10th Brazilian Conference on Natural Products
XXXVI RESEM
4-7 November 2025, Belo Horizonte, MG, Brazil
Section: 05

ELECTROCHEMICAL QUANTIFICATION OF TANNISN AND CATECHINS IN Syzygium cumini PHYTOTHERAPEUTICS AND Syzygium malaccense EXTRACTS USING 3D-PRINTED SENSORS

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Phytotherapeutics based on *Syzygium cumini*, a plant species included in the Brazilian Unified Health System (SUS) list, are widely used due to their antioxidant and hypoglycemic effects, attributed to phenolic compounds like catechins and tannins. Quantifying these classes of compounds is essential to ensure the safety and efficacy of herbal medicines. However, conventional analytical methods, such as high-performance liquid chromatography (HPLC), are expensive and require advanced infrastructure. In contrast, electroanalytical techniques offer low-cost and sensitive alternatives suitable for routine quality control applications. In addition to *S. cumini*, this study explores *Syzygium malaccense*, a species native to Southeast Asia and also cultivated in Brazil, commonly known as Red Jambo. It is used in folk medicine due to its anti-inflammatory and hypoglycemic properties and is rich in polyphenols, with a composition similar to that of *S. cumini*. This study aimed to develop and validate an electrochemical method using square wave voltammetry (SWV) for the quantification of catechins and tannins in commercial *S. cumini* phytotherapeutics and extracts from *S. malaccense* leaves and twigs. Extracts were obtained via sequential maceration with hexane and ethanol. All samples were characterized by total phenolics (Folin-Ciocalteu assay) and liquid chromatography/electrospray ionization time-of-flight mass spectrometry (LC-ESI-MS/MS-QTOF). Electrochemical measurements were performed using 3D-printed working electrodes made from carbon black–polylactic acid (CB-PLA) via fused deposition modeling (FDM). After electrochemical activation, analyses were conducted in 0.5 mol L^{-1} H_2SO_4 containing 30% ethanol. Catechin was used as the analytical standard. Well-defined redox peaks were obtained, with detection limits in the 10^{-7} mol L^{-1} range. *S. cumini* phytotherapeutics exhibited quantifiable levels of catechins, while *S. malaccense* extracts also showed significant concentrations. Results aligned with spectrophotometric and LC-MS data. These findings highlight the potential of 3D-printed electrochemical sensors as tools for phytochemical analysis. Acknowledgments: FAPEMIG, CAPES and CNPq.

Keywords: *Syzygium cumini; catechin; tannins; voltammetry; 3D-printed sensors; Syzygium malaccense.*