CHAPTER I

INTRODUCTION

Thailand has emerged from the 80s as one of the most promising developing nations in the world. In 1988, 1989 and 1990, the two digit growth rates of 13 percent, 11 percent and 19 percent were the highest rates of economic growth .

The highest growth rate of economics benefiting from industrialization and export promotion has been accompanied by a deterioration in environmental quality. Although there are many laws and regulations pertaining to the country. Hazardous waste discharge has serious effects both within and outside the factory zones. In June 1992, new National Environmental Quality Act was replaced the 1975 National Environmental Act, creating a stronger foundation for a system of nation environmental management. However, recognizing that some factories have stolen hazardous waste such as heavy metals and organic substances into the public river, resulting a high cost of waste disposal and recycling.

Petrochemical, electroplating and steel industries are an important industries that evidently affect our environmental quality. Wastewater of these industries contain high concentration of heavy metal ions and chemical substances that deteriorated the aquatic environment. The total concentration of these metals is not the most important point when it comes to understanding the metal's effect on the aquatic environment. The key concept in this case is the speciation of the metal. Speciation "distinguishes between 'filtrable' and 'particulate' fractions of a metal". Filtrable, refers to particles that can be trapped by a filter (usually a pore of 0.45 micrometers). The particulate fraction of the metal includes solid minerals, crystals, metals adsorbed onto humic acids, and metals incorporated into organisms.(kelly. 1988).

Copper, nickel and zinc have been widely used of plating industry (TISTR, 1982). Many small electroplating operations in Thailand could barely afford the high

costs of waste disposal and recycling, thereby increasing the opportunity of polluted rivers and aquatic environment deterioration. Thus an important role of researchers is developing of efficient method with an inexpensive way to remove and recycle heavy metal wastes for participating of electroplator.

In general, there are mainly two techniques for heavy metal removal. The first technique is chemical precipitation that can not to meet the new local industrial waste water standards, in particular effluent from plating industries. The other technique is ion exchange that is a physico-chemical technique. This technique is suitable for heavy metals on the low concentration, but it uses synthetic ion exchange resins that are quite expensive and non-biodegradable substances. In addition, when these synthetic resins have exhausted their capacities for exchanging ions from the solution and they can not be regenerated. Consequently, these synthetic resins represent the waste materials in our environment due to their property.

It is obvious that the lignocellulosic material is mainly composition of most plants, including weed such as water hyacinth that generated many problems of waterflow in irrigation channels, and impacted on aquatic life. Furthermore, the lignocellulosic from this weed has showed the natural ion exchange properties and low cost. Therefore, the ion exchange resin produced from agricultural waste materials for heavy metal removal should be investigated.

Consequently, the emphasis of the study was to used water hyacinth (*Eichhornia crassipes*) as a source of lignocellulosic material for heavy metal ion removal. Water hyacinth is inexpensive and is available throughout of Thailand in quantities that would make it an ideal material for the propose of heavy metal ion removal in industrial wastewater. Furthermore, It may be an available technology for improving the quality of environment because of the maximum utilization of natural resources in native area and could reduce the content of unused synthetic ion exchange resins in environment. Therefore, It should be considered to increase the efficiency and stability of their resins by comparing with the expensive commercial ion exchange resins.

The study was to investigate the optimum condition to treat lignocellulosic of water hyacinth with acidic formaldehyde and use of lignocellulosic-formaldehyde

produced from water hyacinth (formaldehyde treated water hyacinth ; FTWH) as a natural ion exchange resin to remove copper, nickel and zinc ions in synthetic solution, including electroplating wastewater.

Hypothesis

A lignocellulosic substance produced from water hyacinth, could effectively remove copper, nickel and zinc ions when treated with an optimum proportion of acidic formaldehyde.

Objectives

1. To study the optimum concentration for treating lignocellulose from water-hyacinth with acidic formaldehyde solution.
2. To determine the total capacity and efficiency of heavy metal ion removal by lignocellulosic-formaldehyde ion exchange resin produced from water hyacinth.

Scope of study

The study will use lignocellulosic constituent in water hyacinth as a natural ion exchange resin and chelate-forming material. The chemical treatment, heavy metal concentration in synthetic solution and efficiency of heavy metal ions removal are mainly investigated. The heavy metal ions in this experiment are copper, nickel and zinc ions. Wastewater used was the synthetic solution that prepared freshly in laboratory room. For the electroplating wastewater, collecting from Zn-electroplating industry located in Bangkok. The contents of heavy metals were determined by complexometric and atomic absorption spectrophotometry method for batch and column experiments, respectively. All obtained natural ion exchange resin samples were characterized by Fourier Transform Infrared spectrophotometric method while using the Scanning Electron Microscope (SEM) for observing fibre surfaces, within the cell wall and morphology.

Anticipated benefits

1. A guidance for using water hyacinth as a substrate for the efficient removing of heavy metal ions.
2. A guidance for decreasing operation cost of removing heavy metal ions from industrial wastewaters.
3. If the ion exchange resin produced from water hyacinth is widely used, the amount of water hyacinth, which can cause environmental problems, can be reduced.