OXYGEN TRANSFER EFFICIENCY

The oxygen transfer efficiency of aerators is expressed as pounds of oxygen per horsepower-hour. The mass of oxygen transferred per unit of power input is the most important efficiency parameter when considering an aerator. It expresses the amount of energy required to treat the wastewater. This energy is usually 60% or more of the total energy cost to treat water. So, it is imperative to use an aerator that minimizes energy costs.

The transfer efficiency normally is calculated from empirical data obtained in a lab or field setting. The efficiency can range from less than 0.50 pounds to 5.0 pounds or more of oxygen per horsepower-hour. Various factors such as contaminants in the water can affect the actual transfer efficiency. For this reason the test to determine efficiency is normally conducted in a lab setting in clean water. Clean water results are often used for the design and specification of treatment plants. Once this number is obtained, then it is multiplied by a "factor", such as an alpha factor, etc., to arrive at the estimated efficiency in contaminated water.

An alpha factor is the ratio between the mass oxygen transfer in process water (i.e. contaminated water) and clean water. In other words the alpha factor is a measure of the reduction in transfer rate caused by impurities in the wastewater. Determining the alpha factor or translating standard parameters in clean water to non-standard or "process" conditions in contaminated water is the job of a consultant, not the aerator manufacturer. The alpha factor accounts for contaminants in wastewater and is impacted most by soaps and detergents. Of all the various oxygen transfer parameters the alpha factor is the most uncertain and is the most difficult to know.

The clean water and the process (contaminated) water transfer efficiencies vary greatly from one manufacturer to another. One of the purposes of determining the transfer efficiency is to place competing aerators on an equal footing. In other words a 20-hp aerator might inject more dissolved oxygen into the water than a competing 10-hp aerator, but it might do so much less efficiently. A point of confusion is the definition of the term "horsepower." For example, the term horsepower can refer to the brake or nameplate horsepower rating of the motor. This is misleading since an aerator with a 20-hp "nameplate" motor might actually be pulling less than full 20-hp amperage, say an amperage level that would be typical of a motor equivalent to only 17 horsepower. Therefore, a better definition of horsepower is "wire" power or the actual power used by the aeration system which would include all of the inefficiencies of the system such as is found in the motor, in friction loss, etc.

Since the alpha factor is so elusive, it would be ideal if a client could know ahead of time, not just the transfer efficiency in clean water, but the efficiency in the type of water into which the aerator would be placed. Such knowledge would help the client make the right decision on the purchase of a particular aerator without having to depend on an uncertain alpha factor. To this end, VaraCorp is in the process of having the transfer efficiency of its aerator tested in industries such as Oil & Gas (frac) and in municipal wastewater. In addition, clean water tests are in the process of being performed by more than one independent laboratory. One important test has already been conducted for VaraCorp in frac

water by Mike Kettner, PE with Makoshika Enterprises LLC in a Rockwater Energy frac pit. This test shows a rather high transfer efficiency in the process water of 4.7 pounds of oxygen per horsepower-hour. See the complete report in this section of the website. More reports on the transfer efficiency of the VaraCorp aerator will be posted as they are available.

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