

CHAPTER 1

INTRODUCTION

Porous materials have been used in many applications e.g. filter, catalyst support, packing materials for chromatography column, sensor, thermal insulator, selective absorbent, and electrode. They can be made from several types of materials such as polymers, metals, glass, and ceramics. Porous materials made of polymer are very popular due to their strength to weight ratio, high machinability, high production rate, high property controllability, and low cost (Ishizaki et al., 1998). Xerogel is a porous material derived from a gel in which the liquid component is replaced with ambient drying. The result is an extremely low-density solid with several remarkable properties, in which the two most attractive ones are its extremely light weight and excellent thermal insulation. The morphology of xerogel can be modified by using different synthesis parameters such as rate of carbonization, type of amine and effect of additive and surfactant. Carbon xerogel (CX) is one of the unique carbon materials which have pores in nano scale with highly cross-linked structure. Nowadays, development of carbon materials is becoming a topic of great interest due to the growth of carbon materials consumption in many applications, especially, understanding the effects of parameters on pore size, pore volume, and specific surface area of carbon materials.

Generally, the formation of pore in carbon gel could be classified into two type; micropore (<2 nm) located within the carbon particle and meso-macropore (2-50 nm and >50 nm) formed by inter-connection of carbon particles during the phase separation phenomena (Pekala et al., 1989). Microporosity of carbon gel could be easily managed by many activation processes (Wang et al., 2008), (Hanzawa et al., 2002). However, the generation of meso-macroporosity was mainly depended on the behavior of phase separation mechanism between polymer and solvent in the sol-gel process. Many new routes to generate meso-macroporosity of carbon gels have been reported for example: surfactant-templated method, emulsion method, and hard-templated method, etc. It has been applied in many applications including waste water treatment, supercapacitors advance catalyst supports due to their large surface area, resulting in high adsorption capacity and their controllable pores size. The cross-

link density of organic xerogel is one of the most important characteristics. Since high crosslink density not only provides high structural stability after solvent is removed but also provides char yield to construct the CX after pyrolysis (Lorjai *et al.*, 2009).

Recently, the development of polybenzoxazine-based phenolic resins has received great attention as these resins provide not only characteristics found in traditional phenolic, but also many fascinating characteristics such as low water adsorption, dimensional stability, and near-zero shrinkage. According to the wide variation of raw materials, they have tremendous molecular-design flexibility. Furthermore, polybenzoxazine can be polymerized without strong acid or base catalysts and without generating any by-product and volatile. Consequently, polybenzoxazine is promising precursor for organic and carbon xerogel preparation. New organic aerogel was successfully prepared from a new class of phenolic resins called polybenzoxazine synthesized via a simple thermal curing reaction without the use of any catalyst unlike the conventional phenolic precursors. Polybenzoxazine organic xerogel was cost-effectively prepared by using dimethylformamide as a solvent. Carbon xerogel with high specific surface area, low bulk density, high proportion of micropore volume and micropore surface area. The purpose of this work was to produce the novel organic and carbon xerogel from aromatic benzoxazine was obtained and study the effect of surfactant on the pore structure of PBZ-based xerogels, in order to understand the pore forming mechanism and design the microstructure of carbon xerogel.