



## CHAPTER V

### CONCLUSIONS AND RECOMMENDATIONS

Polybenzoxazine (PBZ) membranes were successfully synthesized from bisphenol-A, formaldehyde, and different types of diamines, including hexamethylenediamine (hda), tetraethylenepentamine (TEPA) and triethylenetetramine (TETA). The effective polybenzoxazine membrane for pervaporation system was poly(BA-hda). It was found that polybenzoxazine membranes were suitable for ethanol/water separation of dilute ethanol in water. Poly(BA-hda) showed the longest service time when comparing with poly(BA-TETA) and poly(BA-TEPA). The total water flux ( $\text{kg/m}^2\text{hr}$ ) of poly(BA-hda) membrane for the ethanol/water separation was found around  $0.008\text{--}0.01 \text{ kg/m}^2\text{hr}$  and decreased with time due to the free volume in membranes blocked by mixture clusters after 2 hours. The separation factor of poly(BA-hda) membranes for the ethanol/water separation was increased to higher than 10,000.

The permeate water flux improves by either reducing thickness of membrane, blending with another polymeric material for increased flexibility of polymer chain, or increasing free volume of polymer chain by increasing C-C in diamine. However, the free volume should not larger than molecular size of ethanol to maintain a good separation factor.