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# A COMPARATIVE STUDY ON CHEESE PRODUCTION AND RIPENING

BY  
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A THESIS



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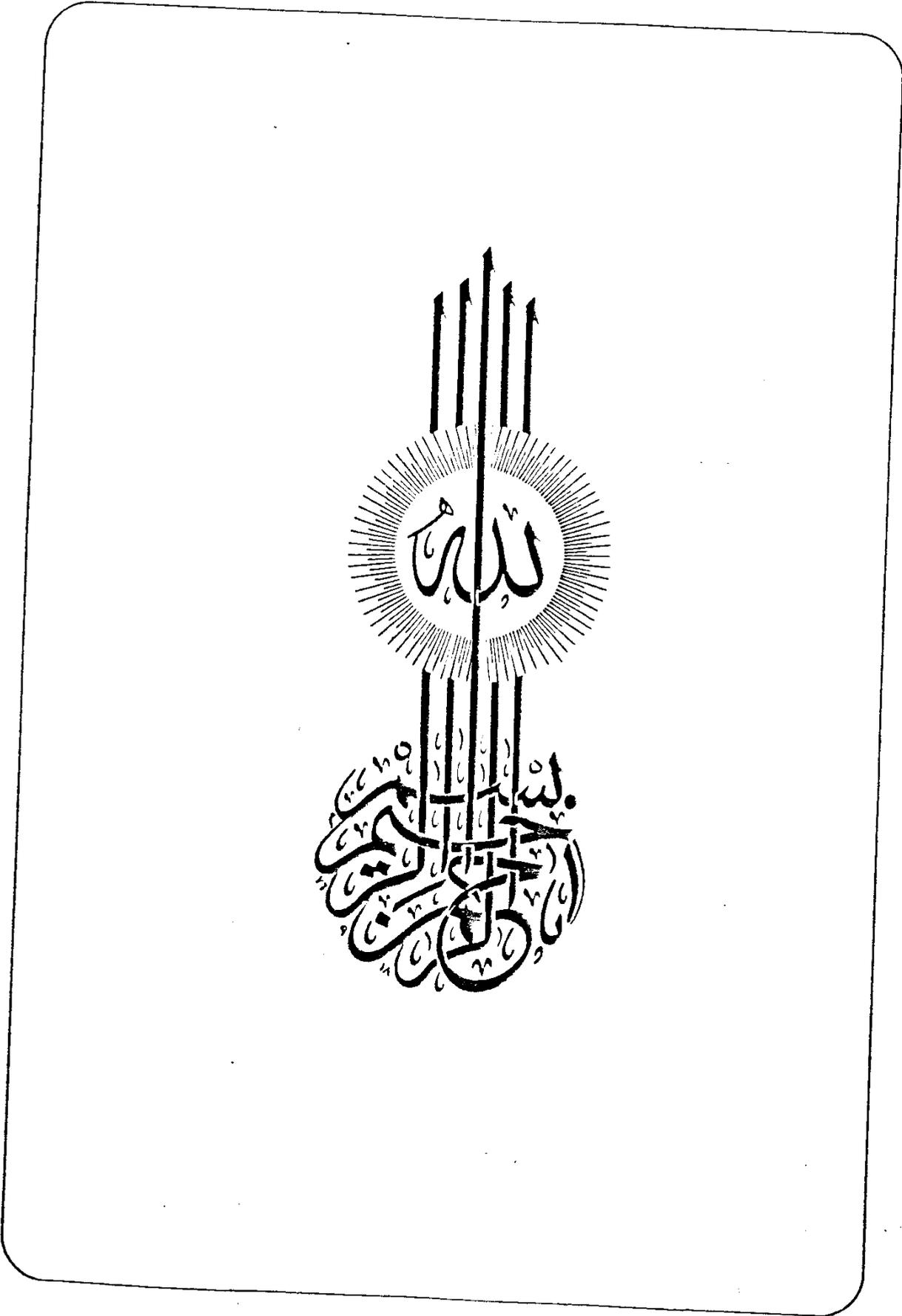


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## APPROVAL SHEET

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# INTRODUCTION

## INTRODUCTION

Cheese ripening is a complex process involving partial breakdown of the curd mainly by proteolysis and lipolysis to give rise to flavour and texture changes typical of the different cheese varieties. Ras cheese ripening period ranges from 4-6 months to secure its characteristic flavour . The acceleration of flavour development in Ras cheese , the main national hard type , has been approach by several workers ( Hofi *et al.*, 1973 a, b, c; Nassib 1974 ; El Erian *et al.*, 1977 ; Abd El- Salam *et al.*, 1978 , 1979 ; Soliman *et al.*, 1980 ; El- Soda *et al.*, 1981, 1982, 1985; El- safty *et al.*, 1983 and Badawy 1987 ).

