Chapter I

INTRODUCTION

Significance of the study.

The control of pollution of the environment is receiving serious concern from governments. In Thailand, the pollution of bodies of water is reported and requires serious study. The treatment of liquid wastes is certainly an important measure in the control of water pollution.

There are many methods of liquid waste treatment in use and under study to day. Each one has its own advantages and disadvantages.

The oxidation ditch is one method of waste treatment in use. The efficiency of oxidation ditches is improved by the addition of an aeration system for supplying oxygen to the aerobic biological treatment process(Pasveer, 1960; Wilson, 1960: Jones and other worker, 1969: Adema, 1967).

In the oxidation ditch the aeration rotor originally known as brush aeration system or Kessener brush(Pasveer, 1960) provides oxygen transfer capacity in addition to natural aeration. Besides, the aeration rotor helps in mixing the sewage mixed liquor.

In order to properly design the aeration rotor of an oxidation ditch for liquid waste treatment, it is necessary to know and understand the performance characteristics of aeration rotors.

Development of Aeration Rotors

The first aeration rotor used for oxygen transfer in water was put into service by HAWORTH in 1916, and known as Haworth paddles(Baars and Musleat, 1959).

Several types of aeration rotor are in use today with improved design, resulting in higher oxygen-transfer capacity.

Different names of aeration rotor are given. Sometimes, the designer's name is used to identify a rotor such as Kessener brush and Haworth paddle. Angle-iron aeration rotor, Plate rotor, Wire gauze rotor are apparently named after the shape or material of the rotor. The W-profile rotor seems to have been named after the arrangement of the blades.

Mechanism of Aeration

The action of the various parameters influencing oxygen transfer in an aeration system employing aeration rotors has not been qualified. So far qualitative description of the mechanism of oxygenation were mode, thus:

Pasveer,A(1953)observed,"Oxygenation occurs when the rapidly rotating horizontal brush creates a zone of intense turbulence drawing air into the liquid. Drag of the rotating brush causes the liquid to circulate in a basin rather than be pumped in large masses through the aeration device. To perform at maximum efficiency, this device requires a confined basin of special geometry"

Eckenfelder (1970) said that,"Oxygen transfer in most types of surface aerators may be considered to occur in two ways: transfer to droplets and thin sheets of liquid sprayed from the blades of the unit, and transfer at the turbulent liquid surface and from entrained air bubbles where the spray strikes the surface of the liquid".

Ribbius cited by Pasveer (1960) defines the action of the rotating brush as being the result of four factors as follows :

"1. The natural surface of the water ripples and surges

2. Drops of water are thrown into the air

3. Air bubbles are introduced into the mass of water.

4. The agitation of the water produces form around the body of the brush, which may represent a large surface of water in small space."

Objective of the Research

The primary objective of this research is to study the influence of selected aeration rotor operational conditions on oxygen transfer in water and waste water. The selected operational conditions include rotor speed in revolutions per minutes and depth of immersion of the rotor blades. Actual water temperature during each experiment were recorded since oxygen saturation in water was influenced by the temperature of the water.

The secondary objective is to study the power consumption for each set of operational conditions for each rotor to get information on the set-up with the least power consumption but the highest oxygen transfer rate or the economical operational conditions.

Scope of the study

Three types of aeration rotor designs were tested in this research. They were called Rectangular Rotor No.1,2 and 3 respectively.

The aeration system to be investigated consisted of a pilot oxidation ditch located near the Sanitary Engineering Laboratory of Chulalongkorn University with an aeration rotor installed. Speed in RPM could only be varied from 30 to 120 RPM because of motor limitations. Blade immersion of 5 cm., 7.5 cm., and 10 cm. were studied. Figure 1 shows the aeration system with rotor No 3 installed while Figure 2 shows the aeration system with rotors operating at 100 RPM and 10 cm. blade immersion.

Over all oxygen transfer rate constants were determined under non-steady state conditions for each set of operational conditions.

