Oxygen Transfer Efficiency A Priority For The Aeration Process

Municipal wastewater treatment facilities must meet strict effluent discharge permit standards to stay in compliance with governmental regulations. By having dependable aeration equipment such as aerators with high oxygen transfer efficiency, such standards are met and cost-savings are achieved.

By Cheri D Cohen

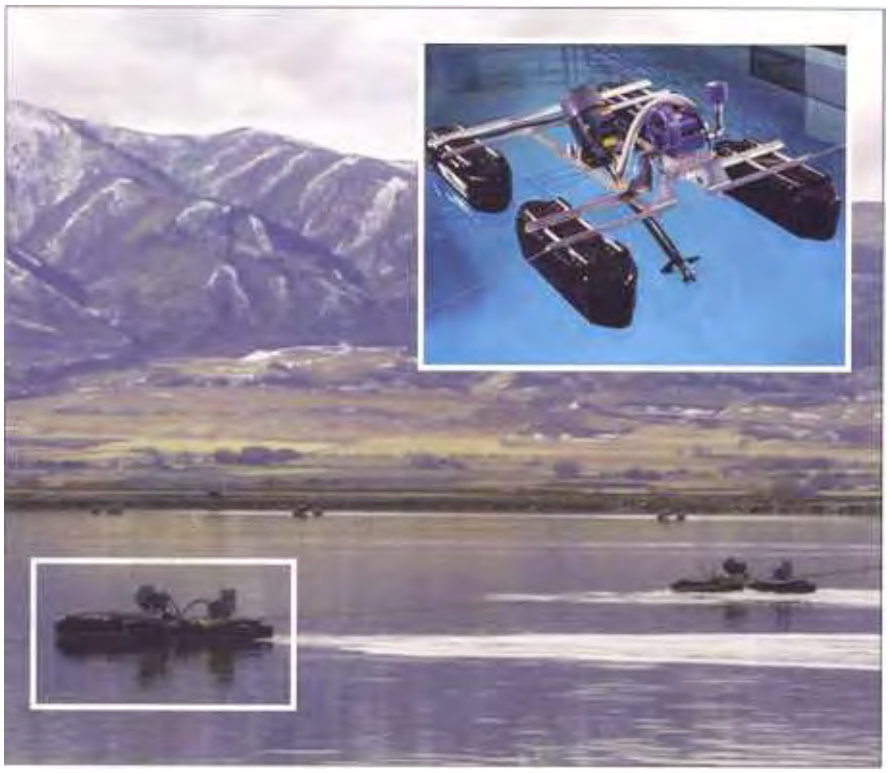
Aerators for cost-saving

In many cases, high electrical costs are incurred at a wastewater treatment plant when the machinery and equipment start to wear out. More energy would be needed to power the plant. To cut down on the energy used and henceforth saving on the electrical costs, a municipal wastewater treatment plant need not replace its entire system. One effective way of cutting down the costs is by upgrading the aging equipment in existing systems with aerators.

In the town of Buckeye in Arizona in the US, a 40 Hp brush rotor was replaced by two 10 Hp TRITON process aerators for its activated sludge oxidation oval system. After the replacement, its rotor power consumption was reduced to 20 Hp and a cost-saving of US$10,455 was achieved for the year.

The city of Logan in Utah had operated on a full AIRE-O2 aspirator aeration system for more than a decade before population growth called for the addition of TRITON process aerators to the system. With the installation of the aerators in the largest municipal lagoon system in the US, an estimated cost-saving of US$20,000 per year was attained.

Cities in the US are not the only ones using the TRITON process aerators. Municipalities throughout Asia are using the TRITON technology to save on electrical costs. A large municipality in the Jiangsu province in China will be using 48 TRITON process aerators for its new wastewater treatment plant scheduled for operation in early 2002.



The TRITON process aerator (insets) being utilised at the municipal lagoon system in Utah.

