CHAPTER I
INTRODUCTION

Hydrogel is a 3D-network structure containing more than 90% water. Aerogel can be prepared from freeze-dried hydrogel by subliming the ice crystals. Conventionally, aerogel is prepared by simply removing water from the aqueous polymer solution. At that time, though the morphology and structural orientation are difficult to control, freeze-drying the hydrogel is an alternative way to control the polymer network before changing the water-based hydrogel to an air-based aerogel. Interpolymer complex (IPC) hydrogel is a type of physically crosslinked gel due to crystallite formation during several freezing-thawing cycles. After mixing two semi-crystalline polymers at an appropriate ratio, followed by a freezing-thawing method, the hydrogel was obtained (Hassan et al., 2000). As a consequence of freeze-drying, a tough aerogel was produced, which can be evaluated from the tension strength.

Inspired by its simplicity in preparing, the hydrogel in water-based system with large amount of water absorption before changing to spongy-like aerogel. Poly(vinyl alcohol) (PVA) and poly(acrylic acid) (PAA) are good candidates. They are, to each other, proton-donating and proton-accepting macromolecules because of the oppositely charged with high hydrophilicity and highly biocompatibility, thermal stability and commercial availability (Kim et al,. 2004). PVA/PAA complex system was previously studied in the field of permeating membranes (Asman et al., 2006, and Gudeman et al., 1995), super-absorbent (Argade et al., 1998) and drug release (Shin et al., 1998).

Most of the research works in PVA/PAA hydrogel preparation are involved with using chemical crosslinking agent to form the crosslinked hydrogel or interpenetrating network hydrogel (Cauich-Rodriguez et al., 1996, Hernandez et al., 2005, Ruckenstein et al., 1996 and Gudeman et al., 1995). Only few reports on preparing physically crosslinked PVA/PAA hydrogel membrane (Hickey et al., 1997 and Peppas et al., 1997). It is important to note that most of the chemical organic molecules to provide covalent crosslinking are toxic. An alternative way to form hydrogels is to apply the reversible ionic crosslinking or interpolymer complexes. In contrast to co-

valent crosslinking, no auxiliary molecules such as catalysts are required (Ohkura et al., 1992).

The present work focuses on preparing PVA/PAA interpolymer complex hydrogel followed by water removal via freeze-drying technique to give aerogel. For avoiding of using crosslinking agent which might show bio-toxicity, freezing-thawing technique is used to prepare physically crosslinked hydrogel. The present work also proposes how to develop gel strength by applying freezing-thawing technique.