CHAPTER I
INTRODUCTION

The production of rice, one of the most important agricultural products of Thailand and one of the major crops in the world, annually generates several million tons of agricultural waste, namely rice husk. After the separation of rice from the paddy, one third of mass remaining as a waste is the rice husk or about one fifth of total grain weight is the husk.

In the past several decades, the efforts to utilize rice husk have resulted in minor usage, mostly in low-value applications in agricultural areas or as fuel. Thus, many workers have attempted to use this agricultural waste to produce more useful materials. Reports have been published on the composition, properties, and intended uses of rice husk since at least as early as 1871 (Sun and Gong, 2001). Rice husk mainly contains cellulose, lignin, and ash. The ash is largely composed of silica with minor amounts of alkalis and other trace elements (James and Rao, 1986). In general, rice husk ash might be considered as impure silica. This ash, which is leftover from the burning of the rice husk comprises almost entirely of silica in the form of SiO_2 which represents approximately 95% by weight of the ash (Cutler, 1974). The content of silica and all impurities in rice husk and rice husk ash may vary depending on the variety, climate, yearly fluctuations and geographic location.

Due to the high silica, the use of rice husk has significantly increased in the past few decades. Both rice husk and rice husk ash are potential raw materials for ceramics, cements and silica-based industries. However, most of the rice producing countries are developing countries and they lack the advanced technology to convert rice husk and rice husk ash into more valuable materials, such as high purity amorphous silica, metallurgical grade silicon, silicon tetrachloride, zeolite, etc; which offer the dual advantages of generating income and reducing environmental pollution.

In addition, silica obtained from rice husk can be used as a filler in polymer composite. Fillers have played an important role in the plastics industry. Because of the expanding industrial activities, there is a continual demand for improved materials to satisfy the increasingly stringent requirements. Silica are often used in the paint and plastics industry. In thermoplastics, silica performs many functions such as reduction in shrinkage and crack formation, reinforcement, improvement in electrical properties, increase hardness, faster molding cycles as a result of increased thermal conductivity, and so on (Gächter and Müller, 1984).

Silica has polar hydroxyl groups on its surface while most polymers, are typically hydrophobic. Thus, silica particles require surface treatment because unmodified silica cannot form efficient physical interactions or chemical bonds with most polymers due to low compatibility of hydrophilic silica with hydrophobic polymer. Silane coupling agents are often used to improve the compatibility but increase the cost of the process. An admicellar polymerization process is an alternative method, which was chosen in this research to modify the surface of silica filler

Admicellar polymerization is the process in which monomers are polymerized inside a surfactant aggregates adsorbed on a substrate surface. This method is the surface analogy to emulsion polymerization. Many types of monomers and substrates can be used in this process, forming ultra-thin films that vary in extent on the substrate surface. The possible applications of admicellar polymerization are to improve interfacial adhesion in polymer-matrix composites (Nontasorn, 2002), to modify wetting behavior and friction coefficient on surface (Barraza *et al.*, 2001), and to enhance the conductivity in conductive composites (Genetti *et al.*, 1998). These positive findings were the motivation for an evaluation of admicellar polymerization as a surface treatment in thermoplastic and thermosetting structural composites. Waddell *et al.* (1995) showed that the performance of a rubber compound was improved by using modified precipitated silica as reinforcing filler by modifying surface of silica with polymerized styrene, isoprene, butadiene and copolymer. In 1998, Grady *et al.* studied modified styrene-isoprene on glass cloth by admicellar polymerization for use in composite manufacture. The composite showed improvement in flexural strength and physical properties when compared to the untreated glass cloth composite.

The objective of the present study was to prepare high purity silica from rice husk. The obtained silica was characterized and its surface modified by admicellar polymerization of styrene monomer in order to improve interfacial adhesion in polymer-matrix composites. The admicellar polymerization results obtained from rice husk silica are compared with those of commercial precipitated silica (Hi-Sil®255).