and Martindah 2015). According to Dayarti (2016) a research which condudcted in West Bandung using 18 dairy cows farmer with total of dairy was 80 heads and 320 samples found 32.5% subclinical mastitis.

Calcium Silicate ($5CaO.6SiO_2.5H_2O$) has many functions for material industry such as good sealing correlated to expansion, and the ability to set in the presence of fluids, bioactivity to release of ions acting as epigenetic signals and good biological properties (Gandolfi et al., 2014). Calcium silicate (CaSi) predicted can absord water and prevent mastitis in dairy cow.

II. MATERIALS AND METHODS

A. Experiment preperation

The dairy cow experiment was started from December 2018–February 2019. Experiment for dairy cow are conducting at Demo Farm KPSBU, Lembang. The materials used were nine of fourty one Holstein Friesian strain dairy cow, concentrate for dairy cows, forages, CaSi soft powdery granule, and IPB-1 reagent and paddle test.

B. Experimental lay-out

Dairy cows divided into three treatment group that consist of three dairy cows for each treatment group. The treatment group defined as Group 1 with rubber mattress floor (control group); Group 2 with rubber mattress floor and 100 g CaSi powder (spread evenly); and Group 3 with rubber mattress floor and 500 g CaSi powder (spread evenly). CaSi powder was spreded after milking and given twice a day because milking was done twice, namely at 5:00 a.m. and 5:00 p.m. During trial there was not

medicated and after trial was done medicated to dairy cow with severe mastitis condition

C. Mastitis examination

Before experiment, mastitis examination was performed to all dairy cows on farm. Examination aims was to determine mastitis prevalence on farm. Examination used IPB-1 Mastitis Test. Fourty one dairy cow were taken milk sample before milking at 5.00 a.m. Milk sample put in paddle test by adding a IPB-1 Mastitis Test reagent. For dairy cows used were physical examinated and microbiological tested to diagnose mastitis condition at 1-days trial and 15-days trial. Physical examinated to know udder clinical change and microbiological tested to know microorganism infection in milk.

D. Sample collection and laboratory analysis

Every week, manure sample were collected before milking at 5.00 a.m. Manure were taken from on cow bedding. Manure were collected 200 gram from each dairy cow. Manure sample were process to analysis of moisture at Livestock Nutrition Laboratory, Faculty of Animal Husbandry, IPB University.

E. Statistical analysis

Manure moisture data collected from this study were analyzed using analysis of variance (ANOVA) and Duncan Multiple Range Test (DMRT).

III. RESULTS

A. Manure moisture

Tabel I present manure moisture during experiment. Manure moisture were significantly different (P<0.05) at 15-days. Group T1 had highest manure moisture (85.10±0.12 %) and Group T3 had lowest manure moisture (80.59±0.83 %). Highest manure moisture means manure wetter condition and lowest manure moisture means manure drier condition.

TABLE I. DAIRY COW MANURE MOISTURE DATA COLLECTED FROM DAIRY FARMS

Treatment Group	Manure moisture (%)		
	1-days	*8-days*	*15-days*
T1	85.45±0.65	85.85±1.06	85.10±0.12 [c]
T2	85.23±0.12	83.09±0.48	83.02±0.92 [b]
T3	84.96±1.62	82.41±1.76	80.59±0.83 [a]

Remark: *In the same column with a different superscript means differ significantly (P<0.05); ** In the same column not superscript means there not differ significantly

B. Mastitis examination

Mastitis examination in farm was 54.29 % were sub-clinical mastitis. Based on Tabel II known that all dairy cows used in this examination were diagnosed sub-clinical mastitis at 1-days trial. This diagnosis based mastitis test, used IPB-1 Mastitis Test, and clinical examination, used physical examination and microbiological test. At 15-days trial, all dairy cows used were examined again for mastitis. Examination result at 15-days present in Tabel II. Based on Tabel II known that dairy cows in Group T3 be better for mastitis condition. T3.3 cow showed negative result for mastitis at 15-days

TABLE II. MASTITIS DIAGNOSIS ACCORDING IPB-1 TEST AND CLINICAL DISORDER

Treatment cow	IPB-1 Mastitis Test		Clinical Examination	
	1-days	*15-days*	*1-days*	*15-days*
T1.1	+	+	++	+
T1.2	+	+	+	+
T1.3	++	-	+	+
T2.1	++	+	++	+
T2.2	+	+	+	+
T2.3	-	-	+	+
T3.1	+	-	++	+
T3.2	++	+	+++	+
T3.3	++	-	+	-

Remark: mastitis diagnosis; (-) negative, (+) mild conditions, (++) moderate conditions, (+++) severe conditions

IV. DISCUSSION

Based on Table I known that treatment Group T3 with spreading 500 g CaSi powder was significantly reduced moisture from manure at 15th day. It mean that CaSi powder absorb more water form manure and make bedding drier. Reich *et al* (2010) explained that dry environment will make cow spend more time to lying down and will cause to increase feeding time.

