



Master's Thesis

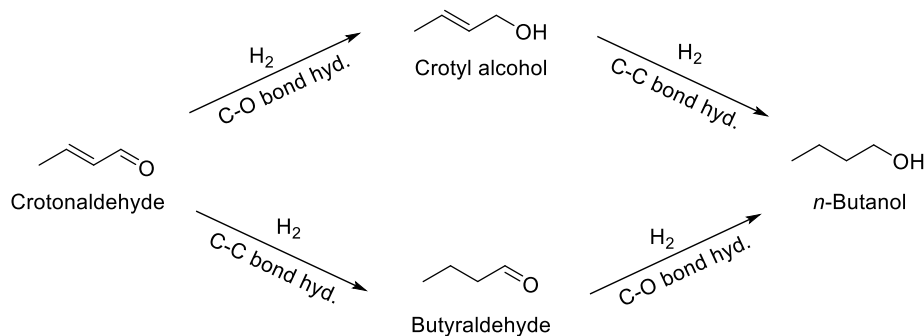
For students of chemical engineering or chemistry (with focus technical chemistry)
(Professur für Anorganische Chemie, Prof. Dr. K. Köhler & Max Hiller)

Modification of a testing unit for the gas phase hydrogenation of aldehydes

Motivation and problem definition

Hydrogenations belong to the most relevant reactions in industrial practice. Structure-activity relationships and mechanistic investigations are important for catalyst optimization. For that reason, an existing and well-working fixed bed catalyst reactor and the testing unit shall be expanded to gas phase hydrogenations of C₃-C₄-aldehydes.

A liquid feed pump and a vaporization unit shall be installed for constant feed flow in the gas phase. Both conversion and selectivity shall be monitored online via gas chromatography. Critical reaction parameters for the hydrogenation of aldehydes (p, T, GHSV, feed flow, H₂:feed ratio, catalyst bed dilution, ...) shall be determined. The hydrogenation of croton aldehyde shall be investigated with focus onto the reaction mechanism (Reaction scheme 1).



Reaction scheme 1: Possible hydrogenation pathways of croton aldehyde to n-butanol.

In addition, copper-zinc catalysts shall be synthesized by various synthesis approaches (precipitation, ligand removal, impregnation, ...) to aim catalyst with different copper zinc interfaces. The influence of these interfaces shall be investigated both regarding catalytic activity and selectivity. Characterization techniques shall be used to characterize the catalyst (XRD, BET/BJH, TPR/TPD, IR, Cu-surface area determination, ...). The spent catalyst shall be characterized after transfer under inert conditions.

Techniques

- Dimensioning of a catalyst test unit, calculation of useful reaction conditions
- Development of methods for online gas chromatography for product analysis
- Modification of a catalyst test unit, installation of pumps, vaporization of liquids
- Standard synthesis of heterogeneous catalysts (co-precipitation, impregnation, ...)
- Standard characterization techniques (XRD, BET/BJH, TPR/TPD, elemental analysis)

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