SEMINAR

# Lactic Acid Bacteria and Culture Collection : Their Role in Food, Health, Industry and The Important of Management of Culture Collection

16 – 17 Januari 2009

Auditorium Faculty of Agricultural Technology
Gadjah Mada University
Yogyakarta, Indonesia

Organized by :

ISLAB (Indonesian Society of Lactic Acid Bacteria)
FORKOMIKRO (Communication Forum of Indonesian Culture Collection Curators)
Center for Food and Nutrition Studies, Gadjah Mada University
Department of Food and Agricultural Product Technology
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In collaboration with :
PERMI (Indonesian Society for Microbiology)
PATPI ( Indonesan Food Technologist Association ) branch Yogyakarta

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*Seminar Lactic Acid Bacteria and Culture Collection : Their Role in Food, Health, Industry and the Important of Management of Culture Collection. Yogyakarta January 16-17th, 2009*
*Gadjah Mada University, Indonesia*

# THE EFFECT OF LACTIC CULTURE HOMOGENIZATION ON COTTAGE CHEESE YIELD

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## ABSTRACT

*Cottage cheese industry has a problem especially on the culture agglutination during manufacture of the cheese. Long chains of lactic culture falling down to the bottom of the vat could decrease the yield of cottage cheese. In this study, skim milk homogenization at 7 (single stage), 71 and 176 kg/cm² (dual stage, 35 kg/cm² second stage) was used in the manufacture of cottage chesese. Each lot of skim milk manufacture d into cottage cheese was inoculated with lactic culture M30. Bulk starter of lactic culture M30 was homogenizedat 0, 35 (single stage), 106 and 246 kg/cm² (dual stage, 35 kg/cm² second stage). The used of 4 different bulk starters with 3 different skim milk treatments produced a total of 12 bulk starter skim milk treatment combinations. All 12 bulk starter skim milk treatment combinations were randomized prior to their manufacture. The experiment was replicated four times in the manufacture of 48 vats of cottage cheese.*

*Either homogenization of skim milk at 71 kg/cm² (dual stage, 35 kg/cm² second stage) or greater or homogenization of bulk culture at 246 kg/cm² (dual stage, 35 kg/cm2 second stage) reduced yield loss. Correlations were made between severity of agglutination determinants and yield loss. This research outlines the procedures that a cottage cheese manufacture can use to determine the severity of agglutination occurring in his vats. Once the severity of agglutination has been determined the manufacturer can estimate the yield loss in his plant by using correlation figures provided by this research. Calculation of yield loss and economic loss can then be computed.*

## INTRODUCTION

Cheese yield and quality are the mayor factors wich cheesemakers are concerned about during the manufacture of cheese. Factors that influence both yield and quality are: casein and Fat content of milk (Van slyke & Price, 1949; Gilles and Lawrence, 1985), handling of curd (Kosikowski, 1963), heat treatment and pH of milk (White and Ray, 1977), culture media (Hicks, et al. 1985; Ustunol et al., 1986), starter culture (Richardson et al. 1983; Ekart et al. 1986; Stoddard and Richardson, 1986), homogenization of the skim milk (Grandison et al., 1986a and 1986b), and food additives such as lecithin (Billy, 1981; Hicks et al., 1985). When cheese yield losses are reduced, the constituent in the whey are reduced which decreased waste disposal problems.

Agglutination causes sediment on the bottom of the vats during curd formation in the manufacture of cottage cheese. The low ph of the sediment indicates that most of the starter bacteria are in the sediment. The severity of agglutination varies with



ISBN : 978-979-19546-0-0

milk source and strains of lactic starter culture used (Jago and Swinbourne, 1959). Wright and Trammer (1957) reported that slow (agglutination susceptible) starters, which have higher activity in homogenized skim milk form a deposit on the bottom of the test-tube after 6 hour at 30°C; whereas, fast (agglutination resistant) starters do not form a deposit. Stadhouder (1963) confirm that agglutination susceptible strains of starter may result in deposit formation in raw or pasteiurized skim milk, and that acid production by agglutinating strains is retarded in unheated skim milk.

In manufacturing cottage cheese, agglutination of certain lactic starters can be detected. Hicks et. al. (1989) developed methods to detect agglutination in cottage cheese vats. Using comparisons between top and bottom sample for lactic Lactococci counts, pH, and percent total solids, they suggested that total solids was a more effective and sensitive method than pH differentials or bacterial enumeration for detecting slight agglutination in commercial cottage cheese vats.

