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Liquid Phase Catalytic Dehydrogenation of Secondary Alcohols to Ketone

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Abstract : Ketones, which are widely used as solvent and chemical intermediates in chemical process industry, are commercially produced by using catalytic dehydrogenation of secondary alcohols at higher temperature (300-500ºC), and pressure (1-5 bar). Although it is possible to obtain high conversion values (60-87%) via gas phase catalytic dehydrogenation, working high temperature and pressure can result in side reactions and shorten the catalyst life. In order to overcome these challenges, catalytic dehydrogenation in the presence of an appropriate liquid solvent has been started to use. Hence, secondary alcohols can be converted to respective ketones at relatively low temperature (150-200ºC) under atmospheric pressure. In this study, methyl ethyl ketone and acetone was produced via catalytic dehydrogenation of appropriate secondary alcohols (isopropyl alcohol and sec-butyl alcohol) in the presence of liquid solvent at 160-190ºC. Obtained methyl ethyl ketone and acetone were analyzed by using FTIR and GC spectrometer. Effects of temperature, amount of catalyst and solvent on conversion and reaction rate were investigated. Optimum process conditions, which gave high conversion and reaction rate, were determined. According to GC results, 70% of secondary butyl alcohol and 42% of isopropyl alcohol was converted to related ketone (methyl ethyl ketone and acetone, respectively) at optimum process conditions. After distillation, 99.13% methyl ethyl ketone and 99.20% acetone was obtained. Consequently, liquid phase dehydrogenation process, which can compete with commercial gas phase process, was developed.

Keywords : dehydrogenation, liquid phase, methyl ethyl ketone, secondary alcohol
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