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Synthesis of succinic acid from biomass-derived furans using a reusable solid acid catalyst with hydrogen peroxide under metal-free conditions

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Abstract

Succinic acid (SA, 1,4-butanedioic acid) is a versatile compound capable of producing useful chemicals such as γ butyrolactone, 1,4-butanediol, and tetrahydrofuran [1]. SA has been currently manufactured from 2-butene through maleic anhydride. For the bio-refinery, it can also be produced through fermentation of glucose (a major hexose in hemicellulose). Glucose and xylose (a pentose in hemicellulose) can be converted into 5-hydroxymethylfurfural (HMF) and 2-furaldehyde (furfural), respectively, by solidcatalyzed elimination of three water molecules [2]. Recently, we found that biomassderived furans (furfural, HMF, and furoic acid [FuA]) could be converted into SA using Amberlyst-15 as a reusable solid acid catalyst in the presence of 30% H2O2 in water solvent at 348-363 K [3]. The maximum SA yield and H2O2 utilization efficiency of 74 % and 85%, respectively, were achieved for the furfural oxidation. A scale-up reaction using furfural (20 mmol) afforded SA with 68% isolated yield. In the oxidation of HMF, 2-oxoglutaric acid (OGA) was formed as co-product, which is converted into SA. This catalytic oxidation process will provide a viable route for SA synthesis because of its easy handling and simple SA isolation.

Biography

Kohki Ebitani; Chemist of Heterogeneous Catalyst, graduated from Department of Chemistry, Hokkaido University in 1992. He worked for Tokyo Institute of Technology 1992-1996 and for Osaka University 1996-2006. Since 2006, he became a Professor in Japan Advanced Institute of Science and Technology. Now he has published more than 130 papers, 5 text chapters, and 24 reviews. In 2012, the Chemical Society of Japan awarded him for his article (*Bull. Chem. Soc. Jpn.*).