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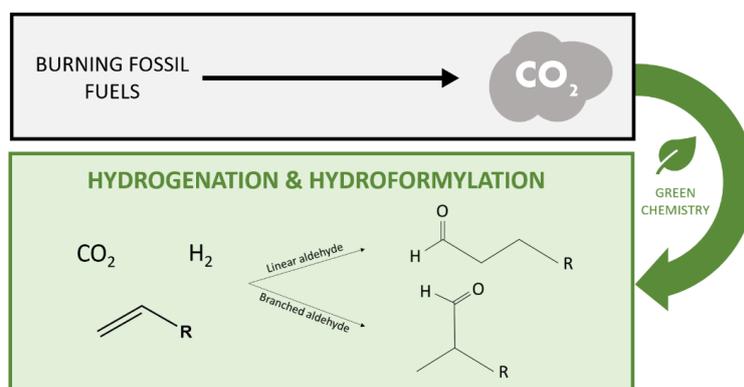
Experimental and kinetic investigation of tetradecene hydroformylation using CO₂

Aim

Assess the viability of performing hydroformylation of tetradecene using CO₂ as a reactant instead of CO. To investigate the reaction, experimental work will be carried out in a fixed bed reactor with a heterogenous alumina-supported rhodium catalyst. Based on this, a kinetic model can be constructed for the reaction to study the preferential pathway of hydrogenation and hydroformylation of the olefin as well as hydrogenation of the CO₂.

Justification

Hydroformylation is performed on a large scale in industry to obtain aldehydes and alcohols from alkenes. During the reaction, an aldehyde group coming from a syngas mixture (CO and H₂) is added to the double bond of the olefin producing chains which are longer by one carbon atom. As a more renewable alternative, CO₂ could be used instead of CO as a reactant. Through the use of a heterogeneous catalyst, the catalyst losses that the homogeneous processes are currently facing can be avoided, although the heterogeneous catalysts usually lead to significant alkene hydrogenation to alkanes [1]. However, hydrogenation of CO₂ to CO would be desirable, so the goal of this thesis is to investigate the feasibility of the hydroformylation with CO₂ as a reactant using a heterogeneous catalyst.



Program

1. Literature survey on hydroformylation with CO and CO₂ and the catalysis of the reaction
2. High-throughput kinetic investigation, experimental campaign of heterogeneous hydroformylation of tetradecene using CO₂ and hydrogen as the gas feed mixture.

1. Navidi, N., G.B. Marin, and J.W. Thybaut, *A Single-Event Microkinetic model for ethylene hydroformylation to propanal on Rh and Co based catalysts*. Applied Catalysis A: General, 2016. **524**: p. 32-44.