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Methanol prodn. in liq. phase methanol reactor - from synthesis gas feed stream contg. carbon mon oxide, carbon di:oxide and hydrogen

C88-114682

Methanol is produced from a syngas feed stream contg. CO, CO_2 and H_2 in a staged process by:

(a) passing the feedstream to a first liq. phase methanol (LPMeOH) reactor to convert a portion of the syngas to methanol which is recovered from the effluent by condensation; and

(b) passing unreacted syngas from the first reactor to a second LPMeOH reactor to obtain a second methanol prod. stream.

Conditions in the first reactor are controlled to favour conversion of CO, rather than CO_2, to methanol, and vice versa for the second reactor.

ADVANTAGE

For the same amt. of prodn., a significant reduction in reactor throughput and size can be achieved compared to conventional processes. The percentage of methanol in the effluent is higher as a result of being able to operate at higher conversion with minimum diluent.

PREFERRED PROCESS

Part of the unreacted syngas from the second reactor can be recycled. The second reactor is operated at higher pressure than the first.

The syngas feedstream (10) is compressed (12), heated by heat exchange (18) with cooling effluent from reactor (32) and united with recycle liq. (28) from the bottom of the first LPMeOH. The combined feedstream (30) is fed to reactor (32) and the effluent (34) is cooled first in heat exchanger (18) and then heat exchanger (36). The cooled effluent (38) is sepd. (40) to obtain crude methanol (41) and an effluent vapour phase which is compressed (42) and combined with second reactor vapour phase effluent (80).

The combined stream (40) is heat exchanged (48) with cooling effluent (64) from the second reactor (62), then combined with recycle liq. (58) and fed (60) to reactor (62). Effluent (62) is cooled by heat exchange (48,66) and sepd. (70) to obtain a second crude methanol stream (72). Part of the vapour phase effluent (74) is purged (82) and the ramainder (76) recycled.

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EXAMPLE

A computer simulation of the process was run for a process producing 2740 tons per day of MeOH, with Cu-Zn powder catalyst. The first reactor was set to operate at 1000 psia and 250°C. and the second reactor at 1500 psia and 250°C..

On a fixed reactor throughput basis, the % MeOH from CO in the second reactor was 5.6% lower than in a corresp. process in which the second LPMeOH reactor was replaced by a gas phase MeOH reactor. % of MeOH from CO_2 was 6.5% higher, overall MeOH prodn. for the LPMeOH reactor was 15.5% higher, and the increase in MeOH from CO_2 was twice the increase from CO.

The increase in the CO_2 per pass MeOH make ratio for the LPMeOH reactor was over 64% greater. (7pp1809EDDwgNo 1/1).