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Co-existence of Pd, Bi2O3 and CuO supported on porous activated biocarbon for electrochemical conversion and energy storage

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Abstract

The co-existence of metal oxides (MO) and activated carbon (AC) causes changes in the catalytic behaviour and activity which would contribute greatly to a number of applications. Pd–AC/Bi2O3/CuO synthesized via the green process was used as a catalyst for electro-oxidation of ethanol and energy storage. Carbonization at 800 °C and hydrothermal treatment in a microwave oven yielded biocarbon (BC) from banana peels with mesoporous and high surface area (690.42 m2 g-1). Cyclic voltammetry (CV), galvanostatic charge–discharge, electrochemical impedance spectroscopy, and chronoamperometry were used to assess the electroactivity of the catalyst (CA). CV of Pd–AC/Bi2O3/CuO revealed 40% enhanced current densities (j) in ethanol electro-oxidation compared to that of the prepared Pd/AC, while the j determined at 20 min of CA measurements was 60% higher than those of the other prepared catalysts. Among the other catalysts, Pd–AC/Bi2O3/CuO revealed high capacitive j and confirmed the near ideal capacitive behaviour with good electrochemical reversibility while the calculated Csp of the electrode system was found to be 369.1 F g-1 at 0.95 mA cm-2. The calculated time constant (t0) value for Pd–AC/Bi2O3/CuO was higher, 390 ms, implying that the catalyst performs better with quick delivery of stored charges indicating better energy delivery capability.