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Title: Sustainable Tannin Gels as Metal and Dye Adsorbent for Enviro

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ABSTRACT (Space limited to 2200 characters)

Adsorption is defined by concentrating the adsorbate from a fluid phase onto the adsorbents' surface or adsorbents' pores. In regard to environmental applications, particularly the wastewater treatment, the adsorption process depicts a powerful tool in the recovery of critical metals and textile dyes. Commonly, activated carbons or activated alumina are employed.[1] However, their generation requires high process temperatures. Thus, natural biopolymers adsorbent materials have gained increased interest in wastewater treatment due to their low costs and low temperature processing as well as environmental and economic sustainability. Among others, tannins show great potential as biosorbents based on their ease of conversion into insoluble matrices, as well as their natural affinity to dyes and metals in wastewaters.[2] Tannin-based gel adsorbent materials are produced in a gelation process, whereby tannin is polymerized in a reaction with an aldehyde (mostly formaldehyde), yielding a crosslinked tannin network. However, in accordance to the biosorbents' sustainability, the usage of toxic formaldehyde should be avoided. Hence, alternative bio-friendly crosslinking agents have to be found in order to obtain a fully sustainable class of tannin-based biosorbents.
Within this work, we present the synthesis of different classes of monolithic tannin-based gels, synthesised using different crosslinkers as well as templating approaches, in order to evaluate their usage as biosorbent in wastewater treatment. Their ability to adsorb heavy and critical metal ions, such as cooper and different textile dyes, like methylene blue, is carefully investigated. Precisely, the adsorption capacity is determined as a function of the used tannin material, its surface modification (e.g. amino- or carboxyl modified tannin gels), the adsorbate as well as the pH value. Furthermore, the applicability in a flow-through adsorption process and the recyclability and thus its circular economic sustainability is evaluated.

References

1- Santos SCR, Bacelo HAM, Boaventura RAR, Botelho CMS (2019) Biotechnol. J. 14: 1900060
2- Bacelo HAM, Santos SCR, Botelho CMS (2016) Chem. Eng. J. 303: 575-587