Carbothermally Prepared Surface Deposited and Embedded Nanoscale Zero-Valent Iron Supported on Lignin Biochar for Cd (II) And Pb (II) Remediation

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Abstract

The remediation of Cd (II) and Pb (II) was investigated by comparing two nanocomposites, synthesized via two different carbothermal reduction routes, with lignin biochar (Lig-BC) acting as the control. The two nanocomposites formed were Lig-sG@nZVI and Lig-eG@nZVI. Lig-sG@nZVI was produced by depositing the nanoscale zero-valent iron (nZVI) onto the surface of Lig-BC, whereas Lig-eG@nZVI was formed by embedding the nZVI into the Lig-BC matrix itself. An evaluation of the effect of pH and contact time for both metals was carried out. The best-fitted model was the Sips isotherm for both Cd (II) and Pb (II). Maximum Sips capacities for Cd (II) and Pb (II) were reported as 6.7, 9.7, 8.1 mg g^{-1} and 24.8, 35.7, 52.4 mg g^{-1} for Lig-BC, Lig-eG@nZVI and Lig-sG@nZVI respectively for both metals. Regeneration studies were also carried out to explore the reproducibility of the materials. A greater remediation was observed with Lig-eG@nZVI for CD(II) and Lig- sG@nZVI for PB(II) respectively, and thereby it can be concluded that the remediation of heavy metals can vary with different types of materials. Compared to the control, both materials showed an enhanced performance, suggesting that nZVI composites are a promising solution for heavy metal remediation.

Keywords: *Biochar, Nanoscale zero-valent iron, Remediation, Heavy Metals*