CHAPTER I
INTRODUCTION

Rubber properties such as tensile strength, modulus, abrasion and tear resistance can be improved by adding reinforcing materials or fillers. Although several fillers are available, carbon black has been widely used because of its excellent reinforcement and relatively low cost. However, its black color is a major drawback.

The use of silica in rubber compounds provides beneficial properties including (1) adhesion to adjoining compounds, wire and fabric reinforcements and (2) a neutral color which can lead to product applications include tire treads, wire and fabric coat compounds. Compared to carbon black, silica can form a stronger and more developed filler network resulting in higher modulus and lower hysteresis (heat build-up) at low temperature (Wang, 1998). However, the interaction between silica particles and hydrocarbon elastomers is weak due to the polar silanol groups on the bare silica surface. In addition, the difference in polarity between the silica and elastomer provides low dispersive forces.

To overcome the disadvantages of using silica, attempts have been made to improve the compatibility of hydrocarbon elastomers and silica by modification of the silica surface with admicellar polymerization. The modification changes the nature of the surface from hydrophilic to hydrophobic (Waddell *et al.*, 1995). Based on previous works (Waddell *et al.*, 1995; Thammathadanukul *et al.*, 1996; and Chinpan, 1996), modification by admicellar polymerization has been performed only in a batch system which yielded relatively inconsistent propertiesthat would not acceptable for most industrial applications. Thus, a continuous admicellar polymerization process seems to be the best alternative.

This work did focus on designing, testing and utilizing a CSTR system to produce admicellar polymerization-modified silicas. In addition, the effects of the amount of monomer and reaction time on the admicellar polymerization on the silica surface were invesigated. The characterization of the modified silica at various operational conditions was also carried out.