Hydrogen + corncobs (with a splash of boron) = fuel of the future?

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(PhysOrg.com) -- The next alternative fuel in a vehicle's tank might be nothing more than gas with a little help from corn. However, instead of the usual petroleum-based fuel, this gas will be hydrogen, and the corn will be in the form of corncob-charcoaled briquettes. To further develop this alternative fuel concept, researchers at the University of Missouri and Midwest Research Institute (MRI) were recently awarded a three-year, $1.9 million grant from the U.S. Department of Energy (DOE) to continue studying a solution to hydrogen storage in vehicles.

"Developmental hydrogen vehicles exist today but current designs require large, bulky tanks of compressed hydrogen gas to hold the fuel," said Peter Pfeifer, professor and chair of the Department of Physics in the MU College of Arts and Science. "The tanks also have a relatively small range, only holding enough fuel to travel up to 200 miles. We will be working on reducing the size and weight of the tank and increasing the storage capacity by developing storage materials that hold hydrogen at a much lower pressure than the current high-pressure tanks. The new tanks will store hydrogen on the surface of appropriately engineered carbons."

Pfeifer will work with M. Frederick Hawthorne, professor of radiology, chemistry and physics and director of the MU International Institute for Nano and Molecular Medicine; Carlos Wexler, associate professor of physics; Galen Suppes, professor of chemical engineering; and researchers at MRI in Kansas City to develop the hydrogen storage material. The research is a continuation of previous studies during which

Pfeifer and his colleagues found that corncobs, when reduced to carbon briquettes and "doped" with boron, have a unique ability to store natural gas with high capacity at low pressure, a discovery that allows for more flexible and less bulky fuel tank designs.

First, Suppes will create carbon briquettes with high surface areas from corncobs in a special multi-step process. The high surface area, where one gram of carbon has an area comparable to a football field, is key to a high storage capacity, Pfeifer said. In the second step of the process, Hawthorne will add boron to the carbon in the briquettes through a process known as "boron doping." Previous research found that adding boron to the carbon greatly increases its storage capacity. Finally, Pfeifer and Wexler will design carbon and boron structures that maximize the storage capacity and will test the storage capacity.

MRI researchers will support the team by designing and constructing the doping system as well as a low temperature hydrogen uptake fixture that is used to determine how much hydrogen is stored per standard liter. MRI also will assist with project management responsibilities for the team.

"We are very pleased to be able to take the innovative fuel storage technology that we are developing for natural gas vehicles and now apply it to hydrogen storage," said Phil Buckley, MRI principal engineer. "It's an honor for the MU-MRI team to be selected by DOE to further develop these concepts."

"This method will help us design the best storage facility and, at the same time, determine the best way to create the material," Pfeifer said. "The collaboration we have on MU's campus as well as the expertise of the scientists and engineers at the Midwest Research Institute is vital to the success of our research. The MU Research Reactor Center also will play an important role in this study. Without this collaboration, this study

would have been very difficult or impossible to complete."

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