

**A**s environmental regulations become more stringent, many textile plants will be required to pretreat before discharging wastewater to publicly-owned treatment works (POTWs).

The carpet industry in and around Dalton, Ga., has begun preparations for pretreatment of wastewater in anticipation of tougher regulations. A recent work-

shop sponsored by the Georgia Tech Economic Development Institute covered principles of wastewater treatment and reviewed some of the technologies used in pretreatment.

shop sponsored by the Georgia Tech Economic Development Institute covered principles of wastewater treatment and reviewed some of the technologies used in pretreatment.

shop sponsored by the Georgia Tech Economic Development Institute covered principles of wastewater treatment and reviewed some of the technologies used in pretreatment.

## A Head Start On Tomorrow's Rules

A recent workshop in Dalton, Ga., explored strategies for the pretreatment of textile wastewater.

*By Warren S. Perkins  
Technical Editor*

### Wastewater Treatment Basics

Jim Walsh of the Georgia Tech Research Institute discussed types of pollutants in textile wastewater, permits for wastewater discharge, and monitoring of pollutants in wastewater.

Parameters commonly regulated in textile wastewater include biochemical oxygen demand (BOD), chemical oxygen demand (COD), total suspended solids (TSS), total solids, volatile solids, oil and grease, pH, nitrogen, phosphorus and metals. Walsh explained that the National Pollutant Discharge Elimination System (NPDES) covers direct discharge of water to navigable waterways. A POTW normally has an NPDES permit that requires monitoring of pollutants and limits the amount of wastewater flow, BOD, COD, TSS, specific chemicals and other pollutants.

John Pierson of the Georgia Tech Research Institute listed a myriad of regulatory drivers for pollution

control. Pierson also discussed environmental drivers for pollution control. Local concerns include smog, groundwater pollution and oil spills. Regional concerns include surface water chemistry, soil degradation, visibility, acid rain, herbicides and pesticides. Global concerns include climate changes, ozone depletion, loss of habitat and loss of biodiversity.

Pierson pointed out that the selection of methods for pretreatment of wastewater requires a knowledge of the wastewater volumes (flow rates) and wastewater characteristics (pollutant concentrations), because these two factors determine mass loadings that, in turn, determine design characteristics for the system.

The important factors in process selection are process applicability to the situation, process performance and costs.

### Pretreatment Technologies

The University of Georgia offered a progress report on a study of pretreatment of carpet dyeing wastewater. Sponsored by the Consortium for Competitiveness in the Apparel, Carpet and Textile Industries (CCAATI), the project has as its objective the evaluation of the technical and economic feasibility of various technologies to lower COD of carpet dyeing wastewater. The project is being conducted by the University of Georgia and Georgia Tech in conjunction with a carpet manufacturing plant in Dalton.

Technologies under consideration include chemical oxidation using ozone, chemical oxidation using hydrogen peroxide at elevated temperatures, membrane separations (nanofiltration and reverse osmosis), chemical precipitation and evaporation.

**Chemical Oxidation With Hydrogen Peroxide.** Oxidation of carpet dyeing wastewater with hydrogen peroxide activated by a

*Editor's Note: Warren Perkins is senior research textile chemist in the University of Georgia Department of Textiles, Merchandising and Interiors.*

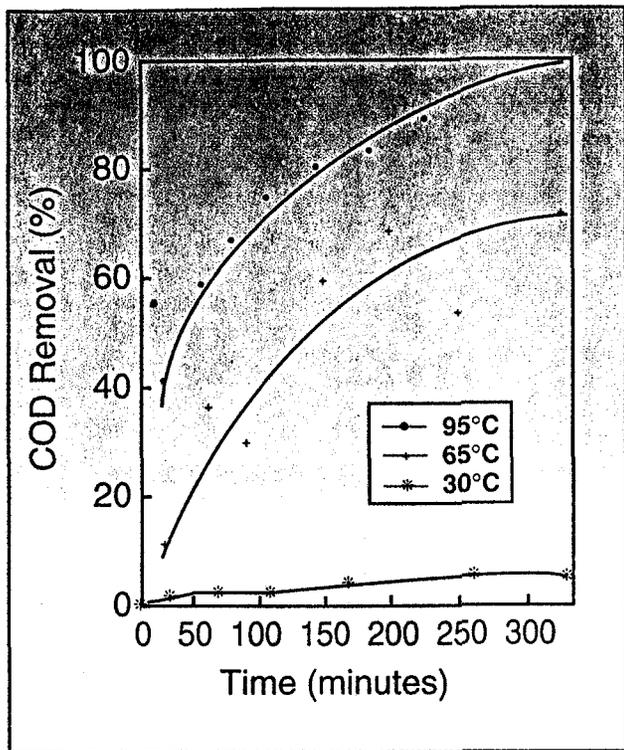


Figure 1. Rate of removal of chemical oxygen demand (COD) with 0.5 percent hydrogen peroxide and 50 mg/L ferrous sulfate heptahydrate.

low concentration of ferrous ions was effective in lowering COD of simulated carpet dyeing wastewater. The amount of ferrous ions used (50 ppm in the case reported) was low, so no sludge was formed. The rate of removal of COD was very dependent on the temperature of the treatment, as shown in Figure 1.

