

## CHAPTER I

### INTRODUCTION

Fillers or reinforcing materials are usually added to rubber to improve its tensile strength, abrasion, modulus and tear resistance. Carbon blacks are the most common and efficient fillers for the preparation of high quality rubber products such as tires, because they offer excellent reinforcement at a relatively low cost. As carbon blacks can only be used in products with black color, a search for alternative fillers, which permit the production of highly durable colored products, has led to silica.

Silica is often used as reinforcing fillers in rubber industry because it provides natural color and compared to carbon blacks, lower hysteresis loss, which, for tire applications, leads to a lower rolling resistance and consequently fuel savings. However, silica requires a surface treatment because unmodified silica cannot form chemical bonds with rubber due to low compatibility of hydrophilic silica with hydrophobic rubber. Although the compatibility can be enhanced with bifunctional organosilanes, the organosilane agents are expensive (Thammathadanukul *et al.*, 1996).

An alternative to improve the compatibility of silica in rubber compounds is admicellar polymerization, in which organic monomers solubilize in surfactant layers adsorbed onto the surface of precipitated silica (Chinpan, 1996). It has been shown that the admicellar polymerization can beneficially reduce compound curing times and improve specific rubber compound performance in both chemical and physical properties (O'Haver *et al.*, 1996). Unfortunately, this process has been performed only in batch systems, which are not practical for industrial applications. Attempts have been made to carry out the modification with continuous systems (Chaisirimahamorakot, 2001; Nontasorn, 2002). In order to apply industrially, amounts of surfactant and initiator loadings in the *in-situ* polymerization process should be reduced.

The objectives of the present research are to minimize the amounts of initiator and surfactant for admicellar polymerization of silica using a continuous

stirred tank reactor and to test the properties of rubber specimens prepared with different modified silicas.