Polymer- and nanomaterial-modified electrodes using deep eutectic solvents

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Deep eutectic solvents (DES), green and promising alternatives to non-aqueous solvents and room temperature ionic liquids, are being used in polymer science, metal electrodeposition and nanomaterials. Synthesis of DES is normally done by mixing two solid non-toxic components, leading to a viscous liquid. In DES for electrochemical applications, eutectic formation is due to strong hydrogen bond interactions between an acceptor, such as choline chloride, and a donor such as urea, ethylene glycol or glycerol (DES reline, ethaline and glyceline). Electroactive polymer-modified electrodes have been prepared by electropolymerisation in DES, used to tune the nanostructure and polymer film surface morphology. Addition of a second hydrogen bond donor, a small percentage of strong acid, promotes polymer film formation. First studies involved formation of films of the conjugated polymer poly(3,4-ethylenedioxythiophene). Recently, formation of redox polymers on the surface of carbon nanotube or graphene modified glassy carbon electrodes has also been investigated by us, comparing with modified electrodes prepared in aqueous solution, including poly(neutral red), poly(methylene blue), and poly(brilliant cresyl blue). Sensor platforms and oxidase enzyme biosensor platforms have been constructed. The enhanced characteristics of the (bio)sensor platforms will be described and compared with those containing polymer films formed in aqueous solution.

Keywords: deep eutectic solvents; modified electrodes; electroactive polymers; electrochemical sensors