

Electrochemical oxidation of ascorbic acid mediated by carbon nanotubes /Li+/ carbon paste modified solid electrode

Abstract

Multi-walled carbon nanotube (MWCNT) was used to modify BPPG electrode because of its unique structure and extraordinary properties. MWCNT modified electrode exhibited obvious enhancing and electrocatalyzing effects to the oxidation of ascorbic acid using cyclic voltammetry technique. MWCNT was bonded on BPPG electrode surface using carbon paste with ratio of 30% (w/w) carbon paste (binder): 70% (w/w) MWCNT. This method of modification has lowered the capacitance background current and enabled lower detection limit of ascorbic acid concentration. The electrical conductivity property of MWCNT modified electrode was further improved with the intercalation with lithium ion and resulted in current enhancement of 2 times on the oxidation current of ascorbic acid. Parameters of pH and temperature showed significant relation to the sensitivity of MWCNT modified electrode. Under the optimized parameters, the calibration curve constructed was linear up from 50 μM to 5 mM with sensitivity of 34.5 mA M⁻¹. The practical application of MWCNT modified electrode was demonstrated with Vitamin C pill and orange juice. Good reproducibility and recovery of ascorbic acid concentration showed the feasibility of MWCNT modified electrode to be used in the detection of ascorbic acid in aqueous solution. This also proposed MWCNT modified BPPG electrode possessed advantages such as low detection limit, high stability, low cost and simplicity in fabrication.

Keyword: Multi-walled carbon nanotube; Ascorbic acid; Basal plane pyrolytic graphite electrode; Cyclic voltammetry; Modified electrode.