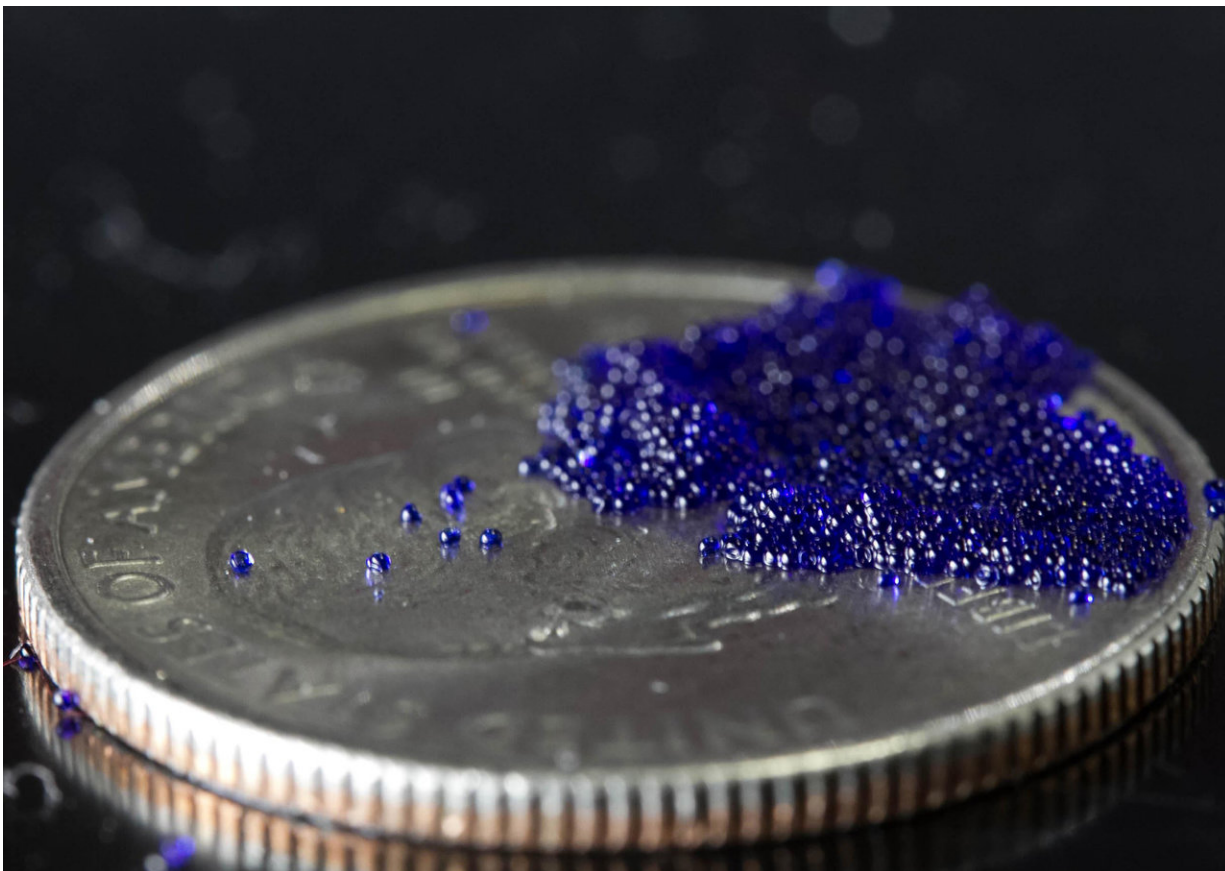


Professor models system using baking soda filled capsules to capture CO₂ emissions

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Picture of microcapsules that can capture carbon dioxide from power plant exhaust. Credit: John Vericella at Lawrence Livermore National Laboratory

Although the use of renewable energy is on the rise, coal and natural gas

still represent the majority of the United States energy supply. Even with pollution controls, burning these fossil fuels for energy releases a tremendous amount of carbon dioxide into the atmosphere—in the U.S. alone, coal and natural gas contributed 1,713 million metric tons of CO₂, or 98 percent of all CO₂ emissions from the electric power sector in 2017.¹ In an effort to mitigate these effects, researchers are looking for affordable ways to capture carbon dioxide from power plant exhaust.

Research led by the University of Pittsburgh and Lawrence Livermore National Laboratory (LLNL) uses microcapsule technology that may make post-combustion [carbon](#) capture cheaper, safer, and more efficient.

"Our approach is very different than the traditional method of capturing carbon dioxide at a [power](#) plant," said Katherine Hornbostel, assistant professor of mechanical engineering at Pitt's Swanson School of Engineering. "Instead of flowing a chemical solvent down a tower (like water down a waterfall), we are putting the solvent into tiny microcapsules."

Similar to containing liquid medicine in a pill, microencapsulation is a process in which liquids are surrounded by a solid coating.

"In our proposed design of a carbon capture reactor, we pack a bunch of microcapsules into a container and flow the power plant exhaust gas through that," said Hornbostel. "The heat required for conventional reactors is high, which translates to higher plant operating costs. Our design will be a smaller structure and require less electricity to operate, thereby lowering costs."

Conventional designs also use a harsh amine solvent that is expensive and can be dangerous to the environment. The microcapsule design created by Hornbostel and her collaborators at LLNL uses a solution that

is made from a common household item.

"We're using baking soda dissolved in water as our solvent," said Hornbostel. "It's cheaper, better for the environment, and more abundant than conventional solvents. Cost and abundance are critical factors when you're talking about 20 or more meter-wide reactors installed at hundreds of power plants."

Hornbostel explained that the small size of the microcapsule gives the solvent a [large surface area](#) for a given volume. This high surface area makes the solvent absorb [carbon dioxide](#) faster, which means that slower absorbing solvents can be used. "This is good news," says Hornbostel, "because it gives cheaper solvents like baking soda solution a fighting chance to compete with more expensive and corrosive solvents."

"Our proposed [microcapsule](#) technology and design are promising for post-combustion carbon capture because they help make slow-reacting solvents more efficient," said Hornbostel. "We believe that the decreased solvent cost combined with a smaller structure and lower operating cost may help coal and [natural gas](#) power [plants](#) maintain profits long-term without harming the environment."

Hornbostel detailed her model in a recent paper in *Applied Energy*, "Packed and fluidized bed absorber modeling for carbon capture with micro-encapsulated sodium carbonate solution" ([DOI: 10.1016/j.apenergy.2018.11.027](#)).

More information: K. Hornbostel et al, Packed and fluidized bed absorber modeling for carbon capture with micro-encapsulated sodium carbonate solution, *Applied Energy* (2018). [DOI: 10.1016/j.apenergy.2018.11.027](#)

Provided by University of Pittsburgh

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