CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Based on the experimental results, the following conclusions can be drawn:

1. The pH of the wastewater could affect nickel removal efficiency. At high pH, nickel ions are adsorbed to the oxide surfaces and the proton (H^+) is released. Whereas at low pH, the reactions are reversed (desorption) and nickel ions are released. Therefore, it is recommended that the removal of nickel with iron oxide. The pH should be maintained in neutral range. It has been reported that the hydroxyl group was the dominant adsorbable species in a pH range of 6 to 7 for nickel ions adsorbed by iron oxide as follows,

$$S\text{-}OH + M^{2+} = S\text{-}OM^{(2-1)+} + H^+$$

S-OH = oxide surfaces

M^{2+} = metal

2. Controlling factors for the column studies are contact time (also depending on influent flow rates and column heights), influent metal concentration and sufficient oxygen. In order to remove nickel efficiently by this process, these factors should be simultaneously compromised.

3. X-Ray Diffraction results supported the findings that nickel can be adsorbed on the surface of iron oxide. The structure may be $NiO\text{-}NiFe_2O_4$.

Recommendation for future work

1. A study to remove the other heavy metals such as chromium, copper, or zinc. from metal plating wastewater with iron column is recommended.

2. Larger scale of a pilot plant study is recommended to scale up the experiment for future use.

3. A continuous flow reactor, which has openings for easy access to oxygen or air, is recommended. This type of design can prevent the incomplete iron oxidation and increase HFO sorption capacity.

4. A regeneration study is recommended. It can be conducted to study the possibility of further reuse the iron crap.