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Abstract

Facile Synthesis of 3D Printed Tailor-Shape Electrode PLA-GnP for Electrochemical Sensing †

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Abstract: Additive manufacturing (AM) has made enormous advancements in technology and materials development, and attention is required for the development of functionalized printed materials. AM can assist in manufacturing complex designed tailored-shaped electrodes efficiently for electrochemical sensing in the food industry. Herein, we used commercial fused deposition modeling (FDM) filament and polylactic acid (PLA) for FDM 3D printing of a self-designed electrode with minimal time and cost compared to commercial electrodes. Surface functionalization on the 3D printed PLA electrode was conducted using GnP to enhance the electrical conductivity. Scanning electron microscopy confirmed the homogenized surface coating of GnP that provides electron flow behavior for the 3D printed electrode. The electrochemically functionalized 3D printed electrode was tested against standard 3-monochloropropane-1,2-diol (3-MCPD) with known concentrations and characterized using cyclic voltammetry and differential pulse voltammetry methods. The results showed a basis for the promising application of detecting and quantifying 3-MCPD, a food contaminant known for its potential of being carcinogenic. The fabrication of functionalized 3D printed polymer electrodes paves the way for the development of complete 3D-printable electrochemical systems.

Keywords: additive manufacturing; fused deposition modeling; polymer; palm oil contaminant; cyclic voltammetry

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