CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Sewage sludge is an important source of inland water pollution when it is released into local rivers or lakes without treatment. Sewage Sludge has negative effect to the environment; it contains organic wastes, sewages and fertilizers contain nutrients such as nitrates, sulphates and phosphates (Halim, 1988). Its chemical oxygen demand (COD) and biochemical oxygen demand (BOD) are high. The effluent is non-toxic because no chemicals are added during the sample extraction process (Singh et al., 1999). Most commonly, sewage sludge treatment use anaerobic digestion for the primary treatment.

Over the last century, anaerobic digestion (AD) has emerged as a reliable treatment solution for the stabilization and disintegration of sludge. The process was initially used for the treatment of domestic wastewater and sewage sludge in the municipal treatment plants. But over the past 20 years, the true potential of anaerobic digestion has been explored and major advances in reactor design, configuration and operation and in our understanding of the nature of the microbial biochemistry; physiology and ecology have been reported (Craik et al., 1995). The growing interest of the researchers in this process is a testimony to the viability and applicability of the process .High ultrasonicated membrane anaerobic system treatment (UMAS) would reduce treatment costs by increasing the digestion rate and eliminating the need for cooling facilities prior to biological treatment (Chiemchaisri et al., 1995).

The feed system was designed to provide continuous addition of feed solution (Raw sewage sludge) by gravity flow, from feeder tank which is on top of the reactor. The laboratory digester is completely mixed-semi continuous followed steady state operation, so that the experimental results could be used to investigate the performance of ultrasonicated

membrane anaerobic system (UMAS) under steady state conditions .And the volume of biogas produced is measured by using a 20 litres water displacement bottle.

1.2 RESEARCH BACKGROUND

Anaerobic digestion is biological process that occurs in environment. It occurs naturally in swamp, water -logged soil and paddy fields, deep bodies of water, and the digestive systems of terminates and large animal. It utilizes microorganisms to break down biodegradable organic material with little or in the absence of oxygen. Almost any organic material can be processed with anaerobic digestion including waste papers, agriculture wastes, industrial effluents, leftover food, animal and human excreta. It is widely used for the treatment of wastewater sludge in many industries (Residua, 2003).

Anaerobic digestion is a renewable energy source because the process produces bio methane which consists of methane (50 - 80%). Methane is a gas that contains molecules of methane with one atom of carbon and four atom of hydrogen (CH_4). It is the major component of the "natural" gas used in many home for cooking power generation. As methane is about twenty times more potent as carbon dioxide this has significant negative environmental effects. Besides, anaerobic digestion also releases carbon dioxide (20 - 50%) and traces levels of other gases such as hydrogen, carbon monoxide, nitrogen, oxygen, and hydrogen sulphide. (Noor et al., 2010).

The relative percentage of these gases depends on the feed material and management of the process. Anaerobic digestion is one of the fundamental processes in sewage sludge treatment for reducing and stabilizing the organic solids due to its high organic fraction. There are more innovative waste treatment facilities attributed to improve anaerobic digestion technology. With the advancement of membrane technology, application of membrane filtration in the treatment of sewage sludge can contribute to developing an efficient sewage sludge treatment process that is capable of retaining biomass concentration within the reactor and producing high quality effluent .Membrane separation techniques have proven to be an effective method in separating biomass solid from digester (Noor et al., 2010).

Anaerobic digesters produce conditions that encourage the natural breakdown of organic matter by bacteria in the absence of air. Utilizing anaerobic digestion technologies can help to reduce the emission of greenhouse gasses in a number of key ways: such as

Replacement of fossil fuels, reducing methane emission from landfills, displacing industrially-produced chemical fertilizers, reducing vehicle movements and reducing electrical grid transportation losses. Methane and power produced in anaerobic digestion facilities can be utilized to replace energy derived from fossil fuels, and hence reduce emissions of greenhouse gasses increasingly, however, anaerobic digestion is seen not as a process for stabilizing sludge, but as an opportunity to recover the energy embedded in the substrate, traditionally in the form of methane (Horan and Nigel, 2009). The major contaminants found in wastewater are biodegradable organic compounds, volatile organic compounds, recalcitrant xeno biotic, toxic metal, suspended solid, nutrients (nitrogen and phosphorus), microbial pathogens and parasites as displayed in Figure 1.1.