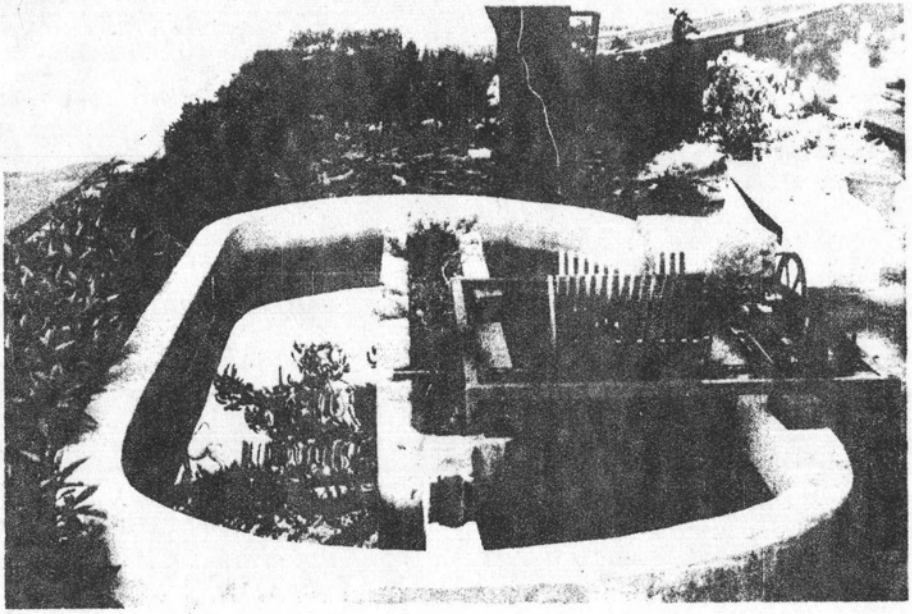

FIGURE 1 The aeration system with rotor № 3

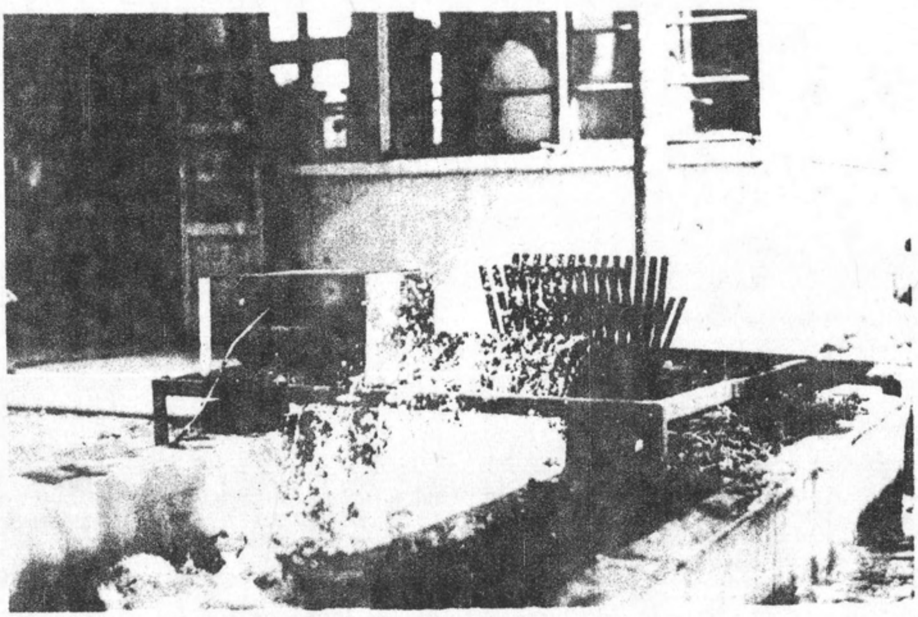

FIGURE 2 The aeration system with rotor № 3 operating at 100 RPM and 10 cm rotor blade of immersion