

# CHAPTER I

## INTRODUCTION

### 1.1 Statement of Problem

Natural rubber (NR) possesses excellent elasticity, flexibility and resistance against splitting. These properties are attractive for a wide range of applications including medical products that in principle can be manufactured from NR latex such as surgical gloves, tubings, catheters and balloons. However, the poor blood compatibility of NR in comparison with silicones and polyurethanes limits its direct use in biomedical applications.

Blood coagulation generally involves the adsorption of plasma proteins followed by the platelet adhesion and activation. In order to suppress those actions, several means of surface modification have been proposed. Surface grafting of hydrophilic monomers onto material surface is recognized as one of a simple and versatile method that can effectively reduce protein adsorption and platelet adhesion.

The use of UV-induced graft copolymerization of hydrophilic monomers which are poly(ethylene glycol) methacrylate (PEGMA), 2-methacryloyloxyethyl phosphorylcholine (MPC) and *N*-vinylpyrrolidone (VPy) on NR latex films in the presence of benzophenone as a photosensitizer was reported. This approach can be conducted in aqueous solution so it is an environmental-friendly method. The fact that it does not involve the plasma-pretreatment, the surface damage of NR can be minimized. The studies are carried out on both unvulcanized and the vulcanized NR latex films. Results from blood compatibility studies of surface-modified NR latex films are addressed in terms of plasma protein adsorption and platelet adhesion. To assure that the mechanical properties of NR are still maintained after graft copolymerization, all modified NR samples are subjected to tensile tests.

## 1.2 Objectives

1. To modify the surface of natural rubber latex film by graft copolymerization of hydrophilic monomers.
2. To determine the effects of surface modification on the blood compatibility and mechanical properties of natural rubber latex film.

## 1.3 Scope of the Investigation

1. Literature survey for related research work.
2. Preparation of unvulcanized and vulcanized NR latex film.
3. Graft copolymerization of NR latex film by hydrophilic monomers induced by UV light ( $\lambda = 360 \text{ nm}$ ) in the presence of benzophenone as a photosensitizer. The grafting yields as a function of the following variables are investigated :
  - Monomer : poly(ethylene glycol) methacrylate (PEGMA,  $M_w = 360$ ), *N*-vinylpyrrolidone (VPy) and 2-methacryloyloxyethyl phosphorylcholine (MPC)
  - Monomer concentration
  - Grafting time
4. Characterization of the surface properties of modified NR latex films by
  - Attenuated total reflection infrared spectroscopy (ATR-IR) technique
  - Water contact angle measurements
5. Determination of blood compatibility of modified NR latex films in terms of plasma protein adsorption and platelet adhesion.

6. Investigation of the tensile properties of NR latex films before and after surface modification according to ASTM D 412.



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