

Glycerol waste valorization to mesoxalic acid over a bimetallic Pt-Pd/CNT catalyst in alkaline medium

Abstract

Glycerol electro-oxidation offers a green route to produce the high value added chemicals. Here in, we report the glycerol electro-oxidation over a series of multi walled carbon nano tubes supported monometallic (Pt/CNT and Pd/CNT) and bimetallic (Pt-Pd/CNT) catalysts in alkaline medium. The cyclic voltammetry, linear sweep voltammetry and chronoamperometry measurements were used to evaluate the activity and stability of the catalysts. The Pt-Pd/CNT electrocatalyst exhibited the highest activity in terms of higher current density (129.25 A/m^2) and electrochemical surface area ($382 \text{ m}^2/\text{g}$). The glycerol electro-oxidation products formed at a potential of 0.013 V were analyzed systematically by high performance liquid chromatography. Overall, six compounds were found including mesoxalic acid, 1,3-dihydroxyacetone, glyceraldehyde, glyceric acid, tartronic acid and oxalic acid. A highest mesoxalic acid selectivity of 86.42% was obtained for Pt-Pd/CNT catalyst while a maximum tartronic acid selectivity of 50.17% and 46.02% was achieved for Pd/CNT and Pt/CNT respectively. It was found that the introduction of Pd into Pt/CNT lattice facilitated the formation of C3 products in terms of maximum selectivity achieved (86.42%) while the monometallic catalysts (Pd/CNT and Pt/CNT) showed a poor performance in comparison to their counterpart.

Key Words: Pt-Pd/CNT; glycerol electro-oxidation reaction; mesoxalic acid; HPLC

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