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## This Week

### Dry, clean and green

30 Aug 97

DRY-CLEANING machines that use liquid carbon dioxide as a solvent will go on sale in the US next year-thanks to chemists in North Carolina who have developed CO<sub>2</sub>-soluble detergents. Dry-cleaners will lose their characteristic smell, and the new process will cut the amount of toxic waste produced in cleaning clothes.

Joseph DeSimone, a chemist at the University of North Carolina, Chapel Hill, says liquid CO<sub>2</sub> is an ideal solvent because after cleaning, the CO<sub>2</sub> can be evaporated off, collected, liquefied and reused.

The problem in developing the process, says DeSimone, has been that CO<sub>2</sub> by itself is not a good solvent. However, he points out that not much dissolves in water without the help of detergents, yet water is the most common solvent. What CO<sub>2</sub> needed, he thought, was the right detergent.

Detergent molecules such as those in washing-up liquid have two chemically distinct ends: one has a liking for water, the other sticks to dirt. Normal detergents do not dissolve in liquid CO<sub>2</sub>, so DeSimone created three CO<sub>2</sub>-soluble detergents. One end of the detergents has a fluorocarbon group, which makes them soluble in CO<sub>2</sub>. The other end is soluble in water, oil or silicone, depending on the type of dirt being removed. The person doing the dry-cleaning has to decide which of the detergents is best suited for the job.

DeSimone's company, MiCell, will start selling liquid CO<sub>2</sub> dry-cleaning machines next year. They operate at room temperature at a pressure "about ten times the pressure of a bicycle tyre", according to a spokesman for MiCell.

Most dry-cleaners currently use chlorinated hydrocarbons such as perchloroethylene. But the US Environmental Protection Agency (EPA) is clamping down on the toxic waste emissions this produces. After cleaning with the new machines, the liquid CO<sub>2</sub> is evaporated and collected for reuse, leaving a residue of detergent and dirt.

Brad Lienhart, president of MiCell, says that cutting waste and pollution is the company's strongest selling point. "Dry-cleaner owners are saying 'get this burden off my back'," he says. He hopes to sell a hundred machines in the first year of business. About 15 000 conventional dry-cleaning machines are sold around the world every year. Buster Bell, who owns Bell Laundry and Dry Cleaning in South

Carolina, says the MiCell technology looks competitive, and he likes the reduced environmental impact. "You really don't know what is coming from the EPA," he says.

**Amy Adams**

From **New Scientist magazine**, vol 155 issue 2097, 30/08/1997, page 12

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