Novel Technology Could Produce Biofuel for Around $0.65 a Liter

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(PhysOrg.com) -- A novel technology for synthesising chemicals from plant material could produce liquid fuel for just over €0.50 ($0.65) a liter, say German scientists. But only if the infrastructure is set up in the right way, states the research published in this month's issue of Biofuels, Bioproducts & Biorefining.

Developed by scientists at the Karlsruhe Institute of Technology (KIT), this novel technology is known as bioliq, and is able to produce a range of different types of liquid fuel and chemicals from plant material such as wood and straw.

Bioliq involves first heating the plant material in the absence of air to around 500°C, a process known as pyrolysis. This produces a thick oily liquid containing solid particles of coke termed biosyncrude.

The biosyncrude is then vaporised by exposing it to a stream of oxygen gas, before being heated at high pressures to a temperature of around 1400°C. Known as gasification, this process transforms the liquid biosyncrude into a mixture of carbon monoxide and hydrogen termed syngas.

After any impurities are removed from this syngas, it can be catalytically converted into a range of different chemicals and fuels, including methanol, hydrogen and a synthetic version of diesel. This stage of the technology is fairly well developed, as syngas derived from coal and natural gas is already used to produce liquid fuels on a commercial scale

in South Africa.

Bioliq is now taking its first steps towards commercialisation. In conjunction with the German process engineering company Lurgi, KIT is starting to construct a pilot plant based on the bioliq technology, which should be fully completed in 2012. Providing the technology works at this scale, the question then will be how best to implement bioliq at a larger scale, so that it can effectively compete with fossil fuels.

To try to come up with an answer, a team of KIT scientists led by Nicolaus Dahmen has used a simple economic model to calculate the cost of producing fuel at a bioliq plant with an annual production capacity of around 1 million tonnes. This is around a tenth of the size of a modern oil refinery, but is a similar size to refineries that produce liquid fuel from oil and gas.

Dahmen and his colleagues quickly realised that incorporating both the pyrolysis and gasification steps at this central plant wouldn't work, because of the problems and expense involved in transporting sufficient quantities of bulky straw and wood to the plant. They estimated that if sufficient plant material was transported on trucks, it would quickly bring the road network around the plant to a halt.

So they came up with an alternative set-up. "Biomass is pre-treated in around 50 regionally distributed pyrolysis plants to produce the biosyncrude," explains Dahmen. "This can then be transported economically over long distances to supply a central fuel production plant with a high capacity."

The advantage of this set-up is that it is much cheaper and more convenient to transport liquid biosyncrude than bulky wood and straw. This is especially the case if the biosyncrude is transported by rail, which is the most cost effective way to transport material over long distances.

So Dahmen and his colleagues produced an economic model based on this set-up, which suggests that the bioliq technology can potentially produce liquid fuels for €0.56-1.04 a litre. This would still make the fuel more expensive than conventional petrol or diesel, but this difference could be greatly reduced if different levels of tax were applied to the fuels.

Reference: Henrich E, Dahmen N, Dinjus E; Cost estimate for biosynfuel production via biosyncrude gasification; *Biofuels, Bioprod. Bioref*. 3:28-41 (2009); DOI: 10.1002/bbb.126; www3.interscience.wiley.com/jo … l/121624305/abstract

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