The Dehydration of 1-Hexanol to Co-Monomer Grade 1-Hexene

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The increasing global demand for co-monomer grade 1-hexene has necessitated investigations into alternative routes for the production of this alkene, apart from the existing Fischer-Tropsch synthesis and ethylene trimerization routes.

In this paper we will be describing the dehydration of 1-hexanol, which is produced industrially via the Ziegler alcohol synthesis route (Alfol process), to high purity 1-hexene.

Various α-aluminas were tested as catalysts for the dehydration reaction, in short runs up to 8 hours. At a fixed WHSV=25h⁻¹, the % conversion increases with temperature, with dihexyl ether being the major product for temperatures up to about 275°C. With increasing temperature up to 350°C, the yield of ether decreases and that of the hexenes decreases. From the experiments conducted under different reaction conditions (temperature varied from 250 to 350°C, and WHSV from 3 to 25h⁻¹), it was observed there was a distinct conversion-selectivity relationship, viz. that the selectivity to the ether decreased whilst that to the hexenes increased with increasing conversion, irrespective of the α-alumina type and reaction conditions. For conversions up to 80%, the purity of the 1-hexene, which is defined as the percentage of 1-hexene in the total C₆ alkanes and alkenes, is between 95-97%. The major impurities produced are the 2- and 3-hexenes arising from the double-bond shift reaction of the 1-hexene. Distillation of such a C₆ fraction using a 6m long packed column yields a 1-hexene product of at least 99.2% purity.