Liquid buffaloes' milk constitutes about 66 % of the national milk supply , thus its presence in our dairy products is quite well expected. However its use in hard cheese making has been subject to some undesirable comments ( Gouda 1970; El-Safty *et al.*, 1976 ; El-Erian *et al.*, 1977; Teama *et al.*, 1979 and Elein *et al.*, 1982 ) . The latter recorded a friable body , harsh texture and lacking of flavour characteristics which had developed rather slowly .

Kristoffersen *et al* (1967) initiated the work on the use of cheese slurry system to follow flavour development in Cheddar cheese . Later in (1970) , (1971) Singh & Kristoffersen ; and Sood & Kosikowski (1979 a) continued the former work under other conditions . In 1976 , Dulley used the slurry procedure in the acceleration of the ripening process of Cheddar cheese . Abdel- Baky *et al* (1982 a,b) ; Rabie *et al* (1984) and Badawy (1987) had applied the same technique for the acceleration of the ripening process in Ras cheese made from fresh cow s' milk and / or milk powder .

The present study is devoted to throw some light on the use of slurry system in the enhancement of the ripening of Ras cheese made from buffaloe's milk . The work was conducted in two parts ; the first part was concerned with some factors affecting flavour development in the slurry of that cheese as well as factors affecting its use in cheese making . The use of ample slurry concentration attained in the first part in connection with commercial lipase , & proteinase and their mix was investigated in the second part of this work. Obtained results will not meet only with marketing aspects , but it will also contribute to other economical ones .

# REVIEW OF LITERATURE

## REVIEW OF LITERATURE

### I. Methods for acceleration of hard cheese ripening

The acceleration of ripening in hard cheese has been the goal of many investigators. **Law (1979)** , summarized the methods for cheese ripening acceleration- generally- as follow ; **[1]** addition of enzymes as mammalian and microbial proteases and lipases or microbial proteinase/peptidase mixtures ; **[2]** increased microbial population by addition of modified lactic acid bacteria to cheese milk or by adjustments of the making conditions ; **[3]** use of mutants ; and **[4]** artificial systems as Cheddar curd slurries .

**Lee and Olson (1982)** recorded a review about the acceleration of cheese ripening . They classified the different methods into four approaches , **[1]** control of curing conditions ; **[2]** utilization of micro-organisms ; **[3]** utilization of enzymes ; and **[4]** utilization of cheese slurries or added flavour compounds .

**Ridha et al (1984)** ,summarized the different procedures for enhancing the flavour development and acceleration the ripening of Cheddar cheese . They classified the treatments or additives to the milk into **[1]** addition of B-D- galactosidase ; **[2]** addition of lysozyme treated cells ; **[3]** used of aged lactic acid bacteria ; or **[4]** used of thermal shock treated cells ; and **[5]** used of mutant strain of starter culture . While they mentioned that the additives which can be added into the milled curd are **a.** proteolytic enzymes; **b.** mixture of enzymes ; and **c.** Cheddar cheese slurry .

**El Soda and Saada (1986)** , pointed out the general methods for accelerated ripening of Egyptian cheese varieties. They classed the acceleration methods of Ras cheese ripening into 3 procedurs : **a.** increased microbial population by trace elements ; addition of protein hydrolysate ; yeast autolysate and amino acids;addation of cell filtrates ; addition of aged lactic cultures to the cheese milk ; **b.** addition of enzymes such as lipases , B- Galactosidase or mixtures of enzymes ; and **c.** use of slurry system .

