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1H time domain NMR as a toll for probing distribution of metal ions adsorbed in modified sugar-cane bagasse bioadsorbents

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1H time domain nuclear magnetic resonance (1H TDNMR) was used to investigate the Cu+2 ions adsorbed in the pore structure of a bioadsorbent constituted of polycarboxylated units grafted in the cellulose surface of sugarcane bagasse (PSB). Carr-Purcell-Meiboom-Gill (CPMG) and Gradient-T2 (GT2) correlations experiments were applied to probe T2 relaxation and diffusion of water confined in the inner pores of the samples, providing information on the pore sizes and internal magnetic field gradients (IMFG) distributions within the pore structure. T2 distribution profiles from clean bio-adsorbents, i.e., no ion metal adsorbed, were similar to that of pristine sugarcane bagasse (SB), showing components associated to three pore categories. A direct comparison between the T2 distribution of confined water in clean and Cu(II) saturated bio-adsorbent revealed that the mean T2 value of all components were decreased by to the ion adsorption. CPMG experiments with varying echo times were conducted and processed as described by Hurlimann to estimate the IMFG distributions. (1) The results showed a distribution with three components, which change consistently with the metal ion adsorption, reducing the average values and changing the relative population (intensity) of each component. More specifically, the results suggested that adsorption occurs on the surface of all pores in the SB structure but is more effective in pores with dimension of few micrometers. Two-dimensional G-T2 experiments confirmed the correspondence between the changes in the IMFG and T2 distributions due to the Cu(II) adsortion. This study demonstrates the capacity of 1H TDNMR techniques to provide valuable insights on the metal adsorption by modified SB samples, highlighting its potential to help with the optimization of materials used in environmental remediation and pollutant adsorption processes.

Palavras-chave: 1H TD-NMR. Modified biomass. Metal adsorption.

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