Biomass derived activated carbon catalysts for the one-step dimethyl ether synthesis from syngas.

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Fossil fuels depletion, together with an increasingly stringent in the environmental regulations, are the driving force in seek of alternative clean energy resources. In this scenario, DME is receiving a great deal of attention as a potential renewable substitute for petroleum derivative, since it can be produced from syngas coming from biomass gasification. The development of a DME based economy is related to the implementation of the one-step synthesis process from syngas, in which a bifunctional catalyst is used.

This work deals with the preparation of biomass-derived activated carbon catalysts for the direct DME synthesis from syngas. Two kinds of activated carbons were prepared by chemical (with H_3PO_4) and physical (by CO_2 partial gasification) activation, using olive stones as biomass precursor. To prepare the methanol synthesis catalytic function, the physically activated carbon was loaded with a 20 %(w/w) CuO+ZnO. As for methanol dehydration component, a 5.25 %(w/w) Zr loaded chemically activated carbon was used. The bifunctional catalysts were obtained by physical mixing of their individual components. Different acid/metal activated carbon mass ratios were studied.

The prepared activated carbons were used as catalysts in a fixed-bed reactor (T=250–300 ºC, GHSV=36.4 $L \cdot g_{Cu}^{-1} \cdot s^{-1}$, P=45 bar, H_2/CO=1–3). The catalytic results showed that both CO conversion and selectivity to DME increased with the amount of acid component in the bifunctional catalyst up to an acid/metal mass ratio of 2 (X_{CO}=40%, S_{DME}=58%, T=275 ºC, H_2/CO=3).

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