Chapter I

Introduction

Diffused Aeration

Air diffusion is an important unit operation which has been generally used in sewage and industrial waste treatment for many years and as the result, at the present time many test procedures have been developed so that sanitary engineers can accurately evaluate the operating efficiencies of various diffusion systems but there has not been any general acceptance of standard test procedures referred to this type of aeration yet.

In diffused aeration system, many devices are commercially available in several basic types. Small orifice devices are constructed of silicondioxide or aluminum oxide held in a porous mass with a ceramic binder, or in tubes or bags wrapped with Saran or nylon material. The size of bubbles released from this type of diffuser ranges from 2.0 to 2.5 mm. The absorption efficiency depends on the size of the air bubbles released and the turbulence generated in the system. Another type of air diffuser uses a large orifice device,

such as the sparjer. The sparjer contains four short tube orifices at 90 degree centres from which the air is emitted at high velocity. Tank turbulence tends to redivide large bubbles in to smaller bubbles. The orifice diameters normally range from 1/5" to 1/4". Other commercial units include the hydraulic shear diffuser, the Venturi diffuser and the INKA diffuser.

Development

As to this study the type of the diffused aeration quite differs from many other procedures that have ever been developed before, especially the located position of the diffuser and the source of air supply used. In all types of diffused aeration mentioned above, the diffuser itself is immersed in the absorbing liquid but by this method it is located above, in the atmosphere, thus eliminates the problem of diffuser clogging. Moreover, instead of using air pump or air compressor, a water lift pump is recommended as the source of air supply to this aeration system.

The principle theory of this system is based on the fact that when an incompressible fluid flows in a closed channel such as a pipe or conduit line laid in the atmosphere, there sometime negative pressure occurs at some points inside the line. Now if a small hole is drilled through the point, air will be drawn in, causing a gas-liquid mixture or aeration action along the downstream direction of flow, then if it is discharged through the bottom of a tank containing liquid the aeration will also occur partly in the tank.

Objective & Scope

The primary objective of the research is to theoretically study the way to draw air in contact with the liquid flow in pipe without using air pump. Second purpose is to select the appropriate types of diffusers and size of drilled holes. The last objective is to make a comparative study on the influence of selected diffusers and operational conditions on oxygen transfer in tap water and their power consumption.

The scope of the research is to carry on the comparative study of the effect of oxygen transfer in tap water by the nine selected diffusers as shown in Figure 2, 3 and 4. Uses a pilot oxidation ditch as a test model shown in Figure I and the operational method in Figure 5.

Overall oxygen transfer rate constants are determined under non-steady state condition.