TURNING CONTAMINATED SOLVENTS INTO PROFITS

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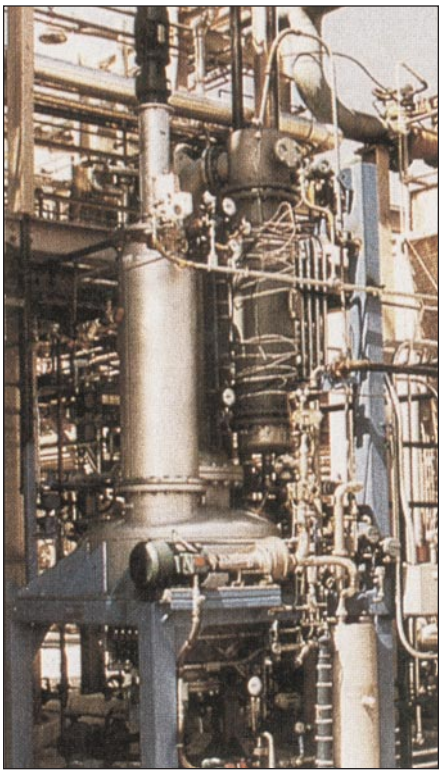

Recovering solvents has helped Lexmark not only to meet the Colorado Governor's Challenge, but also to save money by cutting raw materials and disposal costs

For Lexmark International, Inc. (Lexington, Ky.), a manufacturer of organic photoconductor drums, minimizing the use of the cleaning solvent tetrahydrofuran (THF), was a challenge. Hundreds of thousands of pounds of THF are used each year for cleaning mix tanks and process equipment. While the used THF solution is relatively clean, it contains traces of other solvents and about 1% dissolved polymers, such as polyester, polycarbonate and acrylics. Thus, Lexmark has historically paid to have the THF waste disposed.

In March 1995, Lexmark accepted the Colorado Governor's Challenge, a voluntary program to reduce hazardous waste. One of the commitments that Lexmark made was to reduce the THF solvent waste stream by 25% before the year 2000. This waste reduction would not only be beneficial to the environment, but is also financially attractive. With virgin THF costs at about $1.30/lb and disposal costs at $0.15/lb, a 25% reduction would mean saving at least $250,000/yr.

The most obvious approach to reduce the solvent stream was to purify the THF and recycle it to the process. Because THF is more volatile than the other waste components, evaporation seemed to be the most logical candidate for separation. However, Lexmark's initial lab experiments proved that the dissolved polymers in the waste solution had a tendency to foul the heating surfaces. At one point, fouling was so severe that use of an evaporator seemed to be ruled out. Then Lexmark learned of LCI Corp.'s (Charlotte, N.C.) agitated thin-film evaporator, which is designed to handle material with fouling tendencies. The skid-mounted evaporator consists of two major assemblies, a vertical-heated cylindrical body and a rotor. The feed stream enters the unit tangentially above the heated zone and is evenly distributed over the inner circumference of the heated surface by the rotor.

Fouling polymers are no match for this thin-film evaporator

The action of the rotor is designed to minimize fouling and maximize heat transfer from the body wall. Therefore, volatile components are easily evaporated as they fall through the heated body. The vapors exit through the top of the evaporator where they are ready for condensing and subsequent processing. A liquid portion of the volatile components carry the non-volatile components out of the bottom of the heated zone.

Finding the perfect fit

Two pilot scale tests were run at the LCI test facility in Charlotte to determine the effectiveness of the thin-film evaporator. The first test involved the use of a fixed-clearance rotor. This design was ineffective in dealing with the polymers in the waste solution. Fouling resulted, causing dramatic loss of heat transfer through the body wall. Upon disassembling the unit, the heating surface was found to be covered with a layer of baked-on polymers.

The second test involved a wiped-film rotor assembly. In the wiped-film assembly, the rotor is in direct contact with the heating surface. This gives the rotor ability to mechanically remove any build-up on the heating surface. The wiped-film design handled the polymers without any noticeable loss of heat transfer and no fouling.

Lexmark concluded that the LCI Solvent Recovery System (SRE) with a wiped-film rotor assembly was the best choice of equipment for this application. The SRE is a completely automated "one-button" system. It is easy to install, and requires little attention during operation.

Lexmark installed the SRE and had it fully operational within 9 months of the pilot test. The system has made it possible for the firm to achieve the 25% waste reduction goal, meeting the Colorado Governor's Challenge. Lexmark estimates that the project will pay for itself in less than two years.

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