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Serigraph – Biofilter

Serigraph is a printing, molding, and custom graphics company that prints almost exclusively on plastic. They specialize in decorative, functional, and brand identity solutions for consumer and industrial products, point of purchase and promotions. The company’s global headquarters is in West Bend.

Challenge

Six counties in southeast Wisconsin have elevated ozone levels, and the EPA has designated them as a “nonattainment area” for this aspect of ambient air quality. Businesses in ozone nonattainment areas have stringent restrictions on the amount of volatile organic compounds (VOCs, which contribute to ozone formation) they can emit.

Serigraph’s location in Washington County made them subject to these restrictions. However, the solvent-based inks Serigraph used in their printing were a significant source of VOCs. If Serigraph couldn’t find a cost-effective way to control their VOC emissions, they would need to move out of southeast Wisconsin, the company’s home since its 1949 founding.

Strategy

The standard technological solution to VOC removal is an expensive control technology that uses intense heat to break down the VOCs. However, Serigraph CEO John Torinus was interested in a biological alternative that he’d seen at a printer in Bengaluru, India. In a biofiltration system, VOC-laden air is drawn away from the printing areas, then blown into a chamber containing a medium inoculated with VOC-loving bacteria. In this warm, humid environment, the bacteria digest the VOCs into carbon dioxide and water.

Serigraph conducted a pilot test of a biofiltration system in 1994, and in 1996 contracted with PPC Biofilter to install a commercial-scale biofilter in Serigraph’s new printing facility. A study conducted by PPC Biofilter showed that operating costs for Serigraph’s biofilter would be about \$55,000 per year in electricity and water expenses – and that this would be the most economical way to clean the VOCs from Serigraph’s emissions. The upfront cost of the biofilter was about \$1 million, and half of the cost was covered by a state grant.

| Flow Characteristics: 45,000 CFM. VOC Loading: 45 Tons/Year. Wet Bulb Temperature: 70 – 90° F. | | | |
|-------------------------------------------------------------------------------------------------------|----------------------|-------------------------------------------|--------------------------------------------|
| | Biofiltration | Thermal Treatment w/ Concentrators | Thermal Treatment w/o Concentrators |
| Capital Cost | \$1,400,000 | \$1,800,000 | \$900,000 |
| Operating Cost (10 yrs): | \$820,000 | \$7,100,000 | \$10,955,000 |
| <i>Natural Gas</i> | \$0 | \$700,000/yr | \$1,100,000/yr |
| <i>Electricity</i> | \$42,500/yr | \$35,000/yr | \$20,500/yr |
| <i>Water</i> | \$12,500/yr | \$0 | \$0 |
| <i>Bed Replacement</i> | \$180,000/4 yrs | \$0 | \$0 |
| Removal Efficiency | 85% | > 95% | > 95% |
| Cost per ton of VOC removed over 10 years | \$5,800 | \$20,800 | \$27,700 |

Cost comparison of VOC control technologies for Serigraph’s application. Adapted from PPC Biofilter.



In 2007, Serigraph configured the biofilter to use wastewater from the screen-washing step of the print process as the input for the humidification chamber. As the water filters its way down through the chamber, organic waste (biochemical oxygen demand, or BOD) in the water is removed before the water is discharged to the city sewer.

Finally, Serigraph reduced its VOC emissions by increasing its use of inks that cure under UV light rather than through the evaporation of a solvent. Though this method uses electricity to cure the inks, the increased electric use is offset by the reduced VOC production and the fact that UV-cured inks can produce finer line weights and higher quality printing.

Results

Serigraph's innovative biofilter has been a resounding success, both financially and environmentally. Their current annual operating cost for the filter is about \$40,000 for water and electricity – 27% lower than originally projected. Serigraph's printing plant emits 12 tons of VOCs annually, far below their permitted level of 79 tons per year.

When Serigraph configured the biofilter to reuse and treat water from the screen-washing process, the company reduced its consumption of city water by 40,000 gallons. This amount of water is a small percentage of the company's total use and saved Serigraph little money initially. However, after its treatment in the biofilter, the water that Serigraph does send to the city sewer is now so clean that the company no longer needs a discharge permit for its wastewater, saving \$10,000-16,000 per year in water sampling costs.

Serigraph's biofilter has garnered international attention in the printing industry, and a contingent from Japan visited the company in 2009 to learn about the biofilter. By adopting an innovative VOC control technology, Serigraph has cleaned up its air and water emissions, maintained its 60-year history in southeast Wisconsin, and saved thousands of dollars.

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