Amount of COD removed was approximately proportional to the amount of hydrogen peroxide consumed, with about 3 to 4 units of hydrogen peroxide (as  $H_2O_2$ ) required per 1 unit of COD removed. Lower temperatures can be used if the concentration of ferrous ions is increased; however, this produces a sludge that requires disposal.

**Chemical Oxidation With Ozone.** Dr. Ed Law of the University of Georgia reported that treatment of carpet dyeing wastewater with ozone produces only a small reduction in COD. But recently published papers have reported that pretreatment of textile wastewater with ozone improved the biological treatability of the wastewater.

In one study, pretreatment of

textile wastewater with ozone followed by biological treatment in an aerobic system reduced COD dramatically compared to biological treatment without ozone pretreatment. Studies are underway in the CCACTI project to determine if pretreatment with ozone similarly improves biodegradability of carpet dyeing wastewater.

**Aerobic and Anaerobic Biological Treatment Processes.** Charles Ross of Environmental Treatment Systems Inc. reported on the use of aerobic and anaerobic systems for treatment of textile wastewater. Aerobic systems include lagoons, activated sludge processes, sequencing batch reactors, biotowers and rotating biocontactors, land application and artificial wetlands. The activated sludge process that is common for treatment of mixed textile and domestic waste is shown schematically in Figure 2.

As the influent is aerated, microorganisms feed on the waste and oxidize organic materials. Metal ions in the wastewater complex with organic matter in the treatment system and are partially

removed with the sludge. Dye molecules also may adsorb on organic matter and be partially removed with the sludge.

After biological treatment, the wastewater enters the clarifier, which separates most of the water from the sludge. Part of the sludge, rich in microorganisms, is recycled into the aeration lagoon. Polymeric flocculants often are added to assist solid/liquid separation and color removal in the clarifier.

Strong points of an aerobic system include: good performance for low to medium  $BOD_5$  wastewater; capability to treat to low discharge requirements; long, extensive operating histories; and effective removal of nitrogen.

Some weaknesses of aerobic systems include: high energy (electric power) requirements; sludge production; and sensitivity to load fluctuations.

Only recently has anaerobic treatment been seriously considered for treatment of textile wastewater. Its strong points include: suitability for high- $BOD_5$  wastewater; low sludge production; low energy requirements; potential for energy (gas) production; and capability for handling load fluctuations.

In addition, anaerobic treatment may be effective for removal of color from textile manufacturing wastewater.

Weaknesses of anaerobic systems include: limited availability of design information; short operational histories; unsuitability for nitrogen removal; and narrow temperature operating range.

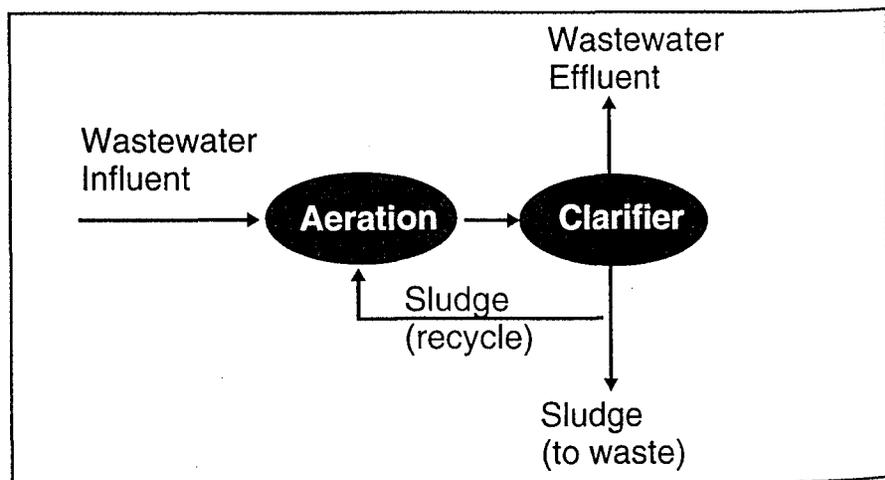


Figure 2. An activated sludge wastewater treatment system.