USE OF MILK PROTEINS AS NANO-PARTICLES IN PREPARATION OF EDIBLE FILMS WITH FUNCTIONAL PROPERTIES

By

SAYED HUSSEIN SAYED ABDELHAMID ABOLILA

B.Sc.Agric. Sc. (Food Sci. & Tech.), Ain Shams University, 2011

A thesis submitted in partial fulfillment
Of
The requirements for the degree of

MASTER OF SCIENCE
in

Agricultural Sciences

(Dairy Science and Technology)

Department of Food Science
Faculty of Agriculture
Ain Shams University

2017

Approval Sheet

USE OF MILK PROTEINS AS NANO-PARTICLES IN PREPARATION OF EDIBLE FILMS WITH FUNCTIONAL PROPERTIES

By

SAYED HUSSEIN SAYED ABDELHAMID ABOLILA

B.Sc.Agric. Sc. (Food Sci. & Tech.), Ain Shams University. 2011

This thesis for the M.Sc. degree has been approved by:

Dr. Ali Ibrahim Ali Mansour .....
Professor of Dairy Science, Faculty of Agriculture, Al-Azhar University

Dr. Yehia Ali El-din Hammad .....
Professor Emeritus of Dairy Science and Technology, Faculty of Agriculture, Ain Shams University

Dr. Rezk Azab Awad .....
Professor of Dairy Science and Technology, Faculty of Agriculture, Ain Shams University

Dr. Ahmed Ismail Metwally .....
Professor of Dairy Science and Technology, Faculty of Agriculture, Ain Shams University

Date of examination 18 / 4 / 2017

USE OF MILK PROTEINS AS NANO-PARTICLES IN PREPARATION OF EDIBLE FILMS WITH FUNCTIONAL PROPERTIES

By

SAYED HUSSEIN SAYED ABDELHAMID ABOLILA

B.Sc.Agric. Sc. (Food Sci. & Tech.), Ain Shams University, 2011

Under the supervision of:

Dr. Ahmed Ismail Metwally

Professor of Dairy Science and Technology, Food Science Department, Faculty of Agriculture, Ain Shams University (Principal supervisor)

Dr. Rezk Azab Awad

Professor of Dairy Science and Technology, Food Science Department, Faculty of Agriculture, Ain Shams University

Dr. Osama Ibrahim El- Batawy

Associate Professor of Dairy Science and Technology, Food Science Department, Faculty of Agriculture, Ain Shams University

ABSTRACT

Sayed H. A. Abo-Lila: Studies on Use of Milk Proteins as Nano-Particles in Preparation of Edible Films with Functional Properties. Unpublished. M.Sc. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2017.

The goals of this study were to investigate the characteristics (physiochemical, mechanical and barrier properties) of functional edible films prepared from different types of cow's or buffalo's milk protein using different plasticizer (glycerol or sorbitol). Moreover, our study also carried out to investigate the possibility of using total milk proteinates (TMP) edible film containing some preservatives as a dipping or packaging in Ras cheese during ripening and its effect on the characteristics of cheese quality. The study was conducted in two parts, the first part, eight different types of milk proteins (acid casein, rennet casein, casein co-precipitate and total milk proteinates) were prepared from cow's and buffalo's milk. These proteins were used as polymers to form sixteen edible film samples using different types of plasticizers (glycerol or sorbitol). The result edible films were evaluated physiochemically, mechanically and for their barrier properties. The results indicated that the type of protein polymer and plasticizer used in edible film formation had significant effect on its physiochemical, mechanical and barrier values. Different edible films plasticized by glycerol were higher in moisture content, swelling, water solubility, elasticity, water vapor and gas permeability values, while lower in thickness, tensile strength and elastic modulus values compared with the different edible films plasticized by sorbitol. No significant differences were observed in all physiochemical, mechanical and barrier properties values between different edible films prepared from different cow's proteins and films formed using different buffalo's proteins. It could be concluded that, all types of milk proteins especially total milk proteinates

(TMP) prepared from cow's or buffalo's milk could be used as a suitable polymer for prepare edible film with good physiochemical, mechanical and barrier properties.

In the second part, eight Ras cheese samples were manufactured and dipped or packaged by different types of edible coating solutions or films prepared from buffalo's total milk protein (TMP), some of which containing different preservatives. Control Ras cheese were neither dipped nor packaged with any film or wax, while one of other cheese treatment was coated by paraffin wax. The other treatments were either dipped or packaged whether with TMP containing or not preservatives, namely 0.1% of mixture of nisin+natamycin (1:1) or potassium sorbate+natamycin at the same level and ratio.

The obtained results revealed that, the coating of Ras cheese with TMP edible film led relatively to reduce the rate of cheese moisture loss and hence the salt in water phase remained in the ranges those encouraged the growth of lactic acid bacteria to develop more acidity and hence enhanced the ripening rate as explained from the determined ripening indices (Soluble nitrogen and Total volatile fatty acids). That has indeed reflected in the relative cheese weight stability during ripening. The presence of preservatives in the film kept cheese under microbiological control according to the yeast and moulds count. Organoleptically, the cheese coated with TMP persevered with potassium sorbate+natamycin whether by dipping or packaging gained the highest sensory scores.

The forgoing results led to conclude that, Ras cheese could be hold its weight during ripening period besides improve its marketing quality when coated with edible film based on milk protein especially persevered with 0.1 % of mixture of potassium sorbate+natamycin (1:1).

Key words: milk protein, edible film, functional properties, dipping Ras cheese, packaging Ras cheese

ACKNOWLEDGMENT

My endless thanks are to Allah for conciliation and providing patience. I would like to express my deep sincere gratitude to ***Prof. Dr. Ahmed I. Metwally*** Professor of Dairy science and Technology, Food Science Dept., Faculty of Agriculture, Ain Shams University, ***Prof. Dr. Rezk A. Awad*** Professor of Dairy Science and Technology, Food Science Dept., Faculty of Agriculture, Ain Shams University and ***Dr. Osama I. El-Batawy*** Associate Professor of Dairy Microbiology and Technology, Food Science Dept., Faculty of Agriculture, Ain Shams University for their kindness constrictive criticism, their efforts, helpfulness continuous supervision, providing the necessary advice and help throughout this work.

I sincerely thank and appreciate ***Prof. Dr. Yehia. A. Heikal*** Professor of Food Science and Technology, Food Science Dept., Faculty of Agriculture, Ain Shams University for his efforts, helping, kindness and generous advice during my work in this research.

The author would like to express his deep thanks to ***Prof. Dr. Stefan junge, Dipl.- Eng. Katharina Kaiser and Mrs. Sandra solga*** (Institute of packaging engineering, (Beuth university of applied sciences, Berlin-Germany) as well as ***Mrs. Jana Brugger and Mr. Bernd Lallinger***, (Brugger Feinmechanik GmbH, Munich-Germany) for the facilities and guidance provided by gas-permeability tests of the casein films.

Last, and by no means least, my heartfelt thanks to my colleagues and all staff in Food Science Department, Faculty of Agriculture, Ain Shams University.

LIST OF CONTENTS

LIST OF TABLES

No. **Page**

LIST OF FIGURES