

Electrochemical behaviour of real-time sensor for determination mercury in cosmetic products based on PANI/MWCNTs/AuNPs/ITO

ABSTRACT

Mercury is a common ingredient found in skin lightening soaps, creams, and makeup-cleansing products. It may cause skin rashes, skin discolouration, and scarring, as well as a reduction in the skin's resistance to bacterial and fungal infections. By looking at this scenario, developing a sensor that involved a simple procedure and fasts for real-time detection without affecting mercury sensitivity is urgently needed. For that reason, a fast and sensitive electrochemical method was developed to determine mercury in cosmetic products with the composition of polyaniline/multi-walled carbon nanotubes/gold nanoparticles/indium tin oxide sheet using methylene blue as a redox indicator. The significantly enhanced electrochemical performance was observed using cyclic voltammetry (CV) and differential pulse voltammetry (DPV). In order to detect mercury qualitatively and quantitatively, deposition potential and deposition time were respectively optimised to be 0.10 V and 70 s. The modified sensor was revealed a wide detection range of mercury from 0.01 to 10.00 ppm with a limit of detection of 0.08 ppm. The modified sensor towards mercury with a correlation coefficient (r^2) was of 0.9948. Multiple cycling, reproducibility, and consistency of different modified sensors were investigated to verify the modified sensor's performance. The developed sensing platform was highly selective toward mercury among the pool of possible interferents, and the stability of the developed sensor was ensured for at least 21 days after 10 repeated uses. The proposed method is a fast and simple procedure technique for analysing the mercury levels in cosmetic products.