DEVELOPMENT OF Ni/MgO BASED CATALYTIC PELLETS FOR CONVERSION OF ETHANOL INTO BUTANOL

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Work-In-Progress Abstract

Bio-ethanol as fuel additive suffers of several limitations such as a low energy content per unit volume compared to gasoline, a high water solubility, a great corrosivity. Due to these concerns, it cannot be used in large proportion unless engines are modified [1]. Substitution of ethanol for butanol, in addition to the advantage of a greater calorific value associated to the higher alcohol, can avoid engine modification. Furthermore, it can be transported via the existing gasoline pipelines [1]. Thus, recently, production of fermentation-derived butanol has attracted renewed interest [2]. n-butanol is currently produced by biomass fermentation with *Clostridium* microorganisms (Acetone Butanol Ethanol or ABE fermentation) on the industrial scale in many industrialized countries [2]. Nevertheless, alternative routes to ABE fermentation are under development.

In this framework, the catalytic upgrade of ethanol into butanol is widely investigated. The process of alcohol dimerization to produce a higher alcohol is known as Guerbet reaction [3]. The reaction is not selective and, in addition to butanol, significant amounts of by-products as acetaldehyde and ethylene can be formed [3]. A suitable combination of both acid and basic sites and the addition of an active metal capable to provide hydrogenation/dehydrogenation properties are considered key-features to drive the reaction path towards the production of butanol.

In this work, a preliminary study of powder catalysts consisting in Ru or Ni dispersed on supports with different acid base character was done in a lab-scale rig which allowed us to select a chemical formulation which will be reproduced as catalytic pellets to be used in a pre-pilot scale rig. The best performance was obtained with 1%Ni/MgO powder catalyst. Best operating conditions were also defined. Catalytic pellets were produced using high surface area γ-Al_2O_3 commercial pellets as substrate which were coated with MgO by several impregnation cycles before adding nickel. Pellets were physically and chemically characterized to match their properties to those of the corresponding powder catalyst and their catalytic performance were preliminarily verified in the small scale rig before the final use in the large scale plant.

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