**Production of DME and gasoline from biomass-derived syngas**

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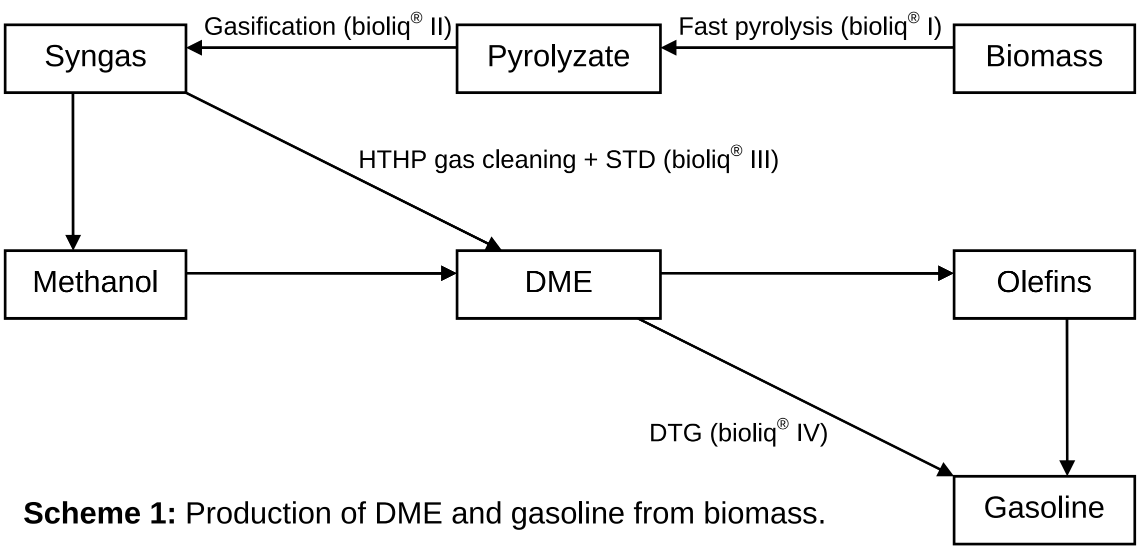
Dimethylether (DME) is gaining steadily increasing interest and due to several favourable properties[1] applications of DME are remarkably expanding. Currently, major markets are its use as an aerosol propellant in the cosmetics industry and as starting material for dimethyl sulfate production. It can also be employed as solvent in aerosol formulations or as starting material for the synthesis of acetic acid and olefins. In addition, DME exhibits an enormous potential as fuel, e.g. for power generation in gas turbines, as a replacement for liquefied petroleum gas in domestic applications and, due to its high cetane number and comparatively clean combustion, for diesel engines.[2] Furthermore, it can be converted, like methanol, to gasoline and diesel.[3]

Production of DME can be carried out *via* catalytic dehydration of methanol.[4] However, remarkable progress was made in recent years regarding direct synthesis of DME from syngas (**S**yngas-**T**o-**D**ME, STD), which is beneficial in many respects.[5] Slurry phase as well as fixed bed reactors were developed for this highly exothermic process[6] and the latter technology was chosen for the STD process elaborated at the *Karlsruhe Institute of Technology* (KIT). Investigations concentrated on the use of biomass-derived syngas, i.e. carbon monoxide-rich syngas, as starting material with $H_2$/CO ratios around 1 and variable further components.[7] These studies were carried out in the context of the bioliq® process,[8] which is currently installed at KIT. The entire process is outlined in Scheme 1. It comprises fast pyrolysis of biomass in the initial step (bioliq® I) followed by gasification of the thus obtained pyrolyzate (bioliq® II) and direct conversion of the resulting syngas to DME (bioliq® III). The latter step is divided into dry **H**igh-**T**emperature-**H**igh-**P**ressure (HTHP) syngas cleaning (bioliq® IIIa) and subsequent synthesis of DME in one single reactor (bioliq® IIIb) without isolation of intermediately formed methanol. The process is dimensioned for a 700 $Nm^3h^{-1}$ syngas flow and a concluding **D**imethylether-**T**o-**G**asoline (DTG) reactor allows for the synthesis of gasoline from DME (bioliq® IV).




**Scheme 1:** Production of DME and gasoline from biomass.

Results obtained from laboratory plants as well as information about the bioliq® process, especially the DME production unit, will be presented. Upscaling from laboratory to pilot scale and investigations on the influence of several parameters, e.g. temperature, pressure, flow rate, syngas composition, catalysts and catalyst poisons, on DME synthesis will also be discussed.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[2] C.-H. Hwang, C.-E. Lee, K.-M. Lee, *Energy Fuels* **2009**, *23*, 754-761.

[3] S. Lee, M. Gogate, C.J. Kulik, *Fuel Sci. Technol. Int.* **1995**, *13*, 1039-1057.

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[5] X.-J. Tang, J.-H. Fei, Z.-Y. Hou, X.-M. Zheng, H. Lou, *Energy Fuels* **2008**, *22*, 2877-2884.

[6] T. Ogawa, N. Inoue, T. Shikada, Y. Ohno, *J. Nat. Gas Chem.* **2003**, *12*, 219-227.

[7] H. Leibold, A. Hornung, H. Seifert, *Powder Technol.* **2008**, *180*, 265-270.

[8] http://www.bioliq.com