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Heterogeneously catalysed conversion of glucose to glucaric acid

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PURPOSE OF THE ABSTRACT

Gluconic and glucaric acids, the main products of glucose oxidation, are considered among the most promising bio-based chemicals. In particular, glucaric acid has been gathering increasing attention as it may be used for the synthesis of bio-based adipic acid, while specific glucaric acid salts and lactones have also been found to possess anti-carcinogenic properties [1]. Commercially, glucaric acid is produced biotechnologically, which accounts for its small scale production and increased price. As an alternative route, oxidation with HNO_3 or $KMnO_4$ has been proposed, while the most studied heterogeneous catalysts include Au, Pt or Pd on different supports with O_2 as oxidant [2]. However, the synthesis of glucaric acid entails the oxidation of the C6-hydroxyl group which requires more severe conditions than that of the C1-aldehyde (which leads to the synthesis of gluconic acid). Hence, during the chemocatalytic synthesis of glucaric acid side and consecutive C-C cleavage reactions generally occur, resulting in a poor selectivity [3]. With the aim of moving beyond the state-of-the-art we studied the efficiency of Pt, Ni or Cu supported on Al_2O_3, MCM-41 and TiO_2, in terms of yield and selectivity for glucaric acid synthesis. The catalysts were fully characterized (ICP-OES, XRD, SEM, N_2 adsorption, TPD, pyFTIR), followed by their screening at standard experimental conditions. Further experimental factors varied were the O_2 pressure (at 5 and 15 bar) and the pH value (at 6 or 8). The results obtained indicate the potential of Ni to be used as an alternative to noble metals.

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FIGURES

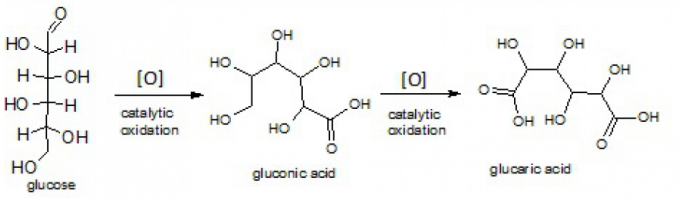

FIGURE 1

Glucose oxidation

Figure 1: Glucose oxidation reaction

FIGURE 2

KEYWORDS

glucose oxidation | glucaric acid | heterogeneous catalyst

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