

FACILE HYDRODEOXYGENATION OF CELLULOSIC BIOMASS DERIVED KETONES USING SOLID ACID CATALYSTS

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There are significant concerns over the geopolitical, socioeconomic and environmental effects of the continued extraction and use of fossil fuels, and therefore the production of sustainable liquid transport fuels from biomass is one of the main challenges of the 21st century. The conversion of hemicellulose and cellulose (and their sugar monomers) to fuels one of the most viable approaches as they represent >70% of all lignocellulosic biomass. Recently, production of suitable hydrocarbon fuel molecules (C₈-C₁₆ alkanes) has been reported by the C-C coupling of sugar-derived aldehydes with short-chain biomolecules and subsequent hydrodeoxygenation of the bioketones produced. This process, however, requires the use of palladium-containing catalyst, non-catalytic amounts of acetic acid and long reaction periods for significant yields to be achieved (>15 h). In this study, the near-complete hydrodeoxygenation of these bioketones to alkanes (>95% in <1 hr) was achieved via significantly improved conditions and more industrially viable catalytic systems. Each step of the overall hydrodeoxygenation mechanism – ketone reduction to alcohol, alcohol dehydration to alkene, and alkene hydrogenation to alkane – was screened for catalyst activity, temperature and (if applicable) H₂ pressure in batch conditions. This ultimately leads to an optimized multifunctional heterogeneous catalyst system, which was carried on and used in a more industrially relevant continuous flow reactor.