CHAPTER VI
CONCLUSIONS

Polycarbazole (PCB) was synthesized via interfacial polymerization method using carbazole monomer and ammonium persulfate (APS) as the oxidant. The effects of surfactant types and surfactant concentrations on the synthesized PCB were investigated based on the roles of micelle formation.

The particle shape of PCB was changed from the hollow sphere structure to macroporous honeycomb structure, connected hollow sphere structure, and small hollow sphere structure with the additions TW20, CTAB, and SDS, respectively. The electrical conductivity values under the effect of surfactant type (fixed monomer:surfactant mole ratios of 1:0.0136) using three surfactants (nonionic as TW20, cationic as CTAB, and anionic as SDS) and without surfactant. The electrical conductivity values were 1.72E-04 ± 5.80E-06 S/cm, 1.00E-03 ± 7.88E-04 S/cm, 2.16E-05 ± 1.79E-05 S/cm, and 2.72E-06 ± 3.16E-07 S/cm, respectively. Moreover, the particle packing of a connected hollow sphere increased with increasing CTAB concentration, consistent with the enhanced PCB electrical conductivity. The PCB_CTAB at monomer:surfactant mole ratios of 1:0.0136 was 2.63E-03 ± 7.88E-04 S/cm and it was 1.13E+01 S/cm after doped at 1:50 mole ratio of CB:$HClO_4$ that is the highest electrical conductivity.

The electromechanical properties, and the cantilever bending of the SA hydrogels and PCB/HSA hydrogel composites were investigated at electric field strength varying from 0-800 V/mm. For the SA hydrogels, the storage modulus response ($\Delta G'$) and the storage modulus sensitivity ($\Delta G'/G'_0$) increased dramatically with increasing electric field strength. The $\Delta G'$ and $\Delta G'/G'_0$ of SA hydrogels with ionic crosslinking were higher than those of the SA hydrogels with covalent crosslinking. Moreover, the $\Delta G'$ and $\Delta G'/G'_0$ of the SA hydrogels increased with increasing molecular weight of SA.

For the PCB/HSA hydrogel composites, the $\Delta G'/G'_0$ increased with increasing PCB concentration; it was the highest with the 0.10%v/v PCB/HSA, and it decreased at PCB concentrations higher than 0.10%v/v.

In the deflection measurement, the deflection distances and the dielectrophoretic forces of the HSA hydrogel and PCB/HSA hydrogel composites increased with increasing electric field strength. The PCB/HSA hydrogel composites showed greater deflection angles and dielectrophoretic forces than those of the HSA hydrogels.