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Dismantling Dioxins

A new method for chemically treating dioxins and PCBs could help to destroy the toxic pollutants.

By Duncan Graham-Rowe

A New York City-based company believes it has found a way to safely and cheaply dispose of polychlorinated pollutants such as dioxins and polychlorinated biphenyls (PCBs). Its trick is to encapsulate highly reactive compounds that are already known to breakdown the pollutants, but have hitherto been too unstable for practical use.

Dioxins and PCBs are particularly persistent chemicals, which makes them very difficult to break down and dispose of. "Controlled incineration has been the most effective means of getting rid of them," says Greg Merrill, managing director of the [Chlorine Chemistry Council \(http://www.c3.org/\)](http://www.c3.org/), an industry association representing chlorine makers and a division of the American Chemistry Council in Arlington, VA.

But while incineration is the treatment of choice for high concentrations of contaminated waste, lower concentrations tend to be placed in hazardous-waste landfills, he says.

Burying it in the ground is less than ideal, says Paul Johnston, head of Greenpeace Research Laboratories at the University of Exeter, U.K. And few incinerators in the world are capable of incinerating dioxins and PCBs without the secondary formation of dioxins.

So, [SiGNa Chemistry \(http://www.signachem.com/\)](http://www.signachem.com/), the New York-based startup, has developed a remediation method that uses alkali metals, a group of elemental metals that include sodium and lithium, to react with and destroy the polychlorinated pollutants. While such alkali metals are usually too unstable to use for such applications--for one thing, they're explosive when mixed with water--SiGNa Chemistry's trick is to encapsulate them in a porous silica gel, explains Michael Lefenfeld, the company's founder and a chemist at Columbia University in New York City. What makes the technology effective is that the resulting powder preserves the reactivity of the alkali metal but not its volatility. "They associate to [the alkali metals], they don't chemically bond to it," says Lefenfeld.

According to the Environmental Protection Agency, other chemical treatments for breaking up PCBs exist; but they involve operating at very low temperatures, which pushes up the cost, says Lefenfeld. "We do everything at room temperature," he says. By filtering wastes like contaminated soil or sludge through a column of these powders, they've shown that it's possible to dehalogenate them. By binding to the halogen atoms--such as bromine, chlorine, iodine, and fluorine--that are present in the dioxins and PCBs, the treatment compounds break up the toxic chemicals into their harmless constituents. For example, the alkali metals bind to the chlorine atoms that hold some dioxins together, causing the dioxins to break up.

Chemical treatment would be a much more attractive option than incineration, says [Bob Crabtree](http://www.chem.yale.edu/~crabtree/) (<http://www.chem.yale.edu/~crabtree/>), a chemist at Yale University. If other scientists can reproduce the SiGNa Chemistry's experimental results, this method could well be the way forward, he says.

A new method for chemically treating dioxins would be welcomed, says the industry council's Merrill, but he also downplays the scale of the problem. The amount of dioxins produced has plummeted in the last two decades, he says, due to regulations ensuring that alternative manufacturing practices are put into place. The ultimate solution, Merrill says, is not in finding a better way to dispose of dioxins, but in stopping the production of them in the first place.

But Exeter's Johnston says there's still a need to properly dispose of waste contaminated with dioxins and PCBs. "It's not just the United States that has these huge stockpiles of persistent organic pollutants," he says, but places like Africa as well. "The critical question is whether [this new method] is going to be able to compete with other routes of disposal," says Johnston. It will have to be cheaper than incineration to get people to switch from burning this waste, he says.

It should be able to compete with storing polychlorinated pollutants and with existing chemical treatments for them, says SiGNA founder Lefenfeld. But he admits that the treatment won't be able to compete with incineration in cost. "Nothing is cheaper than igniting a flame," he says.

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Cleveland, Ohio

Monday, November 10, 2008 - Wednesday, November 12, 2008

<http://www.clevelandclinic.org/innovations/summit> (<http://www.clevelandclinic.org/innovations/summit>)

[MITX Awards \(http://www.mitxawards.org/\)](http://www.mitxawards.org/)

Boston, Massachusetts

Wednesday, November 19, 2008

<http://www.mitxawards.org/> (<http://www.mitxawards.org/>)

[Academic Enterprise Awards Europe \(http://www.sciencebusiness.net/aces/\)](http://www.sciencebusiness.net/aces/)

Stockholm, Sweden

Tuesday, December 02, 2008

<http://www.sciencebusiness.net/aces/> (<http://www.sciencebusiness.net/aces/>)

[11th Annual MIT Venture Capital Conference \(http://www.mitvcconference.com\)](http://www.mitvcconference.com)

Cambridge, MA

Saturday, December 06, 2008

<http://www.mitvcconference.com> (<http://www.mitvcconference.com>)

[WHIT 4.0 \(http://www.whitcongress.com\)](http://www.whitcongress.com)

Washington, DC

Monday, December 08, 2008 - Wednesday, December 10, 2008

<http://www.whitcongress.com> (<http://www.whitcongress.com>)

[O'Reilly Emerging Technology Conference \(http://conferences.oreilly.com/etech\)](http://conferences.oreilly.com/etech)

San Jose, CA

Monday, March 09, 2009 - Thursday, March 12, 2009

<http://conferences.oreilly.com/etech> (<http://conferences.oreilly.com/etech>)

[South By Southwest \(http://www.sxsw.com/interactive\)](http://www.sxsw.com/interactive)

Austin, Texas

Friday, March 13, 2009 - Tuesday, March 17, 2009

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