

## Chapter 5

### CONCLUSION

The  $[\text{Ru}(\text{phen})_2\text{L}]^{2+}$  complexes, where L = azpy, dmazpy, deazpy, azpym and deazpym ligands, were synthesized by substitution reaction. The chemical properties of these complexes depend on the third ligands. Infrared spectroscopy and cyclic voltammetry exhibit the different chemical properties when changing the third ligands. Elemental analysis, mass spectrometric, UV-visible and  $^1\text{H}$  NMR spectroscopic data can determine the structure of these complexes.

Infrared spectroscopic data showed that the N=N (azo) stretching modes were different in each complexes. The dmazpy and deazpy complexes showed the N=N (azo) stretching modes lower energy than azpy complex as the deazpym complex showed N=N (azo) stretching modes lower energy than azpym complex. Because the substituents groups ( $-\text{N}(\text{CH}_3)_2$  and  $-\text{N}(\text{C}_2\text{H}_5)_2$ ) donated electrons into the  $\pi^*$  orbital of azo function. Thus, the bond order of azo moiety (N=N) was decreased. This result gave one evidence that the  $\pi$ -back bonding from Ru(II) center is decreased in complexes when the third ligand has the substituents groups. Besides, the UV-visible spectroscopic data displayed  $\pi \rightarrow \pi^*$  and MLCT transition bands. Both bands of  $[\text{Ru}(\text{phen})_2\text{L}]^{2+}$  complexes in each solvent were red shifted. Results of the cyclic voltammetric data in complexes, the first reduction couple of dmazpy and deazpy occurred at lower positive potential than that in the azpy complex. Then, dmazpy and deazpy ligands were weaker  $\pi$ -acceptor than azpy ligand. Similarly, deazpym complex occurred at lower positive potential than that in the azpym. Azpym was stronger  $\pi$ -acceptor than deazpym ligand but azpym complex had lowest potential than other ligands in complexes. Then azopyrimidine ligands (azpym and deazpym)

were better  $\pi$ -acceptor than azopyridine ligands (azpy, dmazpy and deazpy) and phen ligand. On the other hand, the Ru(II/III) redox of azpy complex occurred at more positive potential than that of  $[\text{Ru}(\text{phen})_3]^{2+}$  complex. It indicated that the third ligands make the Ru(II) stabilized.