Mastitis is still a serious problem in dairy cows industry because mastitis can cause farmers to lose their income due to loss of milk yield. Therefore, the incidence of mastitis was a major concern during the experiment. Mastitis is inflamation of udder that characterized by udder physical changes (lumpy and/or yellowish milk), increasing somatic cell count in milk (Sudarwanto et al., 2006; Vasilev et al., 2007), and presence of pathogenic microorganism infection (Vasilev et al., 2007). Based on this experiment known that sub-clinical mastitis prevalence on farm were lower than sub-clinical mastitis on West Java by 70,99% (Pisestyani, 2017)

Based on Tabel II known that dairy cow in with treatment CaSi powder on bedding are more reduced mastitis level, and some even recover (treatment cow T3.3). Dairy cow in Group T3 showed more reducing mastitis condition based on mastitis test and clinical examination. Treatment of CaSi powder on bedding made manure drier so manure on bedding were difficult to attached on dairy cow skin and reduced dirtness on dairy cow. Cow with low dirtiness had lower somatic cell count and pathogenic microorganism (Vasilev et al., 2007)

ACKNOWLEDGMENT

This research was supported by Taiheiyo Cement Corporation, Daiba Garden City Building, 2-3-5, Daiba, Minato-ku, Tokyo. The author also would like to acknowledge Center for Tropical Animal Studies (CENTRAS), North Bandung Cooperative of Cow

Husbandry (KPSBU), and Livestock Nutrition Laboratory, Faculty of Animal Husbandry, IPB University.

REFERENCES

[1] R.Z. Ahmad, Mycotic Mastitis in Indonesia, Seminar Nasional Teknologi Peternakan dan Veteriner, pp. 403-410, 2011.

[2] T. Agustina, Outlook Susu Komoditas Pertanian Subsektor Peternakan, Jakarta: Pusat Data dan Sistem Informasi Pertanian Sekretariat Jenderal Kementerian Pertanian Republik Indonesia, 2017, pp. 1-16.

[3] M. Dayarti 2016, Evaluasi Penerapan *Good Milking Practice* Terhadap Timbulnya Mastitis Subklinis di Kabupaten Bandung Barat dan Kuningan,Thesis, IPB University, 2016.

[4] M.G. Gandolfi,F. Siboni,T. Botero, M. Bossu, F. Riccitiello, C. Prati, Calcium silicate and calcium hydroxide materials for pulp capping: biointeractivity, porosity, solubility and bioactivity of current formulations. J. Appl. Biomater. Funct. Mater., vol. 13(1) pp. 43-60, March 2015.

[5] I.S. Nurhayati, Kajian Pengendalian Mastitis Subklinis Melalui Pemberian Anbiotik pada Saat Kering Kandang di KPSBU Lembang Jawa Barat, Thesis, IPB University, 2014.

[6] I.S. Nurhayati and E. Martindah, Pengendalian Mastitis Subklinis melalui Pemberian Antibiotik Saat Periode Kering pada Sapi Perah, Journal Wartazoa, 25(2), pp. 65-74, 2015.

[7] H. Pisestyani. Pengembangan Prototipe Alat Celup Puting untuk Pencegahan Mastitis Subklinis pada Sapi Perah di Indonesia, Dissertation, IPB University, 2017.

[8] L.J. Reich, D.M. Weary, D.M. Veira, and M.A.G. Von Keyserlingk, Effects of sawdust bedding dry matter on lying behavior of dairy cows: A dose-dependent response, J. Dairy Sci., vol. 93(4), pp. 1561–1565, 2010.

[9] M. Sudarwanto, H. Latif, and M. Noordin, The Relationship of The Somatic Cell Counting to sub-clinical Mastitis and to Improve Milk Quality, 1st International AAVS Scientific Conference Jakarta, pp 78-82, July 2006.

[10] N. Vasilev, D. Dinev, Y. Mitev, M. Koleva, and Ch. Miteva, Hygiene Status Of Dairy Cows Reared In A Spacious Building And Resulting Quality Of Produced Milk, Trakia J. Sci., vol. 5(1), pp. 47-51, 2007.