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Physicochemical characterization and therapeutic potential of geopropolis from *Melipona scutellaris of the Maceió, Alagoas*

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ABSTRACT

Background: Geopropolis, produced by stingless bees, represents a distinct variety of propolis characterized by a higher proportion of inorganic materials, such as soil and clay, alongside plant resins. This unique composition grants geopropolis special physicochemical characteristics and potential therapeutic effects, which are influenced by the local flora and the collection environment. The increasing popularity of geopropolis in recent years underscores the need for studies that deepen the understanding of its biological properties and benefits for human health.

Objectives: This study aimed to characterize the physicochemical properties of geopropolis from the species *Melipona scutellaris*, collected in the municipality of Maceió, Alagoas, Brazil.

Methods: The geopropolis samples were obtained from *M. scutellaris* colonies, dried, and ground for analysis. Bioactive components were extracted using maceration and Soxhlet methods, both utilizing ethanol as a solvent. The physicochemical characterization included the evaluation of mechanical mass, quantification of wax content, analysis of loss by drying, total soluble solids, and determination of ash content. The quantification of phenolic compounds and flavonoids was conducted through specific assays, while antioxidant activity was assessed using the DPPH reagent method. For the extraction of volatile organic compounds, solid-phase microextraction was employed, followed by analysis using gas chromatography coupled with mass spectrometry.

Results and Discussion: The analysis results of the geopropolis from *M. scutellaris* indicated that the Soxhlet extraction method achieved a mechanical mass yield of 75.73 ± 0.21%, slightly higher than the maceration yield of 75.08 ± 0.06%. The wax content varied between 0.30 ± 0.02% (Soxhlet) and 0.42 ± 0.01% (maceration). The moisture content was measured at4.52 ± 0.20%, and the ash content was high (65.22 ± 0.76%), suggesting a significant presence of inorganic material. Maceration favored the extraction of flavonoids, with a content of 1.33%, compared to the 0.039% obtained from Soxhlet. Furthermore, the antioxidant activity was higher in maceration (86.11%) than in Soxhlet (75.82%). The analysis of volatile organic compounds revealed 48 compounds, with a focus on aristolene, which represented 60.78% of the area concentration, suggesting its biological relevance.

Conclusion: The geopropolis of *M. scutellaris* is a rich source of bioactive compounds, presenting considerable therapeutic potential. The choice of extraction method influenced the recovery of flavonoids and antioxidant activity, with maceration being more effective than Soxhlet. The high concentration of aristolene suggests an important role in the biological properties of geopropolis. These findings highlight not only the relevance of geopropolis as an antioxidant agent but also open opportunities for future research exploring its applications in health and wellness products, potentially contributing to the development of new treatments based on natural extracts.