Ethanol dehydrogenation reaction to ethyl acetate on copper/ copper chromite catalysts.

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In the recent years, the interest in the ethanol production from renewable natural sources, as a possible alternative energy vector, has strongly grown in the world. The low-cost ethanol availability has also favored the study of the production of different chemicals such as ethylene, ethyl ether, acetaldehyde and ethyl acetate starting from ethanol as raw material. The ethyl acetate production by one step ethanol dehydrogenation reaction is a promising alternative process to the classical one that use acetic acid [1]. The ethanol dehydrogenation to ethyl acetate, in one step reaction, has been studied by using three different commercial copper based catalysts. The reaction has been conducted in a conventional packed bed tubular reactor, by exploring a temperature range of 200-260°C and a pressure range of 10-30 bars. Copper is, normally, present in the catalysts composition in the form of oxide and must be reduced to metal to be active. For this reason all the proven catalysts have been submitted to the already described pre-treatment with a flow stream of hydrogen mixed with nitrogen for about 18 hours at 200°C. This pre-treatment is very important for the catalysts performances and the mentioned prolonged time is necessary for obtaining the highest conversion and selectivity. The best results have been found by using a commercial copper/copper chromite catalyst, supported on alumina and containing barium chromite as promoter. The effect of temperature, pressure and ethanol contact time on both conversion and selectivity to ethyl acetate has been investigated. The operating temperature of 220-240°C, the pressure of 20 bars and finally the residence time of about 98 (grams hour/mol) are the best conditions to obtain an ethanol conversion of 65 % with a selectivity to ethyl acetate of 98-99% [2]. Moreover, the copper/copper chromite catalyst has also shown a good thermal stability with respect to copper due to the promoters effect that preventing the sintering of the metal and the subsequent catalyst deactivation. Furthermore this main advantage of this process is also the possibility to produce pure hydrogen (exempt of CO) in mild conditions as by product that in an industrial plant could be recycled and used as carrier gas.

References

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