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Prodn. of gasoline and distillates from low-ratio synthesis gas - by Fischer-Tropsch conversion followed by zeolite conversion

D/S: E(BE, DT, FR, GB, IT, NL)

Conversion of synthesis gas to hydrocarbons and oxygenated cpds. is carried out by (a) contacting the synthesis gas with an Fe-contg. Fischer-Tropsch catalyst at 204-316°C and 1-1500 psig to form a C_{3+}-rich product contg. $\leqslant$ 20% $CH_4 + C_2H_6$, and (b) contacting at least part of the product with an acidic ZSM-type zeolite at 277-454°C and 1-800 psig, with a WHSV of 0.2-30, to form gasoline and other distillates.

The improvement comprises increasing the rate of synthesis gas conversion by maintaing a H_2/CO ratio of 0.5-1 (pref. 0.6-0.8) and achieving an overall synthesis gas conversion of > 60%.

ADVANTAGES

The process is capable of giving C_{3+} yields of $\geqslant$ 80% and C_{5+} yields of $\geqslant$ 45%.

H(4-E5) N(1-A, 2-A, 2-D, 6-A).

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DETAILS

The catalyst in step (a) is pref. a Fe/K or Fe/K/Cu catalyst. Step (a) can be effected in a series of 2 or more reactors, pref. with intermedate CO_2 removal. Temp. control can be provided by using a reactor in which the catalyst particles are suspended in a liq. medium (esp. a liq.-phase bubble column reactor) or a fixed-bed reactor surrounded by a heat-exchange medium. Water can be charged together with the synthesis gas.

The total effluent from step (a) can be passed to step (b), or the hydrocarbons and oxygenated cpds. can be sepd. and processed separately in step (b). The catalyst instep (b) is pref. HZSM-5.

EXAMPLE

Synthesis gas with an H_2/CO ratio of 1.0 was processed (a) by contacting with a Fe/K catalyst at 270°C and 400 psig (WHSV = 1.0) and (b) by contacting with HZSM-5 at 343°C and 400 psig (WHSV = 1.8). The synthesis gas conversion was 70.5 wt. %, and the total effluent contained

18.1 wt. % hydrocarbons comprising 11.7 wt. % C_{1-2}, 45.8 % C_{3-4} and 42.5% C_{5+}. The C_{5+} fraction contained 61.9 wt % aromatics. (53pp367).
(E) ISR: US4159995; US4086262; US4046830; US4049741; GB1446522; US2665289; GB-787122; DS-933388; GB-690925.