

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 INTRODUCTION**

At the beginning of civilization, human interferences induced changes in nature and environment. The industrial revolution and its negative impact expedite the global environmental degradation. Large scale environmental changes are found in recent years. These alterations on temperature, water, soil, sediment, air and plants are enormous, creating adverse effects on ecosystem. The human footprints are touching the continents, oceans and even outer space. The increasing trend of anthropogenic activities like rapid industrialization is a great threat in this millennium and that could destroy the green planet (Dong et al., 2014; Bedewi, 2010).

In the present world, industrialization could fulfill all the socio-economic objectives such as to alleviate poverty, creating employment for generations, to promote gender equality, to get health care, shelter and education. Nevertheless, the industrial activities may contribute a substantial negative impact on the environment. It promotes climate changes, water, air, soil pollution and extinction of various indigenous species including flora and fauna. Therefore, the economic, socio-cultural welfare and the global environment are now very much of concern. In industrialized countries, although the new technologies and recycling of wastes minimize the environmental effects but it depletes the natural resources. On the other hand, in the developing countries, chemical pollution, air, water and sediment pollution, deforestation, soil degradation and greenhouse gas productions are the general plight by the industrial activities.

The environmental sustainability might be achieved through the initiation of green economy and eco-friendly products, services, technology, treatments methods and management phenomenon (UNEP, 2013). Today, the earth is facing natural disasters each and every year. The improper industrial development and industrialization is the main cause behind the environmental imbalance. The industrial wastewater disposal is a great problem in the world. It has been thrown mostly to the surrounding watersheds. The surface water is one of the most valuable resources in this earth but it is mostly affected by the industrial processes. Industrial practices have made a huge impact on surface water in the world. The industrial dumping causes a lot of harms for the adjacent areas and it is the drawbacks of sustainable industrialization (Changhao and Zhans, 2013).

Sediments are also being contaminated throughout the world by anthropogenic activities. Generally, sediments are being contaminated through industrial activities (EPA, 2014; Wang et al., 2012). The main problem behind sediment pollution is the entry of metals in food cycles. As they are chemically and biologically not degradable, they pose major pollution factors and ultimately make a great harm for animals (Singare et al., 2011). Malaysia is a rapidly growing industrial country and her economy is mainly dependent on the industrial sectors. Gebeng, one of the industrial clusters in Pahang, Malaysia consists of a large number of petrochemicals, chemicals, metal builders, polymer and other industries. It was found a higher percentage of industrial pollution in Malaysia by industries (Chan, 2012). Moreover, it is reported that the surface water and the sediments are being contaminated in the Gebeng industrial area by industrial dumping. It is well known that the chemical treatment methods and procedures have many adverse, lethal and permanent effects on environments. So the environmental friendly alternative treatment measures are needed to combat the challenges of environmental pollution. Use of bioreactor is an environmental friendly and cost effective procedure. At present, treatment through bioreactor is regarded as an advanced technology and significant in environmental protection (Latif et al., 2011). Bacteria play an important role in removing heavy metals as well as contaminants from wastewater (Kumaran et al., 2011).

Now a day, phytoremediation is being used for the industrial wastewater treatment and environmental cleansing. It has been regarded as the latest biotechnology and endeavor to decontaminate environment through phyto extraction of pollutants (Ziarati, 2014). Vetiver grass has large rooting systems and could grow rapidly as well as found potentiality to remove heavy metals (Roongtanakiat et al., 2014; Ho et al., 2013). The best species for the phytoremediation of industrial wastewater are the water hyacinth (*Eichhornia crassipes*) and cattails (*Typha latifolia*) (Sukumaran, 2013). Industry discharges hot water, wastes, various organic, inorganic substances and heavy metals. So, surface and sub-surface water, soils, sediments, plants, fishes, flora and fauna as well as all lives are being contaminated by these types of industrial activities. Today, the planners and policy makers are thinking about recycling and sustainable management of the wastewater. Pollution free water, plant and sediment are indispensable for life. Congenial atmosphere is needed for the existence of human being. So, it is high time for taking measures to save the Gebeng industrial area as well as the surrounding environment.

## **1.2 PROBLEM STATEMENT**

The United Nations estimates that 1.8 billion people will suffer from water scarcity over the world by 2025 (Shuster, 2012). In Malaysia, a severe water crisis happened in 1997-1998. Malaysians usually overuse water and has poor management of water resources. Owing to less rainfall and no rainfall in Putrajaya and some parts of the country in the last couple of years, water rationing has already started. The water demands are increasing many folds day by day in Malaysia (DOE, 2014). The real scenario is the rapid developments including the metal, wood processing, polymer, chemicals, petro-chemical industries that is deteriorating the environmental quality in the Gebeng industrial estate (Sujaul et al., 2012). In previous times, the study area was included into the reserve forest before industrial development. After forest cleaning, the industry started its journey. So, the surface water and studied catchment area is being contaminated due to industrialization. The surface water in the study area contains high BOD, COD, TSS and heavy metals.