Higher Alcohol Synthesis

Edwin L. Kugler , Dady B. Dadyburjor, Lawrence Norcio and Abhay Pathania
West Virginia University
Department of Chemical Engineering
Morgantown, WV 26505

Introduction

Additives are important for the performance of fuels. Octane enhancers like tetraethyl lead, MTBE (methyl tertiary-butyl ether), and some aromatic compounds like benzene and toluene are very well known. However these enhancers are being phased out. Alcohols are also octane enhancers, are naturally occurring, and do not appear to cause any environmental problems.

Over the past decade, the synthesis of mixed alcohols has drawn considerable interest due to the increasing demand for octane boosters. Ethanol and methanol have been used as gasoline additives. Higher alcohols now are preferred to methanol because of their lower volatility and higher solubility in hydrocarbons. Alcohols with proper boiling range may be used as diesel fuel additives. These higher boiling alcohols are expected to have positive effects both on increasing cetane index and on reducing particulate emissions.

Mixed alcohols can be produced from synthesis gas using molybdenum, copper and tungsten catalysts. By improving the catalyst and the process, it is possible to increase the selectivity towards higher alcohols .

Objective

The objective of this research is the production of higher alcohols using synthesis gas. This project addresses working with and improving molybdenum and tungsten catalysts, which are known to be active for higher alcohol synthesis. The effects of co-feeding methanol with synthesis gas will also be explored.

Work completed

The work on the project started in January 2000 after the arrival of a new Ph.D. student. The major part of the work to date involved making the alcohol production equipment (Figure 1) fully functional. The mass flow meters for measuring gas flow rates were reconditioned and recalibrated. The gas chromatograph was repaired by installing a new TC detector unit. Equipment shakedown is in progress.

Future work

In the near future we are planning to test equipment by repeating a few sets of experiments using molybdenum-based catalyst prepared in our laboratory previously. Product analysis and material balance determination will be emphasized. Longer-term research will be focused on improving molybdenum and tungsten catalysts, which are known to be active for higher alcohol synthesis.

Figure 1: Experimental Setup for Higher Alcohol Synthesis