Abstract

Metal-organic frameworks have poor electrochemical properties. However their electron transfer kinetics can be improved by doping these materials with known conductive materials. In this contribution we have proved that electron transfer kinetics of [Cu_3(benzene-1,3,5-tricarboxylate)$_2$(H_2O)$_3$]$_n$ (HKUST-1) can be improved by loading its channels using copper oxide nanoparticles to give CuO@HKUST-1. Electrochemical studies showed that the synergy of copper oxide nanoparticles and HKUST-1 in the nanocomposite lead to high electrocatalysis, fast response for catalysis (less than 5 s) with good signal strengths and excellent selectivity toward the oxidation of citric acid (CA). It was also noted that the oxidation of CA occurred at lower potential (+ 0.47) in comparison to the commonly observed (+ 1.00) for most reported systems and displayed a very high resistance to passivation. This result was attributed to the presence of numerous catalytically active sites and the large surface area of the nanocomposite material which can lower the activation energy barrier for the oxidation of CA. Compared to the precursors, the composite displayed superior electron transfer kinetic suggesting that a synergistic relationship was formed. This work, strongly suggests that the combination of MOFs and conductive nanoparticles maybe used for the development of novel electrochemical sensors.