

Studi unjuk kerja Elektrokimia Screen Printed Carbon Electrode Termodifikasi Multi-Walled Carbon Nanotubes untuk pendeteksian asam askorbat = Electrochemical performance study of Screen Printed Carbon Electrode Modified with Multi-Walled carbon Nanotubes for ascorbic acid detection

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Abstrak

Studi elektrokimia berupa voltametri siklik dan kronoamperometri pada asam askorbat telah berhasil dilakukan pada screen printed carbon electrode (SPCE) dan SPCE termodifikasi multi-walled carbon nanotubes (SPCE-MWCNT) yang masing-masing memiliki luas permukaan aktif sebesar 0,138 cm² dan 0,126 cm². Pengaruh laju pemindaian dan konsentrasi asam askorbat yang dilarutkan dengan phosphate buffered saline (PBS) 0,1 M pH 7,4 terhadap arus dipelajari dengan menggunakan voltametri siklik dimana hubungan keduanya berlangsung linear, sama seperti pengaruh arus terhadap waktu yang dipelajari dengan menggunakan kronoamperometri. Elektroda SPCE dan SPCE-MWCNT teroksidasi masing-masing pada 0,2237 V dan 0,2756 V saat diberikan asam askorbat 10 mM dengan siklus potensial rentang -1 V hingga 1 V. Reaksi yang terjadi pada permukaan kedua elektroda tersebut merupakan reaksi yang dikontrol difusi dikarenakan hubungan antara log puncak arus anodik dan log laju pemindaian menunjukkan hasil yang linier dengan nilai kemiringan mendekati 0,5, yaitu sebesar 0,220 dan 0,222 untuk masing-masing SPCE dan SPCE-MWCNT. Batas deteksi dan batas kuantifikasi pada SPCE ditemukan masing-masing sebesar 1,2588 mM dan 3,8145 mM untuk pengujian menggunakan voltametri siklik, serta 2,8393 mM dan 8,6040 mM untuk pengujian menggunakan kronoamperometri. Sedangkan batas deteksi dan batas kuantifikasi pada SPCE-MWCNT ditemukan masing-masing sebesar 0,5197 mM dan 1,5748 mM untuk pengujian menggunakan voltametri siklik, serta 1,1486 mM dan 3,4805 mM untuk pengujian menggunakan kronoamperometri. Pada pengujian kronoamperometri menggunakan SPCE dan SPCE-MWCNT, dihasilkan juga persamaan linear masing-masing sebesar $y=0,008x+0,07774$ dan $y=0,0091x+0,04781$. Hal ini menunjukkan bahwa SPCE dan SPCE-MWCNT memiliki aktivitas katalitik yang baik terhadap oksidasi asam askorbat.

.....Electrochemical study through cyclic voltammetry and chronoamperometry on ascorbic acid was successfully accomplished on screen printed carbon electrode (SPCE) and SPCE modified with multi-walled carbon nanotubes (SPCE-MWCNT) with an active surface area of 0.138 cm² dan 0.126 cm², respectively. The effect of scan rate and concentration of dissolved ascorbic acid in phosphate buffered saline (PBS) 0.1 M pH 7.4 on the current were studied using cyclic voltammetry, where the relationship between them was linear. Similarly, the effect of current on time when studied using chronoamperometry also resulted in a linear relationship. The SPCE and SPCE-MWCNT electrodes were oxidized at 0.2237 V and 0.2756 V, respectively, when given 10 mM ascorbic acid with the range of cyclic potential -1 V to 1 V. The reaction which occurs on both the electrode surfaces are diffusion-controlled reaction, since the relationship between the log of peak anodic current and the log of the scan rate shows linear results with both slope values approximated to 0.5, which are 0.220 and 0.222 to be exact for SPCE and SPCE-MWCNT, respectively. The limit of detection (LOD) and the limit of quantification (LOQ) in SPCE were found to be 1.2588 mM

dan 3.8145 mM, respectively, when tested using cyclic voltammetry, as well as 2.8393 mM and 8.6040 mM when tested using chronoamperometry. Meanwhile, LOD and LOQ in the SPCE-MWCNT were found to be 0.5197 mM and 1.5748 mM, respectively, when tested using cyclic voltammetry, as well as 1.1486 mM and 3.4805 mM when tested using chronoamperometry. In the chronoamperometric test using SPCE and SPCE-MWCNT, the resulting linear equations were $y=0.008x+0.07774$ and $y=0.0091x+0.04781$, respectively. These phenomena indicated that both SPCE and SPCE-MWCNT had a significant catalytic activity towards ascorbic acid oxidation.