
# XXII B-MRS Meeting 2024

September 29th to October 3rd

# PROCEEDINGS

*Sociedade Brasileira de Pesquisa em Materiais*

# Proceedings of the XXII B-MRS Meeting

Santos, SP 2024

**Conteúdo, revisão textual e gramatical:** Resposanbilidade dos respectivos autores.



ISBN: 978-85-63273-63-5

# Hydrogel beads formed from the sisal lignocellulosic fibers' deconstruction: applications in the purification of water polluted with heavy metals

Giani de Vargas Brião[1], Bianca Groner Queiroz[1], Luiz Antonio Ramos[1], Derval dos Santos Rosa[2], Elisabete Frollini[1]

[1]Instituto de Química de São Carlos - Universidade de São Paulo (*Departamento de Físico-Química*) , [2]Universidade Federal do ABC (*Centro de Engenharia, Modelagem e Ciências Sociais Aplicadas*)

*e-mail: giani@usp.br*

Hydrogels made from sisal biomass, which consists of cellulose, hemicelluloses, and lignin, were produced, and assessed for their ability to sorb toxic metals. The process of creating hydrogel beads from sisal fibers involved the following steps: (i) fibers deconstruction using bis(ethylenediamine)copper(II) hydroxide solution (CUEN, 1M); (ii) dropping the resulting gel in calcium chloride solution at 80ºC ($CaCl_2$-80 ) and 120ºC ($CaCl_2$-120); (iii) crosslinking with citric acid (CA) at 80ºC ($CaCl_2$-CA-80) and 120ºC ($CaCl_2$-CA-120). The beads were characterized by sorption capacity, scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR), and compressive properties. The beads' sorption capacity (q/mmol/g), total and for each metal, was obtained by putting them in contact with simulated wastewater containing several toxic metals for 24 h under agitation and analyzed via ion chromatography. The FTIR spectra of $CaCl_2$-CA-80 and $CaCl_2$-CA-120 indicated the esterification of the hydroxyl groups (band at 1724 $cm^{-1}$). CA crosslinked beads presented smoother surfaces than their counterparts, $CaCl_2$ crosslinked ones. The crosslinking process with CA was expected to increase Young’s modulus of the spheres. However, the reaction at 80°C barely affected the beads’ modulus, while the one at 120°C resulted in beads with a lower modulus than those not crosslinked. These findings suggest that CA caused partial hydrolysis of the bead components. On the contrary, CA crosslinking positively impacted the sorption capacity of Cu(II) and Cr(VI), while the sorption of Ni(II), Zn(II), Mn(II) and Cd(II) was not significantly affected. This is ongoing research, and the initial outcomes indicated a potential application of hydrogels derived from the sisal´s fibers deconstruction for removing heavy metals from wastewater.
Funding: FAPESP, #2023/07447-2.