



Researchers have developed a low-cost system to concentrate the chemical pollutants in electroplating rinse waters.

The Brayton-cycle solvent-recovery system was first installed by the 3M Company at its magnetic tape production facility in Hutchinson, Minnesota, where it saves about 38 billion Btus annually. By ensuring a consistent solvent quality, the system also improves productivity in the tape-making process. Based on the waste-solvent emissions industry-wide in 1980, the Brayton-cycle system could potentially recover 6.3 million tons of solvent, which is equivalent to 0.25 quad. Savings in 2010 are estimated at 10.1 trillion Btus per year.

Electroplating-Wastes Concentrator

The waste rinse water from electroplating processes contains high concentrations of chemical pollutants such as chromic acid, nickel sulfate, and zinc cyanide. Currently, excessive pollutant discharge is avoided by using high-temperature evaporation or chemical precipitation to produce a concentrate for disposal or recycling. These processes consume substantial amounts of energy and have high operating costs. An alternative method for concentrating large volumes of aqueous wastes is to boil the liquid at below-atmospheric pressure because liquids under lower pressure will boil at lower temperatures. This approach is used in multiple-effect evaporators that evaporate liquid in successive stages (or effects), each stage being at a lower pressure than the previous stage.

DOE and LICON, developed a low-cost, vapor-recompression evaporation system for use in concentrating electroplating wastes. The energy efficiency of this system is equivalent to that of a complex 10- to 12-effect evaporation system. In the vapor-recompression evaporator, the energy in the latent heat of the liquid, which is normally lost to the condenser by evaporation, is recycled through the compressor. This provides a temperature difference across the heat exchanger that promotes further evaporation. The only additional energy needed is power to increase the pressure that provides the temperature difference. The result is a substantial reduction in energy requirements per pound of water evaporated. Eighteen systems were operational in 1989, saving an estimated 0.1 trillion Btus per year. Projected savings are expected to reach 19.1 trillion Btus by 2010.

Black Liquor Gasification

Kraft black liquor, a by-product of paper manufacturing, provides a significant source of energy for the paper production process. The energy content of the kraft black liquor has traditionally been recovered by the Tomlinson boiler process, which is characterized by low energy efficiency, high capital and operating costs, significant air emissions, and a potential for explosions.