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## Turning waste to profit...

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HEADNOTE

... Paper mills can turn a pollutant into a money-making [chemical](#)

Bethlehem, Pa.-A new catalytic process can help paper mills save millions of dollars a year by converting a polluting by-product into formaldehyde.

Israel E. Wachs, professor of chemical engineering at Lehigh University in Bethlehem, said Georgia-Pacific Corp. tested his method in mobile pilot plants for two years and succeeded in converting a **methanol**-water waste stream contaminated by sulfur compounds and small amounts of hydrocarbons, known as terpenes, into formaldehyde. The process also minimizes most of the emissions of carbon dioxide (CO <sup>2</sup>) and sulfur dioxide (SO <sup>2</sup>), two potentially harmful by-products of traditional pollution control, Wachs said.

Andrew G. Gibson, an industrial consultant and former process improvement manager at Georgia-Pacific, said the company found a mill producing 2,000 tons a day of pulp would save between \$500,000 and \$1 million a year using the new method to get rid of the contaminated **methanol** waste stream. There are approximately 150 such mills in the U.S. and Canada, said Gibson, and 300 more worldwide.

**Methanol** and sulfur compounds called mercaptans are paper mills' by-products when logs go under intense heat and pressure with a caustic solution in sulfite. The process separates lignin, a polymeric resin that holds together the cell walls of plants, from cellulose, the material used to make paper. At one point, **methanol** and the foul-smelling mercaptans are released into streams. The conventional way to dispose of **methanol** and mercaptans is incineration at 1,500degF, an expensive process often requiring added fuel that emits CO <sup>2</sup>, a greenhouse gas, and SO <sup>2</sup>, an ingredient in acid rain.

"Using conventional pollution control methods," Wachs said, "paper mills at best can only convert an extremely bad pollutant, contaminated **methanol** waste streams, into moderately bad pollutants, CO <sup>2</sup> and SO <sup>2</sup>- and at a major cost. Consequently, the paper mills are not completely solving the pollution emissions but just taking a Band-Aid approach."

Wachs's process also produces [formaldehyde](#), a reactive compound important to the paper mill industry used to make the resins in particle board, as well as molding compounds, brake linings, and other products.

Gibson said Georgia-Pacific asked Wachs in the mid-1990s to develop a process to convert the contaminated **methanol** waste stream into  $\text{CO}_2$  and  $\text{SO}_2$  at mild temperatures in contrast to the incineration method at 1,500degF. Existing methanol-oxidation catalysts of bulk metal oxides or metallic silver, he said, were useless, as they were deactivated by the sulfur compounds and the high steam concentration in the stripper overhead gas containing the **methanol**.

Wachs said he believes the new catalytic reaction, selective oxidation of mercaptans to formaldehyde, can also apply to the chemical, natural gas, and petroleum industries.

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