Wolfgang F Hoelderich et al., J Pet Environ Biotechnol 2014, 5:4
http://dx.doi.org/10.4172/2157-7463.S1.006

OMICS Group Conferences
Accelerating Scientific Discovery

2nd World Congress on
Petrochemistry and Chemical Engineering
October 27-29, 2014 Embassy Suites Las Vegas, USA

New catalyts for biodiesel of 1st and 2nd generation

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At present the 1st generation biodiesel is industrially produced by transesterification of triglycerides with methanol in the presence of homogeneous base catalyst like NaOH yielding a mixture of fatty acid methyl esters (FAME) and glycerol The main disadvantage of this process is the use of required high quality oil or fats i.e. removing free of fatty acids FFA by distillation or a preesterification prior to the transesterification and the laborious catalyst removal. Such problems can be advantageously overcome by the application of bifunctional acid-base heterogeneous catalysts which perform simultaneous esterification and transesterification of unpurified, low cost oils and fats with methanol i.e. tolerating a high FFA content in the feedstock.

The new developed La_2O_3/ZrO_2 catalyst has acidic and basic sites as determined by NH_3- and CO_2-TPD. That enables us to carry out simultaneously esterification and transesterification of low quality trigycerides with high content of FFA yielding high quality biodiesel of 1st generation (98 % yield) and high quality glycerol (98 % yield)

The 1st generation biodiesel containing highly boiling C_{16}-C_{18} esters with high cloud point and high viscosity can cause problems in conventional engines and therefore can only be used as blend with less than 10% in conventional diesel generating a partly renewable diesel fuel. Therefore, the heterogeneously catalyzed conversion of free fatty acids or its esters is investigated to produce 2nd generation biofuels.

Pd catalysts doped on amorphous silica-alumina have Lewis- and Brönsted acid sides and the strength of the acidic centers varies with various silica amounts as detected by NH_3-TPD and pyridine FT-IR. The reactions have been carried out in the continuous plug flow fixed bed reactor or continuous trickle bed reactor under various reaction conditions to produce biodiesel by decarboxylation, decarbonylation, hydrogenation and cracking of the feedstock. The amorphous alumina-silicates act as supporting material for Pd as well as cracking catalyst due to its acidic property. Pd is used for hydrogenation as well as deoxyge-nation . Oxygen is removed in form of CO and CO_2 from the starting material. The main products were saturated, oxygen free hydrocarbons with a chain length between C_6-C_{18}. Gaseous hydrocarbons with a chain length between C-1 and C-5 were found, too, as well as CO, CO_2 and H_2O.

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