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Thermoplastic Starch and Graphite (TPS-Gr) Dipositive with Potential Applications in Electrochemical Sensing for the Detection of Catechol

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Currently, there is great interest in obtaining alternative materials for application in sensing that add good performance with sustainability. Synthetic polymers are commonly used, however, considering ecological consumption, there is growing interest in using biodegradable polymers as replacements for conventional polymeric materials. Therefore, starch, which is a polymer with high availability, low cost and high biodegradability, may have great potential to replace conventional materials. However, native starch does not have plastic characteristics, being necessary to carry out the modification with a plasticizing agent to produce thermoplastic starch (TPS). However, TPS does not have conductive properties that allow its application in electrochemical sensors, being essential the incorporation of conductive materials such as graphite (Gr), for example, to form a conductive composite. In this work we propose a method of producing a biodegradable polymeric composite, with conductive properties, which allow a potential application in the development of electrochemical sensors used as substrate Electrochemical characterization of the material by Electrochemical Impedance Spectroscopy (EIS) and Cyclic Voltammetry (CV) to determine the best proportion. Thus, it was proved that the material developed has a homogeneous and uniform composition with conductive properties. It was also demonstrated the potential of the material for application with a disposable and biodegradable electrochemical sensor, with good selectivity for the detection of catechol in water. The methodology used for the manufacture of thermoplastic starch and graphite composites with different proportions proved to be viable. The device presents easy execution and good reproducibility of the results. Among the tested compositions, the one that delivered the best results in the electrochemical measurements was the composite prepared with 60% graphite and 40%. As a proof of concept, a fabricated electrode was used for CC determination using the DPV electrochemical technique. The electrochemical technique of Differential Pulse Voltammetry (DPV) was used to determine the catechol molecule (CC) over a range of 0.1 to 2.0 mmol L-1, showing a linear regression (R2) of 0.9996 and LOD and LOQ values equal to 1.85 × 10-6 mol L-1 and 6.18 × 10-7 mol L-1, respectively, thus, TPS-Gr exhibited good accuracy, selectivity, and stability in electrochemical applications to detect pollutant molecules such as catechol.