CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Water is a chemical substance that is transparent and almost colourless that constitutes 71% of Earth surface. It is vital for all known forms of lives. Without it, none of all known forms of lives could survive and live. Thus, its existence is very important especially in the clean form. Out of all the water on Earth, only 3% is freshwater that is suitable for drinking and agriculture. And out of the 3%, only 0.3% is on the surface of the Earth which is in rivers, lakes and atmosphere. This can be seen from Figure 1.1.

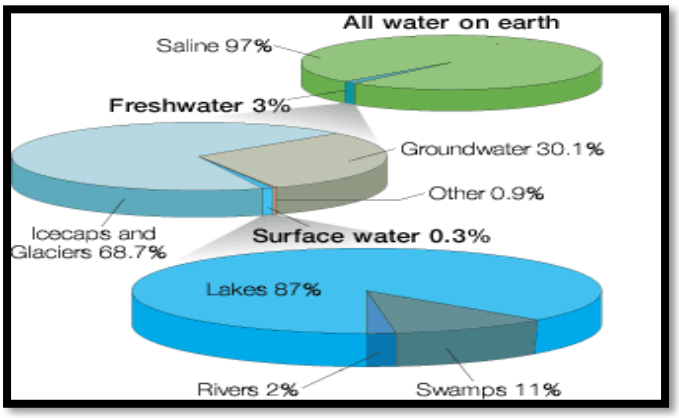

Figure 1.1 Water on Earth.

Source: http://www.pacificwater.org/pages.cfm/water-services/water-demand-management/water-distribution/?printerfriendly=true

In Malaysia itself, the total internal water resource is estimated to be around 580km^3 per year. From the water, it was estimated that 34% was used for agriculture, 30% for municipalities and 36% for industries (FAO, 1999). All these waters were used

for the right purpose, for the continuity of life. However, how much do we know how much of these waters were wasted.

In Malaysia, millions of ringgits were spent by Malaysians for wastewater treatments but none of them were reused by the year 2005 (Hanapi, 2011). At the end of the day, all of them were wasted, discharged into an open water system. They were not reused for there are still no needs of reusing them for we still have an adequate amount of freshwater to fulfil our water demand. But will it still be enough in the future? Water shortage meeting with the lack of awareness of reusing treated wastewater will be a problem in the future.

Clean water supply is an international issue that United Nations had picked on to be solved by the year 2030 through the Sustainable Developments Goals. Goal 6 targeted to achieve safe and affordable drinking water for all. Also, it targeted many others include to increase water-use efficiency across all sectors (UN, 2015). This research mainly was based on this target. Statistics from around the world show that about 70% of total water was used for agriculture. There are still other countries especially the low-income countries were facing difficulties to find the unpolluted water source for agriculture. Thus, it is very common nowadays that wastewater was used for agriculture irrigation. A statistic by WHO predicted that around 10% of the world population were consuming food irrigated with wastewater, 20 years ago (WHO, 2006). This shows that this practice is getting more common among underdeveloped and developing countries.

Around the 1980s, soil-less culture hydroponic and controlled environment for fish bearing aquaculture were integrated into a new system called aquaponics. This system aims to reduce water usage besides preventing soil-borne diseases and reducing pests. This system greatly increases productivity per unit of land and is the most efficient water-saving technology in fish farming (Somerville et al., 2014). With this suitable system, we further try to reduce usage of freshwater by introducing treated wastewater into the system.

1.2 Problem Statement

Malaysians used millions of ringgits for building, operating and maintaining Sewerage Treatment Plants (STP) every year but none of these treated wastewaters or effluent was reused. Wastewater is the combination of human waste, kitchen waste, and storm water. Human waste was often used as fertilizers for farming in older time because they contain a high amount of nutrients that are useful for plant growth. Kitchen waste contains also a high amount of nutrients such as protein from meat and vegetables. Besides useful nutrients, they also contain an amount of heavy metal discharged from the human body and from other sources. When all of these are channelled to the STP, they undergo treatment that removes substances such as heavy metals, oil and grease, suspended solids and other. However, at the end of the treatment, the treated effluent still contains useful nutrients. These nutrients available in the effluent can be reused as fertilizer for farming when the effluent is used to irrigate crops.

The effluent can be used for agriculture irrigation as they have lots of useful nutrients suitable for plants growth. Besides, substance such as oil and grease were almost fully removed, making them more suitable for agriculture irrigation. At the same time globally, water supply is an issue. Changes could be made by reducing the water usage to as minimum as possible, thus agriculture was targeted for it uses the most water. In the world, more than 34% of the water was used for agriculture which is approximately 70% of it. Although Malaysia still able to support all the water demand, water demand is increasing and the clean water supply, on the other hand, is decreasing. In the future, this will be an issue to the country. It will go to a point where another source of water to be considered to irrigates the crops.

So, this research is about reusing of treated effluent for agriculture. Aquaponics is known to reduce usage of water, thus reusing of treated effluent in the system will further reduce the water usage for irrigation.