

Sorption of alachlor in soils amended with soybean stover, sugarcane bagasse, and wood chips derived biochars

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Biochar, the solid residual remaining after the thermochemical transformation of biomass for carbon sequestration, has been proposed to be used as a soil amendment, because of its agronomic benefits. This study evaluated the effect of amending soils of the three states Americans (Minnesota, silt loam; Illinois, silty clay loam; and Pennsylvania, silt loam) with soybean stover (490 °C), sugarcane bagasse (~500 °C), and wood chips (650 °C) derived biochars or same raw feedstocks on the sorption of alachlor. Soil was amended at 10% (w/w), and studies were performed in duplicate using the batch equilibration method. Solutions were prepared with CaCl₂ (0.01 M) in the concentration alachlor (1 mg L⁻¹). All solutions were spiked with the corresponding ¹⁴C radiolabeled herbicide to give solution radioactivity level of 400 Bq mL⁻¹. In plastic centrifuge tubes, 10 mL of alachlor solution was added to 5 g of soil. The tubes were shaken for 24 h, sufficient time for equilibration according to previous kinetics studies. Samples were centrifuged for 15 min at 1280 x g and the supernatants were collected. One mL aliquots of the supernatant solutions were combined with 5 mL scintillation cocktail (EcoLite(+)TM, MP Biomedicals, LLC, Solon, OH), vortexed, and analyzed for ¹⁴C by liquid scintillation counting using a Packard 1500 Tri-Carb counter (Packard Instruments, Downers Grover, IL). Sorption of alachlor increased between 2 and 50 times in all amended soils with biochar as compared to the unamended soil, where the wood chips biochar provided greater sorption in the soil from Pennsylvania. Based on the sorption coefficient (K_d) values, alachlor was considered between relatively low to intermediate sorbing herbicide to the three soils, with K_d ranging 0.22 ± 0.05 to 15.62 ± 0.41 L kg⁻¹. Therefore, the composition of the biochar in the soils amended can play an important role in the sorption of alachlor.

Palavras-chave: batch equilibration, feedstocks, neutral herbicide, retention.

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