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The Reduction of Aerobic Bacterial Counts of Bovine Milk as Influenced By Heat-Treatments at Pasteurisation Temperatures

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Abstract
A number of experiments were conducted to evaluate the bacterial reduction of milk as influenced by the heat treatments at pasteurisation temperature (72 °C for 15 s) considering the Indonesian Standard for raw milk values. The milk samples were collected from dairy farmers in Semarang, Salatiga and Boyolali, Central Java, Indonesia. The heat treatments were conducted in 45 mL glasses bottles dipped in water bath. Considering the temperature histories of the experiments and the bacterial counts, nine of twenty samples indicated their reductions were less than 2 logs cycle standardised although the initial numbers were surprisingly less than $1 \cdot 10^6$ cfu·mL^{-1}.

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Keywords: aerobic, bacterial counts, bovine milk, heat-treatment, pasteurisation

Introduction

Central Java contributes in supplying raw milk for national consumption. The supply has been increased approximately 2.34 % p.a. by population growth of 5.8% p.a. [1,2]. The most volume of milk are further processed to final products e.g. pasteurised and UHT milks by national dairy industries. Many of them are processed by regional dairy industry into products marketed for regional consumers. Some of them are directly accessed by the consumers as raw milk and cooked at households prior to consumption.

There were some poisoning outbreaks after milk consumption reported [3,4]. A further study indicated that outbreaks were due to high bacterial contents present in milk, including pathogens. Quality standards for raw milk as well as that for ready to consume standard had been set by the National Standardisation Agency of Indonesia. Concerning the bacterial quality, the standards for both the milk are $1 \cdot 10^6$ cfu·mL^{-1} [5] and $1 \cdot 10^4$ cfu·mL^{-1} [6] respectively. In addition, pathogen is obligatory absent in the ready to consume milk. The quality of raw milk is under responsibility of

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farmers whereas the later is under either the dairy industries or the household processors which are usually act also as consumers. The later quality could be achieved by heat-treatment as the most popular method in food processing and preservation. Since the heat-treatments are compulsory for milk prior consumption, a serious concern to the efficiency of the treatment to the bacterial quality is necessary.

This work was aimed to evaluate the efficiency of heat-treatments at pasteurisation temperature (72 °C for 15 s) considering the High Temperature Short Time pasteurisation method [7]. The method was applied on several milk samples collected from milk producing regions in Central Java i.e. Semarang, Salatiga and Boyolali. The work is beneficial in supplying an information as a basis for developing a precise heat-treatment resulting in qualified ready-to-consume milk considering the National Standardisation Agency of Indonesia. At end-point of food chain, the qualified milk meets the issue in food safety of local and regional consumer.

Materials and Methods

Samples collection

Milk samples were collected from Salatiga city, Semarang regency and Boyolali regency, all located in Central Java, Indonesia. The conditions of transportation as well as the storage prior further treatments and analysis were set to a temperature limiting the bacterial growth (5 °C).

Heat-treatment

Soon after arrived in the laboratory, the samples were heat-treated at pasteurisation temperature (72 °C for 15 s) in accordance with High Temperature Short Time treatments pasteurisation [7]. The treatments were carried out on the milk containing 45 mL glass bottles dipped in a water bath. The temperature histories during the treatments were recorded by a data logger.

Bacterial enumeration

The bacterial counts were enumerated by mean of spread-plate method on 9 cm Nutrient Agar and incubated for 48 h at 30 °C prior to calculation (Equation 1) [8].

$$\bar{c} = \frac{\sum c}{n_1 \cdot 1 + n_2 \cdot 0.1} \cdot d \qquad \text{Equation 1}$$

c : mean of bacterial counts

$\sum c$: total of bacterial counts observed on all plates used

n_1 : number of plates at the lower dilution step

n_2 : number of plates at the higher dilution step

d : dilution factor