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DETAILED KINETIC INVESTIGATIONS ON THE SELECTIVE OXIDATION OF BIOMASS TO FORMIC ACID (OXFA PROCESS)

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We present a detailed kinetic study of the selective catalytic oxidation of different biogenic substrates to formic acid (OxFA process) using two different homogeneous polyoxometalate catalysts. By using high oxygen pressures (30–60 bar) and temperatures of 80–90°C in aqueous solution, we were able to investigate the rate-determining substrate oxidation step catalyzed by the oxidized form of the polyoxometalates (POMs) by keeping the concentration of the catalytic active species constant. Under these conditions, kinetic parameters like effective reaction order and reaction rate constants could be determined by the differential method for model substrates like glucose, fructose, sorbitol and gluconic acid. Finally, a detailed kinetic study for water-insoluble biomasses like beech and spruce wood showed differences in formic acid (FA) formation and product selectivities depending on the composition of the wood in terms of their ratios of lignin, cellulose and hemicellulose.

BIOGRAPHY

Jakob Albert is currently working as Assistant Professor and Head of the research group "Biomass and Sustainable Production of Platform Chemicals" at FAU's Institute of Chemical Reaction Engineering (CRT). He holds a Diploma in 2011 and a PhD degree in 2014 from the FAU in Chemical Engineering. His key activities are in the research fields of biomass valorization, sustainable platform chemicals, polyoxometalate catalysts and multiphase reaction systems. He is an inventor on 19 invention disclosures and patents and has received numerous scientific awards e.g. the Promotionspreis of the Technical Faculty of the FAU in 2014, a Max-Buchner-Scholarship in 2015, an EAM Starting Grant 2015, an Innovation MINT-Award 2016 and the Science Sets Sail Award of the Excellence Cluster Engineering of Advanced Materials in 2017.

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