CHAPTER 1

INTRODUCTION

1.1 General

In wastewater treatment processes, aeration induces oxygen into the liquid phase, providing an aerobic environment for microbial degradation of organic matter. The purpose of aeration is two-fold: 1) to supply the required oxygen to the metabolizing microorganisms and 2) to provide mixing so the microorganism come into intimate contact with the dissolved and the suspended organic mater.

Over the past 25 years, aeration systems and operations have become more important and receive increasing scrutiny among environmental engineering professionals. Aeration system is an important requirement for normal activated sludge plant operation and may comprise 40-60% of the energy cost of running a treatment plant. Therefore, dissolved oxygen (DO) in water is an influential factor in the efficiency of wastewater treatment system. 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 the total power input. The suitable oxygen transfer rate of the aeration process should create optimum conditions in the aeration system and reduce power consumption, which is the main contribution for operational cost.

Efficient and reliable oxygen transfer systems are needed for economical wastewater treatment. There are many factors that affect oxygen transfer rate and efficiency. Prominent among these factors are aeration method, dissolved oxygen concentration, geometry and wastewater characteristics (Stenstrom *et al.*, 1981).

The concentration of surface active agent can have profound effects on aeration rates, and has been noted previously by a number of investigators. In some instances, the presence of surfactants may reduce the oxygen transfer rate by much as 80%. In other cases, it has been reported that oxygen transfer rate is enhanced by the presence of surfactants. The large variation in transfer rate requires that the effects of surfactants be included in aeration system design (Stenstrom and Hwang, 1980).

Estimating the oxygen transfer rate of an aeration system is one of the more important functions of a process design engineer. Underestimating the oxygen transfer rate of a proposed aeration system results in an overdesigned system which may be energy intensive and expensive to operate. Overestimating the oxygen transfer rate results in inadequate oxygen transfer and reduced process efficiency.

Several methods have been proposed to estimate the oxygen transfer rate of the aeration system, but the most common procedure is to estimate the oxygen transfer rates in clean water and then translate that rate to field condition. Estimating of the clean water transfer rate are usually made by determining the volumetric oxygen transfer coefficient and equilibrium oxygen concentration from a nonstedy state reaeration test (Stenstrom *et al.*, 1981).

1.2 Objectives

The main objective of this study is to investigate the effects of surfactants on oxygen transfer rate, especially with respect to different concentrations and power intensities. The specific objectives are:

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 are observed in the field, in a controlled laboratory condition so that it can be quantified and documented.

1.3 Scopes of the Study

1. This study used a baffled circular tank, 300 liters, as a reactor performing at laboratory scale level.
2. The turbine aerator system was selected .
3. Dodecyl sodium sulfate (DSS) was used as a surfactant.
4. The optimum oxygen transfer coefficient in the presence of surfactants was tested by varying surfactant concentrations and power inputs.
5. ASCE standard (1993) was used as the guideline for determining oxygen transfer coefficient in clean water.
6. ASCE DO parameter estimation program (Lee *et al.*, 1997) was used to calculate the optimum K_La from experimental data.