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**DEPARTMENT OF FOOD TECHNOLOGY
MASSEY UNIVERSITY**

**PHYSICAL AND RENNET COAGULATION PROPERTIES
OF RECOMBINED CHEESE MILK MADE FROM
MILK PROTEIN CONCENTRATE (MPC-56)**

**A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE
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ABSTRACT

The effects of heat treatment and homogenization on the physical and rennet coagulation properties of recombined cheese milk (40% total solids) made from reconstituted milk protein concentrate (MPC-56) (20%) and fresh frozen milkfat for recombination (FFMR) (20%) have been investigated. The effects of heat treatment of the concentrate prior to drying were also studied.

Heat treatment, either during MPC powder manufacture or after reconstitution and recombination of MPC powder had a significant influence on whey protein denaturation, viscosity, and rennet coagulation properties of recombined cheese milk.

The degree of whey protein denaturation, as determined by the decrease of soluble whey protein at pH 4.6, increased with increasing severity of heat treatment, and β -lactoglobulin A was more heat sensitive than β -lactoglobulin B and α -lactalbumin.

Recombined cheese milk showed shear thinning behaviour, e.g. recombined cheese milks behaved as pseudoplastic materials. The viscosity of recombined cheese milk determined at a shear rate of 18.5 - 731 s⁻¹ increased with increasing severity of heat treatment, indicating aggregation of protein and fat particles. The changes in viscosity were related to the degree of whey protein denaturation and the interactions between whey proteins and casein micelles.

The rennet coagulation properties of recombined cheese milk were determined in terms of gelation time (GT), storage modulus (G'), and the force required to fracture the renneted gels (yield force). In general, G' and yield force decreased with increasing severity of heat treatment. Gelation time appeared to remain unaffected by heat treatment, either of the recombined cheese milk or during MPC manufacture. There was an almost linear inverse relationship between G' or yield force and whey protein denaturation of up to ~ 60%. Further denaturation had no further effect. It is likely that denaturation and complex formation between whey proteins and casein micelles sterically interferes with the aggregation of altered casein micelles, resulting in slower increases in G' and yield force values.

Compared to heat treatment, the degree of homogenization appeared to have a minor effect on the physical and rennet coagulation properties of recombined cheese milk. Increased homogenization pressure resulted in a decrease in average fat globule diameter and an increase in viscosity. Rheological parameters, i.e. G' and yield force of renneted-induced gels decreased as the homogenization pressure was increased. The changes in milk fat globule diameter and its surface composition are probably involved in this phenomenon.

Microstructure examination and permeability measurements of renneted gels indicated that the casein networks were very strong and dense with limited porosity.

Since increasing heat treatment and homogenization reduced the strength of renneted gels, with only a small effect on gelation time, it might be possible to use these two processes to counter the gel firmness problem of recombined cheese made from MPC powder.

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