Oxygen transfer efficiency

The TRITON process aerator has the unique ability to disperse oxygen throughout an entire wastewater treatment basin, and this is the key to its efficient oxygen transfer and performance effectiveness. Numerous factors affect oxygen transfer calculations. These include alpha factor, beta factor, wastewater temperature and site elevation. Alpha and beta are used as correctional factors in calculating oxygen requirements. They account for the difference between process water characteristics and clean water.

Bubble size is one of the components that determines alpha factor along with surfactants, turbulence, power input per unit volume (Hp/MG), tank geometry and degree of treatment.

Significance of bubble size

Aerator propeller designs need to accomplish three simultaneous functions to determine its overall efficiency. Firstly, the propeller has to create a precise flow velocity to inject the proper amount of air. Too much air will result in the air going straight to the water's surface as large bubbles, reducing oxygen transfer. Secondly, the propeller will determine the maximum volume of water flow. Thirdly, the propeller needs to create shear flows to shear airflow to produce "fine bubbles".

The TRITON process aerator is able to inject more air into the water and yet break the bubbles into smaller 2 mm bubbles, a standard considered as "fine bubbles" by the Environmental Protection Agency (EPA). Breaking up a one-inch diameter bubble into fine bubbles increases the total surface area from 3.14 square inches to more than 39 square inches. The fine bubbles also have a longer hang time. By increasing the surface area and creating longer hang times, more oxygen can be transferred.

Using the TRITON process aerator, less energy is needed to inject significantly more oxygen and produce greater mixing rates. The regenerative air assist motor increases the volume of air injected into the water dramatically. The dual propeller design accomplishes two functions of creating a plume of ultra fine bubbles while simultaneously driving the plume farther and deeper through the water column. This extends the contact time and the reach of the bubbles for maximum oxygen dispersion effectiveness.

Oxygen dispersion efficiency

In the treatment of wastewater, an aeration system's effectiveness in providing a complete and uniform transfer of oxygen throughout the entire basin varies with technologies. Due to the unique TRITON process aerator technology that produces a horizontal and circular flow pattern, the equipment provides whole basin circulation.

Mr Brian Cohen (left), Director of Sales, and Mr Bill Randall (far right), Vice President of Aeration Industries at the Jiangsu province treatment site in China.

Together with its props, the TRITON process aerator is able to create a high-velocity horizontal stream of oxygen that sweeps solids along with it, keeping them in suspension for more efficient biological treatment. This dispersion of oxygen throughout the basin results in more efficient wastewater treatment and higher removal rates of biological oxygen demand (BOD) and suspended solids.

The TRITON process aerators are strategically placed to create a flow linkage between units. This keeps solids in suspension to be treated by the uniform dissolved oxygen levels. The ability to maintain desired velocities and oxygen dispersion of any size basin through horsepower and linkage ensures energy consumption for aeration and mixing, and hence no energy is wasted.

One adavantage of the TRITON process aerator is its flexibility. It can be deactivated from time to time to match the demand of the system during fluctuating hydraulic flows or loadings in the wastewater. This usually results in additional energy savings.

It is capable of dispersing oxygen throughout the entire basin, thereby preventing treatment problems such as short-circuiting, dead zones and only partial aeration. Also, the horizontal flow technology requires less energy to operate than conventional vertical-type aeration systems that must overcome gravity to throw water up into the air and thus, consume larger amount of energy.

What makes the TRITON?

The TRITON process aerator is a motor-driven air assist propeller-type floating surface aerator that injects air from the onboard high-efficiency regenerative air-assist system. The air is then forced under the surface of the water through a hollow shaft where a specially designed prop breaks up the air into fine bubble aeration, as defined by the EPA.

With its excellent mixing capability, uniform distribution of oxygen throughout the entire basin at all depths is ensured. This results in high BOD removal rates, no sludge build-up and no odours. **WWA**

This article is contributed by Ms Cheri D Cohen, Marketing Consultant for Aeration Industries International Inc.