## **II. Slurry process as a method for acceleration of hard cheese ripening**

**Kristoffersen *et al* (1967)** , initiated a process for accelerating flavour development in Cheddar cheese curd. Twenty four-hour-old , Salted and unpresseed Cheddar curd was blended with sterilized 5.2% NaCl solution at 45 °C for 3-4 min (2 : 1) and the homogeneous slurry stored at 30 °C with sufficient daily agitation . They listed the composition of fresh slurry as follow : 41.5% Ts ; 21.5 % fat ; 3.2% salt and pH 5.1-5.2 . They reported that the slurry developed a flavour like that of mild Cheddar cheese within 5 days of storage at 30 °C . The flavour of fresh slurry was essentially bland with a slight suggestion of acid and diacetyl . After two days the flavour was distinctly malty, and disappeared after three days when the characteristic Cheddar cheese flavour become apparent . The desirable flavour increased in intensity through nine days when storage was discontinued .

**Singh and Kristoffersen (1970)** studied some factors affecting the flavour development in Cheddar cheese slurry. These factors are storage temperature, salt concentration, agitation, addition of glutathion, riboflavin, minerals; and storage of curd at frozen conditions ( $-20^{\circ}\text{C}$ ) for less than two weeks. The slurries were prepared from normally manufactured Cheddar curd. They demonstrated that composition of the slurries were usually within the following ranges: moisture from 59 to 59.6%; fat from 20 to 22%; salt from 3 to 3.2% and the pH of the fresh slurries was from 5.1 to 5.2, generally increased by 0.1 to 0.2 unit during storage. They reported that the slurries exhibited a diacetyl-like flavour during the early stages of storage and cheese-like flavour appeared after 4 days. At least 6 days were required before full flavour was developed. They finally mentioned that more flavour was achieved when the conditions included incubation at 30 to 35°C, NaCl concentration of slurry was 3%, daily agitation and the incorporation of Na citrate, Mn, Co or riboflavin and glutathion.

**The same authors (1971)** accelerated the ripening of Swiss cheese curd by using slurry process. Swiss curd was manufactured from pasteurised milk standardized to 3.2% fat and a commercial strains of *Str. thermophilus* and *L. bulgaricus* were used. The curd formation and dehydration were according to the conventional procedure. Slurry was prepared by blending two parts of curd with one part of sterilized salt solutions to give slurries with 1.0, 1.6 and 2.4% salt. During blending, a commercial strain of propionic acid bacteria was incorporated. They reported that Swiss curd slurries containing approximately 40% Ts;

18.5% fat, 1.6% salt and 1.1% added propionic culture, developed full characteristic Swiss cheese flavour after 5 to 6 days of storage at 30 °C .

**Singh and Kristoffersen (1971)** used the slurry process to determine the effect of lactic cultures and curd milling acidity on the development of flavour and the biochemical changes in Cheddar curd . For curd milling acidity , the order of flavour preference was for curd milled at 0.55 , 0.45 and 0.35% acidity regardless of culture . For culture effect , the order preference was for curds made with **(a)** a commercial mixed strain-all purpose culture, **(b)** *Str. cremoris* C<sub>13</sub> ; **(c)** *Str. lactis* C<sub>10</sub> ; and **(d)** a commercial butter milk culture . they listed the composition of fresh slurry as 41% Ts, 21% fat , and 3.1% salt. They observed that characteristic Cheddar cheese flavour became apparent after 4 days of ripening at 30°C and reached maximum intensity and quality after 7 days. Results for 7-days- old slurries with the commercial all -purpose culture **(a)** and *Str. cremoris*, **(b)** yielded slurries which were superior to those obtained with other cultures under all conditions . However slurries of acceptable flavour were obtained only with **(a)** and **(b)** for curd milled at 0.55% and 0.45% acidity .

**Sutherland (1975)** , used Cheddar cheese slurries in processed cheese manufacture as a substitute for the matured cheese ingredients . Matured cheese component in processed cheese was replaced by various combinations of 4 rapidly ripend cheese - curd slurries .Slurry **(a)** , ripened for 17 days at 25°C had a mild Cheddar flavour ; **(b)** renneted at pH 6.1 had a blue vein flavour ; **(c)** containing Kapalase K, had an increased fatty acids