

WHAT TYPE OF AERATION SYSTEM TO USE IN SHALLOW APPLICATIONS

Bulletin Brief

Selection of aeration mixing systems involves many decisions to assure optimum performance and the most economical selections. Comparison of different aeration types and features is important to allow the engineer and the customer to utilize the aeration system most advantageous for their particular application.

The relative efficiency of aeration mixing systems with the performance levels of different types of aeration devices is discussed in Technical Bulletin 127 showing several types of aeration mixing devices with the relative energy consumption per unit of oxygen supplied to clean water. From the discussion presented in Technical Bulletin 127 it is clear that diffused aeration systems have huge advantages for energy conservation when working to supply oxygen to water and wastewater systems.

Technical Presentation

One of the items that has developed over the years is a general belief (myth) that diffused aeration systems do not work well in shallow basins. This belief suggests that high efficiency diffused aeration systems only work well in deep basins because the oxygen transfer percent is greater in a deep basin than in a shallow basin. This belief is misleading and a technical evaluation is extremely important to make the right decision.

Any and all diffused aeration systems achieve higher percent oxygen transfer efficiency in deep tanks or deep water than they do in shallow water. This percent oxygen transfer efficiency is only one-half of the equation. The amount of energy consumed in any aeration system using diffusers must consider 2 issues:

1. Water depth over the diffusers with operating pressure on the compressor system.
2. Percent oxygen transfer

While a diffused system operating at 5 ft of water depth is going to receive only one-half the oxygen transfer efficiency percent at 5 ft that it does at 10 ft, it cannot be evaluated on the water depth only. The fact is that diffused aeration systems utilize almost exactly the same energy to deliver a given amount of oxygen to the wastewater independent of water depth. When the oxygen transfer percent at 5 ft water depth is one-half of the oxygen transfer percent at 10 ft of water depth, you must consider the

other half of the equation, i.e., pressure. Remember the operating pressure at 5 ft water depth is also one-half the operating pressure at 10 ft.

FACT - Oxygen transfer efficiency of diffusers based on pounds or kilograms of oxygen per horsepower (kW) remains almost constant independent of depth. Increasing depth increases oxygen transfer percent, but also increases operating pressure; therefore, the 2 variables cancel out and the energy consumption per unit of oxygen stays constant. Oxygen transfer in a shallow basin is reduced in percent; however, the operating pressure is also reduced by a similar factor. Therefore, the energy remains virtually constant.

Given these facts on diffuser oxygen transfer, it is clear that energy conservation is a major item for consideration on all aeration basins regardless of depth. Energy savings with diffusers are also available for shallow aeration basins as defined in the comparison of different types of aeration devices attached.

Operation of diffusers in shallow basins does have some unique characteristics that must be recognized. The energy consumption remains virtually constant independent of the depth of the basin but several other issues are worth considering:

For shallow basins the capital cost of diffuser systems is substantially increased compared to deep basins. Since diffusers are operating at a given volume of gas per unit and the diffusers do less work per unit in shallow basins, shallow systems have more volume of air applied and longer capacity or volume blowers are required.

The motor stays the same on the blower but the volume of air handled must increase. Energy stays constant, capital cost increases with shallow basins.

Shallow basins using mechanical aerators are severely limited because of damage to the floor of the basin and/or the liner. The energy concentration of mechanical aerators in a shallow basin is a very damaging issue for the basin floor and its effect on process performance. By comparison, diffused aeration systems distribute energy throughout the basin and minimize any erosion, do not damage or harm the liner or basin floor, and provide maximum process flexibility.

Having the aeration system completely submerged for diffuser systems can be a major benefit as follows:

1. Minimize icing issues,
2. Minimize visual effects,
3. Minimize hazards since there are no electrical issues in the basin, and
4. Minimize vandalism since nothing is exposed.

High efficiency diffused aeration systems are a very suitable product for use in shallow basins. High efficiency diffused aeration systems deliver maximum energy efficiency. Proper selection of these diffuser systems capable of delivering economical system operation with superior performance can enhance overall operations. Diffused aeration systems have been successfully used in basins as little as 0.5 meters total water depth!

For additional information regarding your specific application contact Environmental Dynamics Inc. at (573) 474-9456.