In homogenizer of the common type, milk is brought under a high pressure and forced trough a very narrow opening, usualy a slit in a spring-loaded valve. The pressure fluctuations in liquid disrupt particle such as fat globules into small size, increasing the surface area of the fat about six-fold. Homogenization of the skim milk before addition of starter reduced agglutination of bacteria during the early stages of acid development and eliminated minor sludge formation. Curd yield increased by up to 5% and average manufacturing time was reduced by 40 min following homogenization (Grandison, et al. 1986).

Jose et al. (1989) showed that homogenization of medium prior to addition to addition of culture increased clumping of the bulk starter cells, but homogenization of finished bulk starter reduced culture chain length and severity of agglutination in skim milk. They suggested that agglutination was most inhibited when bulk culture was homogenized only after the bulk starter had reached the desired pH. Milton et al. (1989) reported that homogenization of bulk culture increased bacterial count (cfu/ml) and prevented agglutination by breaking apart long bacterial chains and aggregates associated with agglutinating cultures. They found that homogenization decreased starter bacteria sediment and recommended that all bulk cultures be homogenized at a pressure of 176 kg/cm$^2$ (dual stage, 35 kg/cm$^2$ second stage).

## MATERIAL METHODS

In this study, skim milk homogenization at 7 (single stage), 71 and 176 kg/cm$^2$ (dual stage, 35 kg/cm$^2$ second stage) was used in the manufacture of cottage chesese. Each lot of skim milk manufactured into cottage cheese was inoculated with lactic culture M30. Bulk starter of lactic culture M30 was homogenizedat 0, 35 (single stage), 106 and 246 kg/cm$^2$ (dual stage, 35 kg/cm$^2$ second stage). The used of 4 different bulk starters with 3 different skim milk treatments produced a total of 12 bulk starter skim milk treatment combinations: All 12 bulk starter skim milk treatment combinations were randomized prior to their manufacture. The experiment was replicated four times in the manufacture of 48 vats of cottage cheese.

**Table 1.** Effect of skim milk homogenization on dry matter cheese yield when skim milk was set with lactic culture M30

| SMH kg/cm² | DMYLD LSMEANS | P t comparison of all means | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| 7 | 3.11 | --- | 0.0001 | 0.0001 |
| 71 | 3.25 | | --- | 0.0343 |
| 174 | 3.32 | | | |

C.V. = 2.24 ; SMH = skim milk homogenization; DMYLD = dry matter cheese yields (kg/100 kg skim milk)

**Table 2.** Effect of bulk culture homogenization on dry matter cheese yield when skim milk was set with lactic culture M30

| BCH kg/cm² | DMYLD LSMEANS | P t comparison of all means | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| 9 | 3.10 | --- | 0.0024 | 0.0001 | 0.0001 |
| 35 | 3.22 | | --- | 0.2167 | 0.0069 |
| 106 | 3.24 | | | --- | 0.1045 |
| 246 | 3.32 | | | | --- |

C.V. = 2.24; BCH = bulk culture homogenization; DMYLD = dry matter cheese yields (kg/100 kg skim milk)

## RESULT AND DISCUSSION

Dry matter cheese yield increased linearly (p .0001) (Table 1) as the homogenization pressure applied to skim milk increased. No significant increase in dry matter cheese yield occurred when skim milk was homogenized at a pressure greater than 71 kg/cm² (dual stage, 35 kg/cm² second stage). Dry matter cheese yield also increased (p0001) as the pressure of homogenization applied to bulk culture increased (Table 2)

No significant increase of dry matter cheese yield occurred when homogenization pressure applied to bulk culture increased from 35 kg/cm² (single stage) to 106 kg/cm² (dual stage, 35 kg/cm² second stage). Also, no significant increased of dry matter cheese yield occurred when homogenization pressure applied to bulk culture increased from 106 kg/cm² (dual stage, 35 kg/cm² second stage) to 246 kg/cm² (dual stage, 35 kg/cm² second stage).

## CONCLUSION

Either homogenization of skim milk at 71 kg/cm² (dual stage, 35 kg/cm² second stage) or greater or homogenization of bulk culture at 246 kg/cm² (dual stage, 35 kg/cm² second stage) reduced yield loss. Correlations were made between severity of agglutination determinants and yield loss.

This research outlines the procedures that a cottage cheese manufacture can use to determine the severity of agglutination occurring in his vats. Once the severity of agglutination has been determined the manufacturer can estimate the yield loss in his plant by using correlation figures provided by this research. Calculation of yield loss and economic loss can then be computed

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Sebagai Peserta Seminar
Lactic Acid Bacteria & Culture Collections:
Their Role in Food, Health, Industry and the Important of Management of Culture Collection

Yogyakarta, 16 - 17 Januari 2009
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