CHAPTER 1

INTRODUCTION

1.1 Background of Study

Natural wetland systems have often been described as the “earth’s kidneys” because they filter pollutants from water that flows through on its way to receiving lakes, streams and oceans. Natural wetland can improve water quality, therefore engineers and scientists construct systems that replicate the functions of natural wetlands. Constructed wetlands are treatment systems that use natural processes involving wetland vegetation, soils, and their associated microbial assemblages to improve water quality. Constructed wetland can be considered as wetlands built to fulfill desired objectives. White (1998) defines a constructed wetland as "purpose built structures, utilizing the predominantly natural materials of soil water and biota, which perform the desired physical, chemical and biological processes and functions of natural wetlands to achieve desired objectives.". Constructing a wetland where one did not exist before avoids many of the environmental concerns and user conflicts associated with natural wetlands and allow design of the wetland for optimum wastewater treatment. Unlike natural wetlands, which are confines by availability and proximity of the wastewater source, constructed wetlands can be built almost everywhere, including lands with limited uses and other system components can be managed as required include vegetation (Reed et al., 1988).

Designing and building wetlands to treat wastewater is not a new concept. As many as 5,000 constructed wetlands have been built in Europe and about 1,000 are currently in operation in the United States. Constructed treatment wetlands, in some
cases involving the maintenance of important wetland habitat, have become particularly popular in the Southwest, where the arid climate makes the wetland habitat supported by these projects an especially precious resource. Constructed wetland can significantly reduce biological oxygen demand (BOD), suspended solids (SS), and nitrogen, as well as metals like zinc and copper, traces organics and pathogens. The basic treatment mechanisms include sedimentation, chemical precipitation and adsorption, and microbial interactions with BOD, SS and nitrogen, as well as some uptake by the vegetation (U.S. EPA, 1988).

Constructed wetland is now widely used to provide “natural” ecotechnological treatment solutions for urban, industrial and agricultural waste-, storm-and drainage-waters (U.S. EPA, 1993, 2000; Kadlec and Knight, 1996; IWA, 2000). Construction and operating costs are low relative to mechanical treatment plants providing suitable land is available, and provision of wildlife habitat and green spaces may provides ancillary benefits. Much of the historical development and application of constructed wetland has occurred in America, Europe and Australia, but interest is now rapidly increasing in Asia.

Phytoremediation is widely viewed as an ecologically acceptable alternative as opposed to the conventional physicochemical techniques of heavy metals in polluted water or wastewater including zinc and copper. During disposal, a large amount of waste can increase the concentration of metals and become toxic. At higher concentration, heavy metals such as zinc and copper are known to cause many illness, damages or illness to human (Gunawardhana et al., 2002; Gurzau et al., 2003). Every industrial will be discharged heavy metals like zinc and copper everyday and it will increase from day to day.

Wetland plants are an important component in constructed wetlands. The roles that they can fulfill or to which they can contribute to are numerous. Wetland plants have adaptations that allow the transportation of oxygen to the roots and rhizomes (Brix, 1997). Plants that thrive and flower in soil that is saturated for a long period can be considered wetland plants (Sainty and Beharrell, 1998). Water lettuce (*pistia stratiotes*) is one of the wetland plants in group of floating plants (Wong,
2004). There are many cases that related to water lettuce and involving the plant in the same family with water lettuce (floating plants) such as water hyacinth and many more.

1.2 Objective of Research

The objective of this study is to determine the removal efficiency of heavy metals (zinc and copper) in synthetic wastewater using constructed wetland.

1.3 Scope of Study

The study will be focused on the percentage of removal of zinc and copper using constructed wetland. The constructed wetland designed with the same plant species, which is water lettuce (*pistia stratiotes*) species. This experiment also focused on the zinc and copper removal from synthetic wastewater using constructed wetland. The scopes for this study were:

a) To study the removal efficiency of heavy metals (zinc and copper) as the quantities of plant were varies.

b) To study the removal efficiency of heavy metals (zinc and copper) as the pH conditions were varies.

The experiment was carried out at Basic Science Laboratory, Faculty of Chemical Engineering and Natural Resources, Universiti Malaysia Pahang (UMP). The study was carried out within 7 days of treatment.