

Search for high quality fuels from inexpensive biomass gets breakthrough

November 30 2010



Chemical engineering experts at The University of Nottingham have helped a team of international researchers find a way of producing inexpensive renewable liquid fuel out of low grade oils made from renewable products such as farm waste and wood chips.

The process, using a unique integrated catalytic process, could open the door to a chemical industry based on renewable biomass feedstock.

Dwindling petroleum resources combined with economic, environmental and political concerns about the petroleum-based economy in which we live makes it imperative to develop new processes for the production of [renewable fuel](#) and chemicals.

The research, led by the University of Massachusetts-Amherst (UMASS) in collaboration with experts at Southeast University, Nanjing in China and Nottingham, and published in the journal *Science*, demonstrates how cheap renewable pyrolysis oil, bio-oils produced from biomass, can be

upgraded into high commodity chemicals such as mono-alcohols, diols, light olefins and [aromatic hydrocarbons](#) — which are used in the production of plastics.

Because of their oxygen content these bio-oils have not been of high enough quality to use in the production of synthetic fuels so far. Now the team of scientists have converted the bio-oils into 11 different biomass-derived feedstocks using a de-oxygenation process which makes them more compatible with current fuels and chemical crude oil refinery settings.

Aimaro Sanna, from the Department of Chemical and Environmental Engineering, said: “Overall, this is a very promising and flexible catalytic process that would sensibly decrease the economical disadvantage of biomass compared with fossil fuels and would make possible the conversion of biomass on an industrial scale.”

This new catalytic process is flexible enough to produce different targeted distribution of organics to suit different existing petrochemical products in function of the different market conditions — for instance gasoline additive or feedstock for the chemicals industries.

Currently, Aimaro Sanna is a research associate at the National Centre for Carbon Capture and Storage (NCCCS) based in the University of Nottingham’s Division of Energy and Sustainability. The Centre addresses issues of global importance in the area of sustainable and affordable energy technologies.

He said: “My contribution to this work came out of an intense six month research collaboration at the Catalysis Bioenergy Centre at UMASS led by Professor George Huber working on the bio-oil hydrotreating. The goal of the project was to add hydrogen to the biomass derived molecules by reducing thermally unstable functionalities to more stable

alcohols and by controlled cleavage of C-C and C-O bonds without consume high amount of hydrogen required in a typical full hydrotreating process.”

Future advances in the field of metal and zeolite catalysts, combined with reaction engineering, will lead to the design of even more efficient and economical processes to convert biomass resources to renewable chemical industry feedstocks.

The Nottingham research group lead by Dr. John Andresen is also proposing an innovative multi-steps [catalytic process](#) able to convert biomass into bio-oil by catalytic pyrolysis.

Despite the fact that the original [biomass](#) contains undesirable high oxygen contents, the catalytic pyrolysis under investigation is able to sensibly decrease its oxygen content. This would be beneficial to the further upgrading of the bio-oil by the novel process developed at UMASS due to a low amount of hydrogen that would be required in presence of low oxygen level in the starting bio-oil.

The University of Nottingham has a broad research portfolio but has also identified and badged 13 research priority groups, in which a concentration of expertise, collaboration and resources create significant critical mass. Key research areas at Nottingham include energy, drug discovery, global food security, biomedical imaging, advanced manufacturing, integrating global society, operations in a digital world, and science, technology & society.

Through these groups, Nottingham researchers will continue to make a major impact on global challenges.

Provided by University of Nottingham

Citation: Search for high quality fuels from inexpensive biomass gets breakthrough (2010, November 30) retrieved 26 April 2024 from <https://phys.org/news/2010-11-high-quality-fuels-inexpensive-biomass.html>

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