PROJECT FACTS

UNIVERSITY OF KENTUCKY CENTER FOR APPLIED ENERGY RESEARCH

BIOFUELS & ENVIRONMENTAL CATALYSIS

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Upgrading of Algae Oil to Hydrocarbon Fuels

One approach for controlling CO2 emissions from fossil fuel combustion involves the use of algae to capture and utilize CO2 by conversion to biomass. Algae are the fastest growing photosynthesizing organisms known, while also possessing higher oil content per mass than other sources of biomass; indeed, some species consist of over 50% oil by weight. This coupling of fast growth rate and high oil content renders algae a potentially ideal source of bio-derived oil. Furthermore, the production of valuable liquid transportation fuels from algae will greatly benefit the overall economics of algae-mediated CO2 capture.

In principle, algae oil can be converted to transportation fuels via either transesterification (to afford the corresponding fatty acid methyl esters) or catalytic upgrading to hydrocarbon fuels. Typically, catalytic upgrading of bio-derived oxygenates utilizes hydrotreating catalysts, such as supported CoMo or NiMo, oxygen being eliminated via hydrodeoxygenation (-H2O) and decarboxylation (-CO2) reactions. A feature of this technology is the fact that high hydrogen pressures are required (50-100 bar). Consequently, this approach is only suitable for refineries (in which hydrogen is readily available), as opposed to distributed processing. As an alternative to hydrotreating, we have been examining the decarboxylation of vegetable oils, as well as model triglyceride compounds, using supported metal catalysts in the absence of hydrogen. This approach has been successfully demonstrated by Murzin and co-workers for the deoxygenation of fatty acids and their methyl esters [P. Mäki-Arvela *et al*., *Energy & Fuels* 2007, *21*, 30].

This project examines the conversion of various triglyceride feeds, including algae oil, to hydrocarbons in the C5-C17 range. The development of catalysts showing increased selectivity to hydrocarbons boiling in the jet fuel range (C8-C16) is also being targeted.

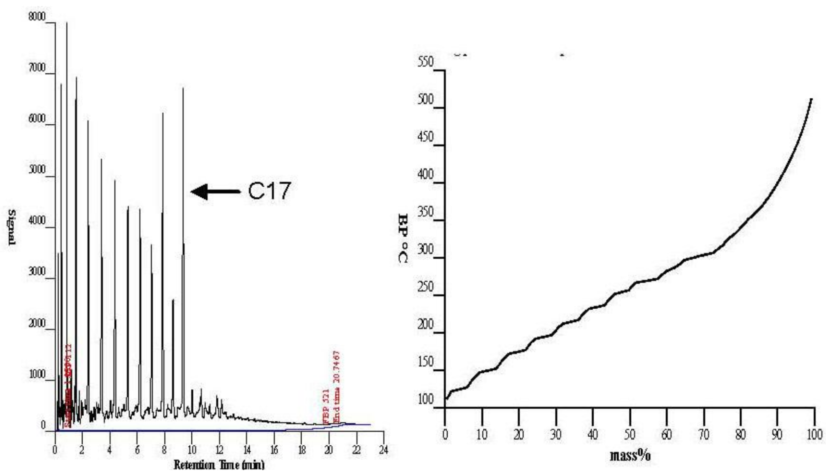

Figure Left: Gas chromatogram of hydrocarbon product resulting from triglyceride upgrading over support Pd catalyst; Right: corresponding boiling point distribution plot