Área: FIS

Starch-Based Eco-Friendly Electrolyte from *Manihot esculenta* for the Anodic Synthesis of Nanostructured TiO_2 Films

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Palavras Chave: *Nanoporous TiO_2, Green Electrolyte, Cassava Starch, Biomaterial, Sustainability.*

Highlights

-Greener anodization of TiO_2 films using cassava *(Manihot esculenta*) starch-based electrolytes;
-Improved corrosion resistance in artificial saliva tests;
-Comparable performance to ethylene glycol electrolytes.

Resumo/Abstract

The development of sustainable alternatives to toxic solvents remains a central challenge in the field of biomaterials. Titanium dioxide nanotube films (TiO_2NT) are widely investigated due to their biocompatibility, high surface area, and corrosion resistance; however, their conventional synthesis typically relies on an organo-aqueous solution containing ethylene glycol (EG), a toxic solvent with low biodegradability. In this work, we propose the use of an aqueous electrolyte solution based on cassava starch (CS) at different concentrations as an eco-friendly substitute for EG in the anodic synthesis of TiO_2NT. Sustainability assessment using the AGREEprep tool confirmed the superiority of CS (0.56) compared to EG (0.29). Morphological analysis by FE-SEM verified the formation of nanoporous structures. Thermal treatment promoted crystallization into the anatase phase, which is desirable for biomedical applications, as confirmed by characteristic peaks in XRD and Raman spectroscopy bands at 144 cm^{-1} (E_g), 197 cm^{-1} (E_g), 400 cm^{-1} (B_{1g}), 519 cm^{-1} (A_{1g} + B_{1g}), and 640 cm^{-1} (E_g). Electrochemical tests in artificial saliva demonstrated that corrosion resistance could be modulated by starch concentration, reaching values comparable to conventional EG-based systems. These results highlight the potential of cassava starch as a green electrolyte component, combining sustainability, renewability, and low toxicity, without compromising material performance. The proposed strategy points toward a promising route for the fabrication of TiO_2 coatings designed for safer and more environmentally responsible biomedical applications.

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