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

A THESIS PRESENTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF TECHNOLOGY IN FOOD TECHNOLOGY

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1996

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.

ACKNOWLEDGMENTS

I gratefully acknowledge my chief supervisor, Associate Professor Harjinder Singh, for his excellent supervision, understanding, warm encouragement throughout my study, especially for his enthusiasm to help, constructive criticism, endless patience in discussion and correction of my English. Without him, this work would not have been possible.

My gratitude and appreciation are extended to Dr. John Lucey for his help during the experimental work and also for reading my manuscripts.

I also wish to express my sincere gratitude to my co-supervisors, Mr Rod Bennett, for his encouragement, invaluable suggestions, guidance in the planning and conduct of the experimental work and advice during the preparation of this manuscript.

Most warm thanks to Mr Bing Soo for introduce me to this project, providing the samples, advice and discussion during the experimental work.

My gratitude are also extent to Anthony McKenna (NZDRI) for his assistance with the confocal microscopy.

I am very grateful to June Lathum, Steve Glasgow, Alistair Young, Gary Redford for their excellent technical assistance, friendship and encouragement.

Thanks to all the staff and postgraduate students in Food Technology Department at Massey University for their help friendship and support which has made my study in New Zealand pleasant and memorable.

Finally, and most important, my special thanks go to my family for their encouragement and constant moral support during this study.

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