CHAPTER V
CONCLUSION

5.1 Conclusion

We have successfully designed and synthesized the molecular sensors containing fluorophore as a signaling unit and boronic acid as a binding site to bind with saccharides. The sensor **Cum_B** containing a coumarin and boronic acid has been synthesized from 3-aminophenylboronic acid hemisulfate and coumarin by nucleophilic substitution reaction to give yellow solid with 76 % yield. A novel sensor **NBDB** consisting of 4′-methoxy-1,8-napthalimide dicarboxylic as a fluorophore and boronate ester as a binding site has been synthesized by nucleophilic substitution reaction and coordinate reaction, respectively. Then, all sensors were characterized by spectroscopy techniques.

Initially, the **Cum_B** was studied on the complexation abilities with various saccharides including fructose, glucose, galactose, ribose, lactose, maltose in 5% DMSO with phosphate buffer pH 7.4 using fluorescence spectrophotometry. The emission spectrum of sensor **Cum_B** displayed the fluorescence quenching at 460 nm upon the addition of fructose possibly caused by PET mechanism. This suggested that **Cum_B** sensor has a selectivity toward fructose. The Job's plot method for the binding mode between sensor **Cum_B** and fructose suggests a 1:1 stoichiometry. The log K_s values of sensor **Cum_B** toward fructose was 3.60. The detection limit of **Cum_B** toward fructose was 2.83 mM.

Additionally, we have developed a novel fluorescence sensor for detection of saccharide based on gold nanoparticle. The sensor **NBDB** was fabricated on gold nanoparticles by interaction between the amine functional group and the gold surface. The complexation studies of sensor **NBDB_AuNPs** and saccharides including fructose, glucose, galactose, ribose, lactose, maltose in 10% DMSO with phosphate buffer pH 7.4 were carried out by fluorescence spectrophotometry. The fluorescence spectra of **NBDB_AuNPs** exhibited the fluorescent enhancement at 460 nm after adding fructose, indicating that fructose replaces **NBDB** to bind with boronic acid on AuNPs. Consequently, inhibition of energy transfer from AuNPs to **NBDB** was performed. The log K_s values and the detection limit of sensor **NBDB_AuNPs** toward fructose was 4.35 and 1.50 mM, respectively. This approach can be concluded that the modification of sensory molecules on AuNPs can increase the sensitively optical change. This demonstrates that AuNPs will act as an amplifier of the signal changes. This sensory system using AuNPs successfully improves a sensing ability of fructose.