CHAPTER 1

INTRODUCTION

1.1 Background

Water contamination with heavy metal discharged from industrial activities and urbanization is a very important problem in the current world which can affect the ecosystem of environment and human health. Attention has been paid to find the methods to remove heavy metals from wastewater from dispose because they will cause the serious problems to environment and human health. Several studies have shown that the biological materials have the ability to accumulate heavy metal from wastewater. The process has gained importance due to its advantages over conventional separation techniques such as chemical precipitation, ion exchange, reverse osmosis, membrane filtration, and activated carbon adsorption, which are used to remove toxic metals from wastewater.

Biosorption is an alternative way to treat the heavy metal waste. It uses the biological materials. Biological materials have been divided to two types which are living biomass and non-living biomass. For living biomass there are like aquatic plants, fungi, algae and moss. Non-living biomass is like bark, lignin and peanut hull. Those biological materials have been use as biosorbent. Most of them are easily to find and live wildly in a large group. The most versatile and commonly used as a sorbent is activated carbon but it is too expensive, so there have been considered other sorbent materials there are biosorbents. Heavy metal also can be removed by inexpensive biological materials. The
performance of any biosorbent depends on biomass characteristics, physico-chemical characteristics of the target metals and the microenvironment of contact solution such as solution pH, temperature, and interaction with other ions (Tsezos et al., 1997).

The researchers have study the capability of the living submerged aquatic plants in removing the heavy metals by making the wetland with the artificial wastewater with heavy metals inside it and gets the good result (Xiaomei Lu et al., 2003; K. S. Low et al., 1994). Some other researchers have been develop a new way in removing heavy metals, there is by change the living aquatic plants into dose form (I. A. H. Schneider and J. Rubio, 1999; Mentaky et al., 2004). It might be through some methods to produce the dose from aquatic plants but it still low in cost and no chemicals are needed. Heavy metals produce phytotoxic effects on plant such as inhibition of chlorophyll synthesis and it also lead to death of the plants.

Heavy metals ions such as Cu\(^{2+}\), Fe\(^{2+}\) and Zn\(^{2+}\) are needed in plant metabolism but when they are present in excess they can become extremely toxic (Sungai Buloh Nature Park, 2001). Iron (Fe) is one of the toxic heavy metal. In plant, Fe is involved in the production of chlorophyl. Iron (Fe) also a component of many enzymes and associated with sulfur to produce other compound that can be catalyze other reaction. Plant also have can accumulate nonessential metal like Cd and Pb. Iron (Fe) applications go from food containers to family cars, from screwdrivers to washing machines, from cargo ships to paper staples. Steel is the best known alloy of iron, and some of the forms that iron takes include: pig iron, cast iron, carbon steel, and wrought iron, alloy steels, iron oxides. It also has been used in textile industry and ink manufacturing.

Water hyacinth (Eichhornia crassipes) is a floating macrophyte, can grow and spread rapidly in freshwater and slow-moving water. They also can live with extremes of pH level, temperature and even grow in toxic water. The useful of non-living water hyacinth in removing metal ions have been investigated and it shown that it have the potential of being a new resources of biosorbent in removing the metal ions. The aim of this research is to study the removal of iron (Fe) from aqueous solution by using dried
water hyacinth as biosorbent at different biosorbent dosage, contact time, pH and temperature.

1.2 Problem Statement

The discharge of heavy metals into aquatic ecosystems had become a matter of concern over the last few decades. These pollutants are introduced into the aquatic system significantly as a result of various industrial operations. The pollutants of concern include lead, chromium, mercury, cadmium, arsenic, uranium, cooper and nickel. The toxic materials may be discharge from mining operations, sludge disposal, fly ash from incinerators, the processing of radioactive materials, metal plating, paints, alloys, pesticides or preservative.

Iron have been applied worldwide for commercial purposes and produced in large amount. It is applicable mostly in manufacturing industry such as automobile parts, laundry machines and containers. It also uses as essential components in producing alloy and steel. It also has been used in ink manufacture industry. Industries that involve ferrous alloys and those that use iron salts, such as ink manufacture and tanneries, discharge iron-contaminated waters. These can pollute both surface and ground waters (David Tin Win et al, 2002)

Aquatic plants have been considered as an alternative way in removing metals. There are many of aquatic plants that have been tested their ability in removing metals such as Potagometon lucens, Salvinia hergozii, Eichhornia crassipes, Myriophyllum brasiliensis, Cabomba sp. and Ceratophyllum demersum (Schneider and Rubio, 1999). It has been considered as one of a cheapest biosorbent resource in removing heavy metals from waste stream. Water hyacinth is easy to find, grow rapidly in pools, lakes, swamps and drainage systems as long as there is freshwater and slow-moving flow. The community of water hyacinth obstructs the flow of water and that can cause flood. It also