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## A new twist on coffee

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You might want to think twice before you toss out those coffee grounds after brewing your coffee. That sludge may one day lead to clean fuel for cars, as well as improved fuel cells. Researchers at the Ulsan National Institute of Science and Technology (UNIST; Ulsan, South Korea) have created an inexpensive, highly stable, solid medium in which to store gases such as methane, by activating the carbon that is naturally present in waste coffee grounds (*Nanotechnology* 2015; doi:10.1088/0957-4484/26/38/385602).

“Work on activated carbon to capture gases is nothing new”, says lead author Christian Kemp, now based at Pohang University of Science and Technology (Pohang, South Korea). “But we found an

effective material that’s renewable and a method that is fast, easy, and cheap.” Carbon activation of solids is usually achieved through a multi-step “stir, soak, and heat” process that makes the materials more absorbent, and is already being tested with old tires, nut husks, and certain types of seeds. The idea to similarly test the capacity of coffee dregs had struck Kemp as he was staring at the bottom of his own coffee cup while discussing an unrelated issue. The UNIST team quickly found that they could reach maximum methane absorption for their coffee grounds with merely a short soak in potassium hydroxide – an ingredient found in common drain cleaners – followed by heat treatment in a furnace to get the mix to 700–900 °C. “Coffee is so absorbent that we could decrease the fabrication time significantly”, explains Kemp. “It took a couple of hours – a

fraction of the 24 hours it usually takes to produce similar carbon capture materials. And it’s renewable.”

There are multiple environmental benefits of storing methane in coffee grounds. In its pure form, methane can serve as a clean fuel source for vehicles. You can pump it into the empty, spacious material of the coffee grounds to create pressurized solid fuel cells that are much safer than conventional high-pressure cylinders. Methane is also an important greenhouse gas, produced by industrial processes and other sources, so its capture is a plus in mitigating climate change. And there’s no shortage of recyclable coffee grounds: according to a study at the University of Bath (*Energy Fuels* 2014; doi:10.1021/ef4022976), nearly 9 million tons of coffee are produced globally each year, with the average small coffee shop producing around 10 kg of coffee waste per day. ■