Wastewater Aeration Membranes

Smurfit-Stone Container

Case Study

Project History

This case study is one of four made possible through the Michigan Department of Environmental Quality's (DEQ) Pulp and Paper Pollution Prevention Program, or P5, a voluntary environmental initiative open to all pulp and paper companies in Michigan.

Program objectives were developed by a partnership between DEQ and the Michigan Pulp and Paper Environmental Council (MPPEC) to lessen the industry's environmental impact. Participants identify environmental substances of concern and establish priorities and goals for reduction of their use, generation, discharge, or emission. The technology transfer shared through the experiences of the participants is an integral part of this program. The four case studies are direct products of this technology transfer objective. Flyash recycling, biosolids composting, and business teamwork case studies have been written in addition to wastewater aeration membranes.

Company Background

Smurfit-Stone Container started as a sulfur pulp mill in 1921 under the name of Northern Fiber Co. and went through many changes. The mill is currently owned by Smurfit-Stone Container Corporation and now employs 277 people. The mill produces 815 tons of brown corrugating medium daily.

The Papermaking Process

Water is essential in papermaking. It is the carrier for the fiber that is put onto the paper machines. This slurry, called paper machine stock, is 99 percent water and one percent fiber. Water is used to dilute pulp to a fine slurry of wood fiber which is then pressed and dried into paper.

Organics from the wood pulp are extracted with the process water. This process is treated to remove organics before it is returned to the environment.

After removing most of the primary solids in the water, the mill focuses its control on BOD (biochemical oxygen demand). Basically, BOD is a parameter that measures the tendency of effluent to consume the dissolved oxygen of its receiving waters. This consumption takes place due to natural biological processes: microorganisms present in the water devour organic materials.

BOD must be reduced to enable living things in rivers and lakes to get essential oxygen to survive. Nature's way is to let the water absorb oxygen from the air, which is a very slow method and easily depleted. Supplying enough oxygen to the water in an enclosed area is the treatment technique used for BOD removal at the Smurfit-Stone mill. One method is called a waste-activated sludge system.

The BOD removal at the Smurfit-Stone Container Corporation mill is accomplished by passing large quantities of air through the wastewater in large aeration basins. This aeration is accomplished with mechanical blowers and

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many thousand fine bubble diffusors. Using fine bubbles creates more surface area contact, better transfer of oxygen to the water, and quicker removal of BOD. Smurfit-Stone Container Corporation of Ontonagon, MI examined their current process to make it more efficient.

Improvements to Process

The Smurfit-Stone Container mill owns and operates a wastewater treatment plant onsite and processes about four million gallons of water per day. The team at Smurfit-Stone wanted to operate a more efficient wastewater treatment plant while decreasing costs. The aerator disks in use at the time were made of ceramic and became a point of focus. The ceramic disks became fouled by an iron-producing bacteria which reduced efficiency and required cleaning twice a year. With two aeration basins containing 11,520 of the 8.7-inch diameter disks, this was a time-consuming process. Also, by shutting down the mill twice each year, earnings were reduced. Money was lost from startup and shutdown losses, cleaning costs, and lowered production levels during the outages. The mill would shut down in the spring and in the fall for approximately four days each period. The shutdowns and startups also had potential environmental impacts at the wastewater treatment plant.

Employees at Smurfit-Stone Container looked into the possibility of replacing the ceramic disks with rubber membrane disks. The Ontonagon mill decided to try the membrane disks but first had to justify that the investment would be worthwhile. Because of the significant costs for the materials and installation, Smurfit-Stone Container had to be sure that the rubber membrane disks would be the solution. A team of employees visited the manufacturer of the rubber disks and a Wisconsin mill that had the membranes in place. Based on environmental benefits and return on investment, they were sold on the project. The disks were installed in the fall of 1995.

Previously, the ceramic disk cleaning was accomplished by spraying first high-pressure water and then a low concentration hydrochloric acid wash.

Results of Revised Process

Smurfit-Stone Container Corporation was immediately pleased with the decision. The rubber membrane disks provided many benefits. The disks have required no maintenance or cleaning since installation, resulting in eliminating mill shutdowns specifically for disk cleaning. With the wastewater treatment plant able to operate during regularly scheduled shutdowns, the mill was able to eliminate the spring outage. Both of these features were a real money saver. It also eliminated the environmental risk of starting up and shutting down the wastewater treatment plant.

The rubber disks operate more efficiently because they do not become fouled or partially plugged. A result is the production of a cleaner effluent by removing more BOD. The rubber membranes are also able to maintain a higher dissolved oxygen rate. After the ceramic disks would foul, they would require more horsepower to maintain the same airflow. Now, less power is needed (a reduction of 200-300 hp) which saves energy and money. The mill used six blowers to run the basins with ceramic disks. With the rubber membrane disks in place, only four or five of the blowers are used. This reduction in power resulted in additional savings.

The only disadvantage seen in the future is that the rubber disks will eventually wear out. Their lifetime is estimated at approximately ten years, whereas the ceramic disks normally never wear out but do require cleaning. When asked if the rubber membrane disks would be recycled after use, Smurfit-Stone Container said it would be looking into the possibility.

The project has paid for itself. With the savings generated from reduced power requirements and more production, due to less downtime, the payback time of this project was estimated to be one year. The project was also beneficial to the environment by reducing energy usage and producing a cleaner effluent.

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