Sorption of Metals from Mining Polluted Water Bodies and Reusability in Land Reclamation Using Hydrochar[1]

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Abstract: Anthropogenetic activities such as mining pose several threats to water bodies from metal and metalloids discharges such as copper, zinc, and cadmium. Hydrothermal carbonization (HTC) is a process that can be used to thermally convert agricultural feedstock biomass into a solid product called hydrochar that can sorb metals from mine polluted water bodies. The objective of this research aims to determine the applicability of hydrochar to remove target metals (Cu, Zn, and Cd), test its sorption kinetics and contact ratio, and its reusability in land reclamation with three hydrochar samples produced via HTC with the same reaction time of 30 minutes and different pyrolytic temperatures of 180 ℃, 220 ℃ and 260 ℃. A synthetic mine water solution was developed at pH 4 and pH 7 to test for the different experimental parameters. Hydrochar samples were tested for metal sorption rate with different masses of hydrochar in both the neutral and acidic synthetic mine water, in addition to the effect of reaction times. The sorption capacity of the 180 ℃ hydrochar sample showed a clear effect of sorbent mass to solution volume ratio in removal rate for pH 4 trials with effective removal seen with 5-10 g of hydrochar treating 35 mL of mine water. At pH 7, there was not a strong influence of increased mass of sorbent, suggesting that solubility and filtration had a greater influence on removal at the higher pH. The research results will seek to confirm the efficacy of hydrochar in water and land reclamation and the potential to close the loop on food-energy-water by diverting food and agricultural waste to water treatment and potentially back to the land for agriculture.

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