

New twist on 1930s technology may become a 21st century weapon against global warming

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Far from being a pipe dream years away from reality, practical technology for capturing carbon dioxide — the main greenhouse gas — from smokestacks is aiming for deployment at coal-fired electric power generating stations and other sources, scientists said here today. Their presentation at the 243rd National Meeting of the American Chemical Society, the world's largest scientific society, was on a potential advance toward dealing with the 30 billion tons of carbon dioxide released into the air each year through human activity.

"With little fanfare or publicity and a decade of hard work, we have made many improvements in this important new technology for carbon capture," said James H. Davis, Jr., Ph.D., who headed the research. "In 2002, we became the first research group to disclose discovery of the technology, and we have now positioned it as a viable means for [carbon dioxide](#) capture. Our research indicates that its capacity for carbon dioxide capture is greater than current technology, and the process is shaping up to be both more affordable and durable as well."

The new approach has a back-to-the-future glint, leveraging technology that the petroleum industry has used since the 1930s to remove carbon dioxide and other impurities from [natural gas](#). Davis, who is with the University of South Alabama (USA) in Mobile, explained that despite its reputation as a clean fuel, natural gas is usually contaminated with a variety of undesirable materials, especially carbon dioxide and hydrogen sulfide. Natural gas from certain underground formations, so-called "sweet" gas, has only small amounts of these other gases, while "sour"

gas has larger amounts. Natural gas companies traditionally have used a thick, colorless liquid called aqueous monoethanolamine (MEA) to remove that carbon dioxide.

Several problems, however, would prevent use of MEA to capture carbon dioxide on the massive basis envisioned in some proposed campaigns to slow global warming. These involve, for instance, capturing or "scrubbing" the carbon dioxide from smokestacks before it enters the atmosphere and socking it away permanently in underground storage chambers. Vast amounts of MEA would be needed, and its loss into the atmosphere could create health and environmental problems, and it would be very costly.

Davis and his group believe that their new approach avoids those pitfalls. It makes use of a nitrogen-based substance termed an "ionic liquid" that binds to carbon dioxide very effectively. Unlike MEA, it is odorless, does not evaporate easily and can be easily recycled and reused.

Davis also described one important advantage the technology has over many other ionic liquid carbon-capture systems. He explained that the presence of water, like moisture in the atmosphere, reduces the effectiveness of many nitrogen-based ionic liquids, complicating their use. Water is always present in exhaust gases because it is a byproduct of combustion. Davis noted that the liquids prefer to interact with carbon dioxide over water, and thus are not hampered by the latter in real-world applications.

Although cautioning that the final application in power plants or factories may look different, Davis envisioned a possible set-up for power plants that would be similar to the one used in his laboratory. He described bubbling exhaust gas through a tank full of the nitrogen-based liquid, which the system could cycle out and replace with fresh liquid. Removing the carbon dioxide would create a new supply of ionic liquid.

Once removed, companies could sequester the carbon dioxide by burying it or finding another way to keep it permanently out of the atmosphere. Others have suggested using captured carbon dioxide in place of petroleum products to make plastics and other products.

Davis suggested that in the future, people might also use the technology on a smaller scale in cars or homes, although he cautioned that these applications were likely a long way away. While his group has not fully explored the possible dangers of the chemicals his technology uses, Davis noted that his compounds are quite similar to certain compounds which are known to be safe for consumer use.

His presentation was part of a symposium on research advances involving "ionic liquids," strange liquids that consist only of atoms stripped of some of their electrons, with applications ranging from food processing to energy production.

Provided by American Chemical Society

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