CHAPTER 1

INTRODUCTION

1.1 General

In a wastewater treatment system, the consideration to conserve energy is a must. Detailed energy analyses are now becoming an important part of every project analysis including operational cost and maintenance cost. More attention is being given to the selection of process that conserves energy and resources (Metcalf and Eddy, 1991). Biological wastewater treatment is one, which is used to remedy the wastewater from a domestic or industrial wastewater.

Aerobic process is a biological treatment process that occurs in the presence of oxygen (Metcalf and Eddy, 1991). An aeration process is needed in aerobic wastewater treatment system. It is an entity process for aerobic system because the aerobic microorganism uses oxygen as an electron receptor to digest organic matter in the wastewater. For this reason, the aeration system is necessary to provide oxygen for microorganisms in the aerobic process. Therefore, dissolved oxygen (DO) in the water is an influential factor in the efficiency of wastewater treatment system.

In every process, operation and maintenance costs are extremely important. There is an increasing trend to minimize power use in the design of wastewater treatment plants by paying more careful attention to recover energy for power generation (Metcalf and Eddy, 1991). Generally, the aeration process is usually the most energy intensive process in a wastewater treatment system, such as activated sludge. It consumes about 60-70% of power input. To reduce this cost, the most suitable oxygen transfer rate of the aeration process should create optimum conditions in the aeration system and therefore reduce power consumption, which is the main contribution for operational cost.

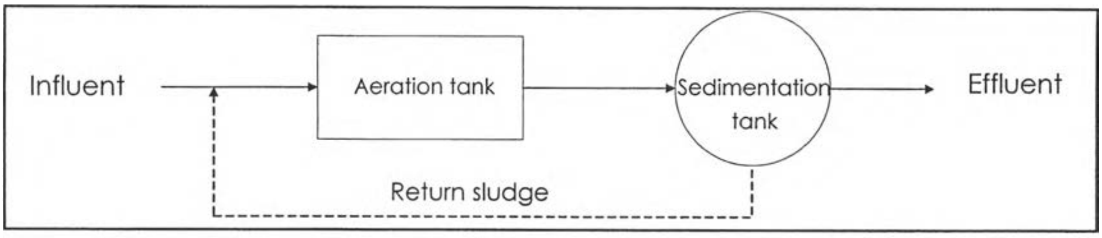

Figure 1.1 Activated sludge process

Oxygen transfer is the most important mechanism in the aeration process. Many factors affect the oxygen transfer rate such as contaminants, temperature, DO concentration, type of aeration device, and power input. These factors reduce the oxygen transfer rates down to 40% to 70% in wastewater compared with clean water conditions. The presence of surfactants in wastewater is one of the main reasons for inferior and therefore uneconomical performance (Wagner *et al.*, 1996). Oxygen transfer can be presented by using the oxygen transfer coefficient (K_La) as an indicator.

There are several reasons to use anionic surfactants. Generally, the wastewater consists of surfactants, which are important ingredients in washing agents and soaps. After washing or cleaning processes, surfactants from household are distributed in the wastewater. Mostly, an anionic surfactant type is used and presented in the wastewater. The concentrations of the other types of surfactant are very low and therefore of no importance with regard to the oxygen transfer process. The measured average concentrations of anionic surfactants in the wastewater are between 6.6 to 11.9 mg/L (Wagner *et al.*, 1996). Another reason is that, the surfactant is used to change the properties of tap water to more closely approach the properties of wastewater, and to mask the effects of trace contaminants in tap water (Stenstrom. *et al.*, 1981). Therefore, the anionic surfactant is used in this research to consider the effect of surfactants on oxygen transfer.

The present problem of this research is the presence of surfactants in the wastewater, which is still the one of the main reasons for an aeration system. Over or under estimation of the oxygen transfer rate decreases the process efficiency or increases the cost of energy consumption when operates the system. The more or the less of DO which is not suitable, the higher the operational cost to the wastewater treatment system will be. The optimum oxygen transfer rate should be studied by using oxygen transfer coefficient (K_La) to find the best efficiency with a suitable power input and cost. For these reasons, the financial concern about cost can be reduced.

1.2 Objectives

The main objective of this research is to investigate the effect of the presence of surfactants on the oxygen transfer by determining the volumetric oxygen transfer coefficient. The specific objectives are as follow:

1. To estimate the optimum oxygen transfer coefficients in water in the presence of surfactants through the variation of power input.
2. To determine the effect of turbulent condition on oxygen transfer coefficient.
3. To demonstrate phenomenon that is observed in the field, in a controlled laboratory condition so that it can be quantified and documented.

1.3 Scopes of the Study

The research is conducted to determine the oxygen transfer rate (OTR) when surfactants are presented. Power inputs are varied by adjusting revolution per minutes (RPMs). Moreover, the assumptions of this research are

1. The baffled tank, 500 liters, is used as a reactor by filling the water sample approximately 400 liters in order to comply with tank standard criteria (Metcalf and Eddy, 1991).
2. The surface aerator is selected to perform the experiment in this research.
3. Two sizes of propeller, which are 10.7 cm and 15 cm, are used.
4. Dodecyl Sodium Sulfate (DSS) is used as a surfactant and the optimum oxygen transfer coefficient in the presence of surfactants is tested by variable concentrations and power inputs.
5. Clean water and water with surfactant at different concentrations are used. Each type of water sample is treated by the same method. Tap water is used as clean water.
6. The ANSI/ASCE-2-91 standard (1993), "The measurement of oxygen transfer rate in clean water", is used to determine the oxygen transfer coefficient (American Society of Civil Engineers [ASCE], 1993).
7. ASCE DO parameter estimation program (DO_PAR) is used to calculate the optimum K_La from the experimental data (Lee *et al.*, 1997).