CHAPTER V

CONCLUSION

The removal of iron ion in the spent sulfuric acid solution by electrodialysis process was studied. Electrodialysis Cell Unit model: PCCell ED 64-4 equipment was employed in this experiment. The batch mode electrodialysis process was used to study factors influencing removal of iron ion in the synthetic sulfuric waster sample such as electric potential, initial acid concentration and other elements in the sample. The effect of electric potential was studied at various applied electric potentials (2.5, 5.0 and 7.5 V). The effect of initial acid concentration was studied at 0.04 and 0.10 N. The effect of other elements was studied at waste solution with Ni and Cr added and without Ni and Cr added. The results of the removal of iron ion were considered from the removal (%), the current density (i), the current efficiency (%) of iron ion and the specific power consumption (SPC) with time.

The effect of electric potential was found that the higher electric potential the faster iron ion could be removed thus the period of the removal of iron ion was shorter. Since the flow rates in this experiment were not controlled, it was found that the flow rate might have affected the removal of iron ion which the faster flow rate the iron ion could be rapid removed. When the higher electric potential was applied, the initial current density was higher and so was the specific power consumption (SPC) whereas the current efficiency (%) for the removal of iron ion was decreased. At applied electric potential of 5 V, the removal of iron from the synthetic sulfuric waste was about 98% within 2 hours, the specific power consumption was 1.94 kW h m^{-3}, and current efficiency was 15.94%.

The effect of initial acid concentration was found that when a waste solution contained high initial acid concentration, the period of the removal of iron ion was longer. The initial current density was also higher due to increase in conductivity,

leading to higher specific power consumption, whereas the current efficiency (%) for the removal of iron ion was decreased.

The effect of other elements (Ni and Cr) present in the waste solution was found in the same way as that of initial acid concentration. When other metal ions were present in the waste solution, the period of the removal of iron ion was somewhat longer, the specific power consumption (SPC) was higher, and the current efficiency (%) for the removal of iron ion was decreased.

The comparison of the removal of iron by electrodialysis between real sulfuric waste sample and the synthetic sulfuric waste sample was found that the period for the removal of iron was not differed. However, the initial current density and the conductivity of solution were significantly different due to influence of the nitric acid used for digestion, leading to high specific power consumption and decrease in current efficiency (%) for removal of iron ion.

Finally, the composition of the sulfuric waste sample after treated by electrodialysis process showed that the concentration of iron ion was 4.33 mg L^{-1}, the concentration of chromium ion was 0.09 mg L^{-1} and the concentration of nickel ion was 0.03 mg L^{-1}, respectively, which were lower than those allowed by the industrial effluent standard regulated by Department of Environment Quality Promotion [17]. But the pH was still lower than that allowed by the industrial effluent standard. Thus, it can not be released to the environment but it can be reused or recycled for the surface treatment process by adding or mixing of the new concentrate acid.