Preparasi nanopartikel core-shell fe3o4@au termodifikasi hemoglobin dan aplikasinya untuk biosensor akrilamida = Fabrication of hemoglobin-modified core-shell fe3o4@au nanostructures on screen-printed carbon electrode for electrochemical acrylamide biosensor.

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Abstrak

Penelitian ini mengembangkan pembuatan biosensor elektrokimia menggunakan nanopartikel core-shell Fe3O4@Au yang dimodifikasi hemoglobin pada Screen Printed Carbon Electrode (SPCE) untuk mendeteksi akrilamida. Fe3O4NP (~4,9 nm) dan core-shell Fe3O4@Au (~5-6,4 nm) berhasil disintesis melalui metode dekomposisi termal. Hasil ini dikonfirmasi oleh analisis UV-Visible Spectrometer (UV-Vis), X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR) dan Transmission Electron Microscopy (TEM). Studi awal elektrokimia hemoglobin optimum didapatkan pada ABS 0,1 MpH 6 dengan konsentrasi optimal hemoglobin sebesar 2 mg/mL. Fe3O4@Au yang termodifikasi Hb memiliki ukuran yang lebih besar, dikarakterisasi dengan Scanning Electron Microscopy (SEM), FTIR, dan Zeta Potensial. Kinerja Fe3O4@Au/Hb dievaluasi untuk mendeteksi akrilamida dilakukan dengan metode Cyclic Voltammetry (CV) pada rentang potensial -0,8-0,8 V, scanrate 50 mV/s didapatkan koefisien regresi linear R2 = 0,98 pada rentang konsentrasi 0-1 μM dengan Limit of Detection (LOD) sebesar 0,136 μM dan sensitivitas sebesar 0,4411 μA/μM. Selain itu, studi interferensi dilakukan untuk beberapa senyawa sederhana lainnya seperti asam askorbat, melamin, glukosa, kafein dan natrium asetat. Pengukuran akrilamida pada real sampel berupa kopi bubuk dilakukan secara elektrokimia dengan biosensor ini dan divalidasi dengan metode standar High Performance Liquid Performance (HPLC).
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This work reports an investigation on the fabrication of electrochemical biosensor based on hemoglobin-modified core-shell Fe3O4@Au nanostructures on screen printed carbon electrode for the detection of acrylamide. Here, both Fe3O4NP (~4.9 nm) and core-shell Fe3O4@Au (~5-6.4 nm) nanostructures were successfully synthesized via thermal decomposition method. These results are discussed by analysis of UV-Visible Spectrometers (UV-Vis), X-Ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR) and Transmission Electron Microscopy (TEM). Preliminary electrochemical investigation at ABS pH 6 also revealed that the optimum amount of hemoglobin immobilization were obtained at ABS 0.1 M pH 6 with an optimal hemoglobin concentration of 2 mg/mL. Hb modified Fe3O4@AuNP has a larger size, characterized by Scanning Electron Microscopy (SEM), FTIR, and Zeta Potential. The performance of Fe3O4@Au/Hb was evaluated to detect acrylamide using the Cyclic Voltammetry (CV) method in the potential range of -0.8-0.8 V, a scanrate of 50 mV/s obtained a linear regression coefficient R2=0.98 in the concentration range 0-1 μM with a Limit Detection (LOD) 0.136 μM and sensitivity 0.4411 μA/μM. In addition, studi interference is made for a number of simple compounds such as ascorbic acid, melamine, caffeine and sodium acetate. The measurement of acrylamide in real samples consisting of ground coffee was carried out by electrochemistry with this biosensor and validated by the standard High Performance Liquid Performance (HPLC) method.