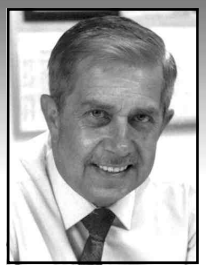

Fact or Fiction?

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Plating & Green Chemistry

"Green chemistry" involves using chemistry for pollution prevention. It is the utilization of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacture and application of chemical products. While there are other methods of achieving pollution prevention that are useful and necessary options, green chemistry is an approach that provides a fundamental methodology for changing the intrinsic nature of a chemical product or process so that it is inherently of less risk to human health and the environment.[1] This sounds to me like something the electroplating industry has been doing for a long time—at least for the past 25 years. Examples include alternates for cadmium, hexavalent chromium, chromates, solvent degreasing, cleaners and cyanide plating solutions to mention a few. Now here are some questions:

1. Have you heard about the Presidential Green Chemistry Challenge?
2. Why hasn't anyone from our industry won an award from this program?

First, let's discuss the Presidential Green Chemistry Challenge Awards Program. This program, launched in 1995, recognizes approximately five individuals and organizations each year. One award is given to each of the following:

- Any sponsor for a project in the use of alternative synthetic pathways for green chemistry
- Any sponsor for a project in the use of alternative reaction conditions (such as the use of solvents that have a reduced impact on human health and the environment, and increased selectivity and reduced wastes and emissions)
- Any sponsor for a project in the design of chemicals that are, for example, less toxic than current alternatives or inherently safer with regard to accident potential
- A small business (annual sales of less than $40 million) for a project in any of the scope focus areas mentioned above
- An academic institution for a project in any of the scope focus areas mentioned above

Here are examples of some awards. In 1999, the five award category winners were:[2]

- Alternative synthetic pathways—Dow AgroSciences LLC for developing a selective, low-risk insecticide.*
- Alternative reaction conditions—Nalco Chemical Co. for developing a water-based process for manufacturing liquid polymers, thereby eliminating the use of oils and surfactants.
- Design of safer chemicals—Lilly Research Laboratories for designing a more efficient process for synthesizing an anticonvulsant drug for epilepsy and other neurodegenerative disorders.
- Small Business—Biofine, Inc. for designing a process that converts cellulosic biomass to levulinic acid, a building block in the synthesis of other chemicals. The process converts waste biomass, including paper mill sludge and agricultural residues, to levulinic acid, which is a versatile intermediate in the synthesis of many products.
- Academic—Terrence Collins, a professor at Carnegie Mellon University, for developing a series of iron-based peroxide activators with applications in water disinfection and in the pulp and paper industries. According to EPA, these catalysts are environmentally friendly and contain no toxic functional groups.

If you check all award-winners for the entire program since its inception, you find no recipients from the electroplating/metal finishing industry. This is not to say that entries have not been made from our industry. In 1996 and 1997, Lawrence Livermore National Laboratory and Technic entered Technic's non-cyanide silver plating process. I know this, because I was involved in the program.[3,4] These same years, Benchmark Products entered a nickel plating process. Neither of these entries made the award category, although Benchmark received an award from the State of Indiana for its process.[5] Other entries related to metal finishing from 1996 to 1998 include the following:

** Spinosad, Dow ArgoSciences LLC*

- IBM-Austin—Eliminating the use of CFCs and other ozone-depleting substances from its printed wiring board and electronic card assembly and test facility, and innovative techniques for chemical and waste reductions in its printed wiring board production facility.
- Lockheed Martin Tactical Aircraft Systems—Use, regeneration and analysis of aqueous alkaline cleaners, and development and implementation of low-vapor, pressure-cleaning solvent blends.
- Rochester Midland Corporation—Development of a new "core" line of cleaners.
- AlliedSignal Federal Manufacturing and Technologies—A new precision cleaning solvent.
- Northern Illinois University—Chrome-free, single-step *in-situ* phosphatizing coatings.
- Great Western Chemical Company—A new method of treating printed circuit waste.
- IonEdge Corporation—Zero-waste dry plating of cadmium.
- Nortel Technology—Development of a chromate-free alternative** for corrosion protection of metal parts.

I don't have a listing of entries for 1999 and 2000; perhaps other metal finishing-related processes have been submitted. As mentioned earlier, however, no plating process won in 1999 and the awards for 2000 have not yet been finalized.

Three books have recently appeared on the subject of green chemistry: *Green Chemistry: Designing Chemistry for the Environment*,[6] *Green Chemistry: Theory and Practice*[1] and *Green Chemistry: Frontiers in Benign Chemical Syntheses and Processes*.[7]

These good examples of green chemistry are edited by EPA scientists and are predominantly taken from the Green Chemistry Challenge Awards, which are sponsored by the EPA. Therefore, it should come as no surprise that, although quite informative, they are heavily biased toward award-recipient processes. The last volume mentioned above[7] does contain a chapter on use of solvents in green chemistry[8] and chapters on use of supercritical fluids as cleaning agents.[9, 10]

So why have we been left out? Undoubtedly there are a variety of reasons. One is that we've been busy working the regulations issues and, to this end, our joint AESF/EPA conferences on pollution prevention are much more important than some award. These conferences were started in 1978, long before the term "green chemistry" was even created.

Second, perhaps our efforts are small peanuts compared to those of firms like Monsanto, Lilly, Dow, etc., and like going for an academy award, we just don't generate enough publicity. Third, a lot of our results are proprietary and this might have hindered some potential applicants. Lastly, the experts who judge the entries are all selected by the American Chemical Society. Perhaps we needed to have some of our own experts on the judging panel. Anyhow, it's now too late because the entries for this last year of the competition were due on December 31, 1999.

Regardless of all this, most of us do not need to hang our heads low. We've come a long way these past 20 or so years in working green chemistry into our processes. In spite of a lack of green chemistry awards, we've been greener than most other industries. We could still do better, however. Are you doing your best to take advantage of the green chemistry our vendors have developed for the industry? P&SF

*** Molyphos, Nortel Technology*

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