

CHAPTER I

INTRODUCTION

Fillers are often used in polymer composites, plastics and elastomers, in order to improve performances for commercial applications. Physical properties such as tensile strength, abrasion, modulus, and tear resistance are improved by the addition of such fillers. Carbon black is the most widely used as reinforcing filler for rubber industries because of its excellent reinforcement at a relatively low cost. It has a drawback, however, in its black color, which limits its use in some applications. Accordingly, a search for alternative fillers has led to precipitated silica.

Silica is generally more expensive than carbon black of equivalent particle size but it produces highly reinforced compounds with neutral color (Wagner, 1976). Unmodified silica cannot form chemical bonds with elastomers due to a lack of natural linking sites. Also, there is poor compatibility between hydrophilic silica and hydrophobic rubber due to the difference in nature. Consequently, the modification of silica surfaces is being intensely considered.

Silane coupling agents are used extensively in industry to enhance the compatibility between fillers and polymer matrices. Although they can impart significant improvements in the physical properties, they are expensive and can greatly increase production costs. An alternative method, modification of precipitated silica by *in situ* polymerization of monomer in adsorbed surfactant aggregates (admicellar polymerization), shows greater overall improvements in rubber compound than some silane coupling agents (Thammathadanukul, 1995; and Chinpan, 1996).

Due to the negative charge of the precipitated silica, the cationic surfactant cetyltrimethylammoniumbromide (CTAB) has been successfully used for *in situ* polymerization in batch and continuous reactors (Nontasorn, 2002). Despite the fact that cationic surfactant is the best type for this purpose, it is more expensive than other types (Rosen, 1989). Therefore, the objectives of the present research were to minimize the modification cost by reducing the amount of surfactant used in the modification process and as well as using commercial grade surfactants. A rubber compound mixed with the modified silica was investigated for its properties.