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TECHNOLOGICAL ASPECTS OF THE
MANUFACTURE OF HALLOUMI CHEESE

A thesis presented in partial fulfilment of the
requirements for the degree of Doctor of Philosophy
in the Department of Food Technology at Massey University

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STATEMENT OF INTENT

Technological research may be considered to be of three different forms:

1. Fundamental research. The objective is to increase the knowledge base from which industry functions. Application of findings may take more than 10 years.
2. Mission-orientated research. This is research with specific objectives undertaken in specific areas. Application of findings by industry may take between 1 and 10 years.
3. Development research. This entails the application and adaption of existing scientific knowledge. The target for utilizing industry is normally less than 1 year.

In this thesis most of the work described falls into categories 2 and 3. Relatively little attention has been applied to more fundamental research.

ABSTRACT

Halloumi cheese is made in some Middle Eastern countries from sheep's and goat's milk. It is a hard, unripened white cheese that tastes like immature Cheddar, and it has the capacity to melt and stretch when heated.

The present investigation was undertaken to provide information on the manufacture of Halloumi cheese from fresh cow's milk, to define a process for its manufacture from recombined milk, and to examine the application of ultrafiltration procedures to Halloumi manufacture.

The first part of the research programme was conducted in order to determine the optimal manufacturing conditions for making Halloumi from fresh cow's milk, and to establish appropriate methods of measuring physical properties of the cheese (stretchability, meltability and fat loss). It was found that those manufacturing variables which altered the rate and extent of acid development (percentage of starter, priming, cooking temperature and time) had a marked effect on cheese physical properties. These variables could be altered by the cheesemaker to optimize Halloumi properties.

Previous reports indicated that Halloumi with desired properties could not be made from recombined milk. The second part of this thesis describes a study of the manufacture of Halloumi from recombined milk (milk made by recombining skim milk powder with anhydrous milkfat). Two main reasons for this were considered, namely, the effect of homogenization treatment used in the recombining process, and the quality of the powder used.

It was demonstrated that high homogenization pressures resulted in poor stretchability and meltability of the cheese. In contrast low pressure homogenization gave cheese with satisfactory properties. A model based on the viscoelastic behaviour of polymer systems was described in an attempt to explain how the homogenization treatments influence the stretching behaviour of the cheese network, and it was possible to verify the model in suitable experiments.

The preheat temperatures of the skim milk used in the manufacture of skim milk powders were also shown to markedly affect the properties of the cheese. High preheat temperature resulted in reduced stretchability and meltability of the cheese. It was likely that this was due to alteration of the mineral balance and to denaturation of whey proteins. The concentration of total solids prior to spray drying was shown to have no significant effect on the properties of the cheese.

In the final part of the investigation, the application of UF to the manufacture of Halloumi cheese was studied using fresh UF milk, and skim milk powder prepared from UF skim milk. When a 5:1 UF concentrate of fresh milk was used, some modification in the setting time and cutting device was necessary. The quality of UF Halloumi was very similar to that of the control cheese.

In considering the manufacture of Halloumi from recombined milk using UF skim milk powder, the effects on the cheese quality of variations in the ratio of protein to fat, in the solids concentration of the recombined milk, and in the calcium content of the UF skim milk powder were investigated. Best results were obtained when the cheese was manufactured from recombined milk with a low protein-to-fat ratio. The use of low-calcium UF skim milk powder, as opposed to high-calcium powder, resulted in some improvement in the quality of the cheese. Varying the concentration of the recombined milk solids had no significant effect on the cheese properties.

The present investigation has demonstrated that good quality Halloumi cheese having the desirable typical stretchability and meltability can be made not only from fresh cow's milk, but also from recombined and UF milks provided that appropriate materials and manufacturing procedures are used.

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