全文に代える要約（要約の電子データを全文と伴にCD-R等で提出することを推奨）

The environment becomes the main topic for researcher since it affects the balancing of the earth. A number of physical activities can bring over an unbalancing of earth by releasing different pollutants in the environment. Heavy metal treatment becomes a particular concern for researchers due to their recalcitrance and persistence in the environment. Microencapsulation is one of the advanced methods to separate and purify various substances since there are some lacks in solvent extraction method. In microencapsulation method, extractants can be packaged within the microcapsules with many useful properties.

Porous polymeric particles are solid-phase adsorbents which employed microencapsulation for a phenolic oxime extractant used for copper (II) ion extraction. Three different types of porous polymeric particles impregnated with the extractant were successfully prepared and used for copper (II) ion removal. They were interconnected spherical pores type (PDVB), small pores type (commercial XAD-4), and multicores type (PVA/Alg-GA) polymeric particles. Those three types of the polymeric particles had different in diameter size and morphology which means the diffusion rate of particle adsorbed onto the polymeric particle was also different.

Extraction of copper (II) ion into three different types of polymeric particles was studied on the extraction equilibrium and the extraction kinetics. The result showed copper (II) ion was successfully extracted into the various types of the polymeric particles (PDVB, XAD-4, and PVA/Alg-GA) impregnated with the extractant at lower pH range. In the case of pH effect on the extraction, the adsorbent structure did not affect the pH dependency on the extraction. As copper (II) ion concentration increased in the solution, the amount of copper (II) extracted was also increased and reached the constant value at the higher concentration of copper (II) ion in the solution. The extraction behavior of Cu(II) with the polymeric particles conformed well to Langmuir-type adsorption.

Complex formation between Cu(II) and the extractant was identified via visual identification of the particles to light green form white. By considering the purity of the extractant, it was suggested that two extractant molecules reacted with one Cu(II) ion

in the polymeric particles. Furthermore, the Fourier transform infrared spectrum showed an interaction between the interconnected spherical pores (PDVB) polymeric particle wall and the extractant. In addition, the electron paramagnetic resonance spectrum indicated that the structure of the extractant-Cu(II) complex in the polymeric particles is a distorted octahedral structure composed of two extractant molecules, which consist of two nitrogen and two oxygen atoms, and two water molecules in axial positions of complex molecules, and its geometrical structure is similar to that in the solvent extraction system.

The extraction kinetics of copper (II) from aqueous solution into three different types of polymeric particles was influenced by the amounts of the extractant entrapped in the polymeric particles and also their structure. The amount of copper (II) extracted into all types of polymeric particles increased with time and reached a plateau after a longer contact time. The extraction mechanism of copper (II) into all types of polymeric particles impregnated with the extractant was found to obey Pseudo-second order kinetics and mass-transfer diffusion models. It is suggested complex-formation and mass-transfer diffusion is the predominant rate-determining step in the copper (II) extraction process from aqueous solution into the polymeric particles.