XIV ENCAT
Encontro de Catálise do Norte, Nordeste e Centro-Oeste
Catálise: Impulsionando a transição energética para um futuro mais sustentável
17-19 novembro 2024 • Fortaleza
SBCAT SOCIEDADE BRASILEIRA DE CATÁLISE

AREA: Characterization

Synthesis and optical characterization of *Lippia grata* leaf extract for the production of carbon quantum dots for heterogeneous photocatalysis applications

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Resumo-Abstract

In recent years, there has been growing concern about the high toxicity of reagents, solvents and other chemical agents present in industrial or household processes. It is known that the processes resulting from these effluents being discharged into the environment pose major risks to society as a whole. In order to minimize these processes, new methodologies for their treatment must be developed, among them, Advanced Oxidative Processes (AOP) have been widely used, especially photocatalysis, based on the oxidative activity of a semiconductor material on the harmful compounds present in the effluent. Photocatalysts are generally produced via a synthesis route involving solvents and environmentally unfriendly processes. Green synthesis methodology, which uses organic compounds present in nature to produce nanomaterials, has been outstanding in obtaining new photocatalysts based on carbon quantum dots (CQDs) [1]. CQDs are carbon nanomaterials that have absorption and photoluminescence properties (in the UV, visible or NIR), their properties include photochemical stability and biodegradation [2]. *Lippia grata* is a highly aromatic plant, endemic to northeastern Brazil, has remarkable pharmacological properties associated with its chemical composition. This study aims to use *Lippia grata* leaf extract to produce CQDs. The plants were collected on the campus of the State University of Rio Grande do Norte/Mossoró/RN. After collection, the leaf were prepared, separated, cleaned and dried on absorbent paper at room temperature in a sheltered place for 48 hours. The leaves were then added to Kraft paper and dried in an oven with forced air circulation at 40°C for 120 hours. After drying, the leaves were macerated until a powder was obtained. Two extracts were prepared using 40 g of these leaves: the first (aqueous) used 200 mL of ultrapure water, and the second (hydroalcoholic) used a mixture of 100 mL of ultrapure water and 100 mL of ethyl alcohol. The extracts were left to stand in the hood for 72 hours, then filtered using a simple filtration system, kept in amber bottles covered with aluminum foil and refrigerated at 4°C. The characterizations were carried out in liquid and solid state, using the techniques of Photoluminescence Spectroscopy, UV-Vis Absorption and Thermogravimetric Analysis. The UV-Vis Absorption tests showed similarities between the spectra, with absorption bands being observed between 250-400 nm and 500-700 nm. In the hydroalcoholic extract, bands near 650 nm characterize the presence of chlorophyll, which was also observed in the aqueous extract with less intensity. In the 250-400 nm region, a shoulder with two distinct variations was observed, related to the presence of flavonoids and phenolic compounds in the extracts, with greater intensity in the hydroalcoholic extract. Photoluminescence analysis showed results with high emission intensities between 580-600 nm and 350-400 nm for both extracts, characterizing the presence of aromatic compounds, flavonoids and chlorophyll. The TG curves showed that the plant powder has a more pronounced loss of mass from 300°C onwards. The compounds present in the extracts are rich in carbon, important structures for the production of CQDs. Based on the results obtained, the CQDs were synthesized using the microwave-assisted bottom-up method, which will later be used for photocatalysis.

Keywords: Green synthesis, nanomaterials, fluorescence.

References

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Acknowledgements

We would like to thank the Universidade do Estado do Rio Grande do Norte (UERN) and the Laboratório de Eletroquímica de Química Analítica (LEQA) for the essential support and assistance in carrying out this study.