New versatile process efficiently converts biomass to liquid fuel

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Researchers have demonstrated a new process to convert all biomass into liquid fuel, and the method could make possible mobile processing plants.

The researchers at Purdue University filed a patent application on the concept in 2008 and have now demonstrated that it works in laboratory experiments, said Rakesh Agrawal, the Winthrop E. Stone Distinguished Professor of Chemical Engineering.

"The demonstration is a step toward commercialization," he said. "Because the process can produce hydrocarbons in a single tandem step, it clearly has a potential to have a positive impact on the biofuels sector."

The new method, called fast-hydropyrolysis-hydrodeoxygenation, works by adding hydrogen into the biomass-processing reactor and is made possible by development of a new catalyst and innovative reactor design. The method has the shortened moniker of H2Bioil (pronounced H Two Bio Oil). Researchers tested the process with cellulose and poplar wood, showing that it represents a potentially practical new biofuels technology.

Findings are described in a research paper published online in October in the journal *Green Chemistry*.

"The successful lab-scale demonstration of the H2Bioil concept paves the way for rapid conversion of biomass species to liquid fuel and

chemicals," Agrawal said. "Furthermore, we envision that the process can be built on a distributed scale for widespread use. Ultimately, with proper design, this concept is amenable to providing mobile plants that could be transported from one biomass-available site to another."

The H2Bioil reactor is capable of processing all kinds of available biomass including wood chips, switch grass, corn stover, rice husks and wheat straw. It sidesteps a fundamental economic hurdle in biofuels: Transporting biomass is expensive because of its bulk volume, whereas liquid fuel from biomass is far more economical to transport. The technology could be used to process biomass into liquid fuel at agricultural sites with a mobile platform, and then transport it to a central refinery for further processing.

Critical to the technology is a new platinum-molybdenum catalyst and design of the hydropyrolysis reactor system. The new method offers advantages over conventional technologies because it produces biofuel from all biomass as opposed to a portion of the biomass such as cellulose or lignin only, Agrawal said.

Biomass along with hydrogen is fed into a high-pressure reactor and subjected to extremely fast heating, rising within a second to as hot as 500 degrees Celsius (more than 900 degrees Fahrenheit).

More information: "Oxygen removal from intact biomass to produce liquid fuel range hydrocarbons via fast- hydropyrolysis and vapor-phase catalytic hydrodeoxygenation." *Green Chem.*, 2015, Advance Article. DOI: 10.1039/C4GC01746C

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