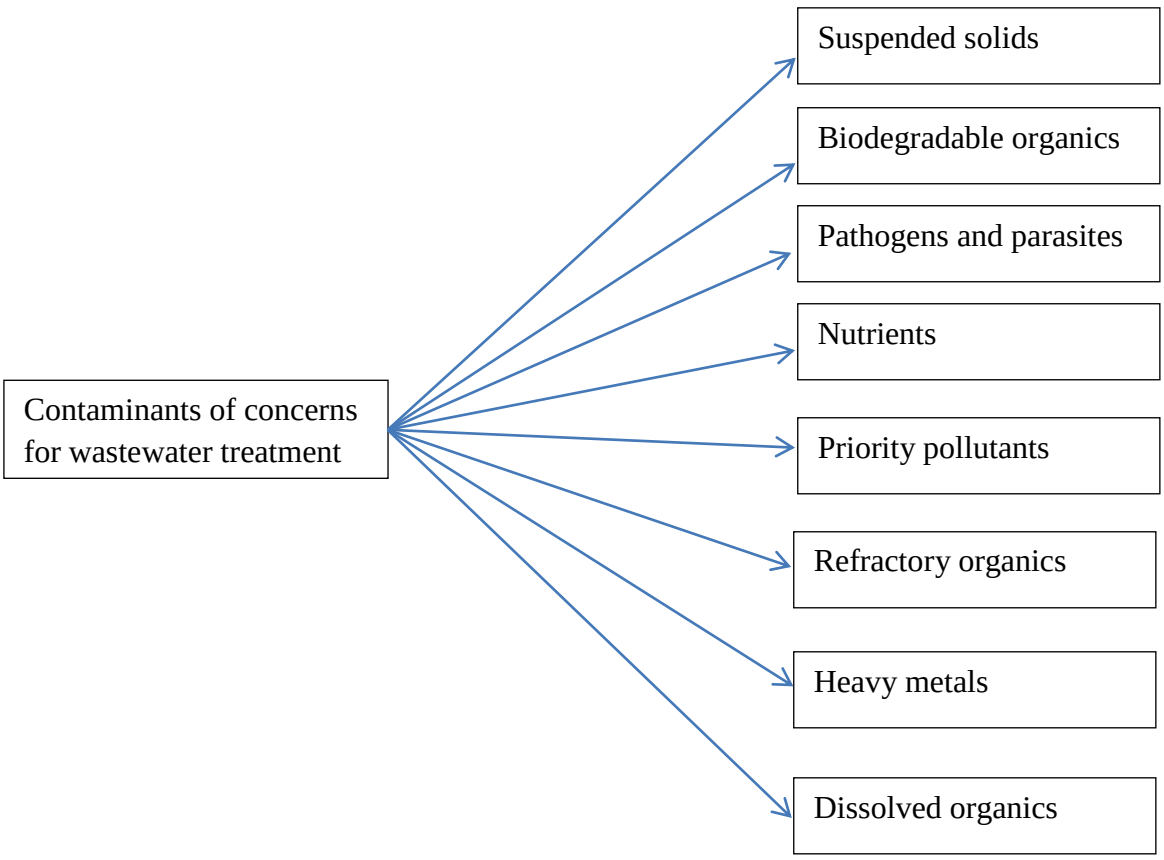

Figure 1.1: Major contaminants in waste water

Source: Gabriel and Bitton (2005).

Domestic wastewater is a combination of human and animal excreta (feces and urine) and grey water resulting from washing, bathing and cooking. People excrete 100 - 500 g wet weight of feces and between 1 and 1.3 litres of urine per capita per day. Each person