



# **BIOTECHNOLOGICAL AND CHEMICAL STUDIES ON HARD CHEESE**

By

**Hani Shaaban Mahmoud Abd Elmontaleb**

B.Sc. Agric. Sci. (Dairy Science), Fayoum Univ., (2006).

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**A thesis submitted in partial fulfillment**

**Of**

**The requirements for the degree of**

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In

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**(Dairy Science)**

Dairy Department

Faculty of Agriculture

**Fayoum University**

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## ABSTRACT

*Ras cheese* produced by ultrafiltration has many advantages on the economical, technological and nutritional levels. On the other hand, it counteracted by slower ripening, hard texture and lack of flavour than traditional one. Due to growing interest in the application of ultrafiltration in hard cheese making and the current interest for producing the cheese flavour compounds, it would be important to improve the quality parameters of Ras cheese from UF- retentate and to produce Ras cheese flavour compounds (RCFC). This study was planned to accelerate and enhance the flavour and texture development of Ras cheese and attempting to produce the accelerated flavour of Ras cheese for industrial applications. So, Lipase enzyme (from *Rhizopus oligosporus* with specific activity 50.000 U/g), Transglutaminase enzyme with specific activity 20 U/g (TG) and mature Ras cheese slurry system were used to evaluate their effects on the acceleration of ripening and the development of texture and flavour of Ras cheese during ripening period at  $12\pm 2^{\circ}$  C for 90 days. The study revealed that the addition of microbial lipase to Ras cheese milk, at 50.000 U/15 kg UF retentate, could be recommended for accelerating the development of flavor and texture qualities in Ras cheese produced from UF-retentate. On the other side, enzymatic crosslinking of milk protein by TG enzyme increased the moisture-to-protein ratio of the experimental Ras cheese leading to increased textural hardness, gumminess and chewiness values. Mature Ras cheese slurry that used in the manufacture of Ras cheese from UF-retentate could be considered as a valuable way for accelerating the ripening of Ras cheese and enhancing the microstructure and flavour score of resultant cheese. In addition, Ras cheese flavour compounds (RCFC) was prepared by using lipolyzed cream and Ras cheese curd prepared from skim milk. Microbial lipase (with activity of 40.000 U/g) from *Rhizomucor mehei* was used at 12000 U/kg fat in the preparation of lipolyzed cream (35 % fat). Based on the chromatographic separation and identification using GC-MS spectrometry in addition to the sensory evaluation of the

prepared RCFC samples, various classes of volatile constituents have been identified as being responsible for the final aroma and taste of RCFC samples. The addition of 30 % lipolyzed cream into skim milk curd and stored for 7 days at 37°C enhanced both chemical composition, organoleptic evaluation and the flavour profile of prepared RCFC samples and it can be a useful way for producing RCFC. Moreover, RCFC was applied successfully in the acceleration and improving the quality characteristics of Ras cheese prepared from UF-retentate during the ripening period.

**Key words:** Ultrafiltration, Ras cheese ripening, cheese slurry, microbial enzymes, microstructure, cross-linkage, Ras cheese flavour compounds (RCFC), lipolyzed cream, volatile compounds.