ACTION OF 1,2,3-TRIKETOHYDRINDENE HYDRATE (NINHYDRINE) ON SUPEROXIDE ANION SCAVENGING IN APROTIC SOLVENTS

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It has been well documented that the superoxide anion ($O_2^{\cdot -}$) and its subsequent products, such as hydrogen peroxide, hydroxyl radical are potent reactive oxygen species (ROSs), which could cause harmful effects to biological systems. Furthermore, $O_2^{\cdot -}$ could couple with nitric oxide (NO), released in different activities of biological systems, resulting in the formation of an extremely reactive oxidant peroxynitrite (ONO_2^-) and the hydroxyl radical. In many circumstances, ONO_2^- has been implicated as a major pathogenic agent in human diseases.

The cyclic voltammogram of 1.0×10^{-3} mol dm^{-3} ninhydrine (NHy), recorded in dimethylsulfoxide (DMSO) in the presence of 0.1 mol dm^{-3} tetraethylammonium tetrafluoroborate at a glassy carbon electrode at 50 mV s^{-1} consists of two redox couples and one irreversible cathodic wave. The two redox couples are due to electrochemical reduction of two carbonyl groups attached to the benzene ring, producing a stable monoanion radical ($NHy^{\cdot -}$) at $E_{p/2} = -0.50$ V and a dianion (NHy^{2-}) at $E_{p/2} = -1.17$ V. The irreversible cathodic peak at –0.80 V is due to the reduction of the third carbonyl oxygen producing an unstable monoanion radical. All potentials were recorded with respect to a Ag/AgCl wire electrode.

Cyclic voltammetric experiments carried out for an air-saturated solution of DMSO showed that with the addition of ninhydrine the oxidation peak current of $O_2^{\cdot -}$ at –0.68 V, formed by electrochemical reduction of O_2 decreased, and finally diminished completely when the ninhydrine concentration was 9.0×10^{-4} mol dm^{-3}. The plot of quenching of the peak current of oxidation of $O_2^{\cdot -}$ with added concentration of NHy shows a good linearity, suggesting that $O_2^{\cdot -}$ is scavenged within the time scale of cyclic voltammetry in DMSO in a concentration-dependent manner. This behaviour is in close agreement with the results obtained in rotating ring disk voltammetric experiments in DMSO where a constant potential of –0.8 V was applied to the Pt disk and the oxidation process of $O_2^{\cdot -}$ at the Pt ring was monitored by sweeping the ring potential from –0.55 V to 0.00 V at a rate of 5 mV s^{-1}. The consecutive addition of 0.1 ml of 0.0255 mol dm^{-3} NHy showed a remarkable decrease in the limiting current of $O_2^{\cdot -}$ oxidation wave. This indicates that the amount of $O_2^{\cdot -}$ reaching to ring is significantly decreased due to the increased quenching of $O_2^{\cdot -}$ by NHy as the concentration of NHy in the solution was increased. Based on these results, it is concluded that NHy can effectively be used to scavenge superoxide anion radical.

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