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Direct preda. of dimethyl ether from synthesis gas - in three phase system using solid catalyst in an inert liquid

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Dimethyl ether is synthesised directly from a synthesis gas comprising hydrogen, carbon monoxide and carbon dioxide by contacting the gas with a solid catalyst.

The improvement comprises using as catalyst a single catalyst or mixture of catalysts suspended in a liquid medium in a three phase system comprising at least one three phase reactor.

The catalyst pref. comprises a methanol synthesis component, esp. copper, and a dehydration (ether forming) component, esp. alumina, silica-alumina, zeolite, solid acid or ion exchange resin.

ADVANTAGES

The method is much simpler than the conventional multistage method comprising three separate steps, shift reaction, methanol synthesis and methanol dehydration. Prior single stage processes (in which these three steps are combined) required expensive heat removal methods, and have only been able to operate with a much more restricted range of H_2/CO and CO/CO_2 ratios than the present process.

The method is of esp. use in an integrated gasification combined cycle power plant for prodn. of electrical energy, and for prodn. of a storable fuel for peak saving.

PREFERRED

The concn. of catalyst is 5-60 wt.% in the liquid medium, e.g. a paraffinic hydrocarbon or blend.

An ebullated bed with granulated or shaped pellet catalyst may be used, or a slurry of catalyst powder.

Reaction takes place at 400-1000 psig, 200-350 deg.C, space velocity 1000-10,000 standard litres synthesis gas/kg catalyst. Water may be added to the gas, esp. when the concn. of hydrogen is less than 10 vol.%. Varying amts. of methanol are co-produced with the dimethyl ether.

EXAMPLE

A "balanced" synthesis gas (55% H_2, 19% CO, 5% CO_2, 21% N_2) was used at 250 deg.C, 800 psig. EP-324475-A+

Catalyst system was a 25 wt.% slurry of 20 g BASF S3-85 methanol catalyst and 20 g 200 mesh Catapal (RTM) high purity alumina, in degassed Witco 70 (RTM) oil. Methanol and dimethyl ether were the only detectable products.

At GHSV 2750 s.l/kg/hr, productivities (mol/kg catalyst/hr) were dimethyl ether 2.8 and methanol 3.0. CO conversion was 52 mole %.(9pp1644RBHDwgNo0/0).

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