Characterization of pesticide sorption properties of biochars and ditch soil to evaluate the efficiency of biochar amendment in ditches for water quality improvement

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Master Thesis

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2023-2024

IDIL – AWARE

WATER

Abstract: Improving the quality of agricultural runoff is a major challenge. The EauCharb'OC project tackles this issue and aims to evaluate the efficiency of targeted biochars amendments in agricultural ditches as a mitigation measure to lower pesticides loads. This master thesis focuses on the characterization of the pesticide sorption mechanisms on ditch soil and biochars. Indeed, sorption is the prime-order mechanisms contributing to pesticide retention during a flood event. Three pesticides having contrasted physico-chemical properties were selected namely napropamide, dimethomorph and metiram as well as the main metabolite of metiram; ethylene thiourea. Five biochars from locally sourced biomasses were tested. Kinetics batch studies were performed to characterize the impact of contact time on sorption. Equilibrium batch experiments were conducted to compare the pesticide sorption capacity of the ditch soil and of the biochars. The SPRI indicator parameterized with the batch results was used to evaluate the potential pesticides retention of the selected pesticide during a flood event in a ditch. Results of our study shows that the adsorption coefficients are higher on biochars than on the ditch soil for all molecules. The two hydrophobic molecules (napropamide and dimethomorphe) are adsorbing more than the two hydrophilic ones (metiram and ethylene thiourea). Time influence adsorption and adsorption equilibrium is globally reached later on biochars than on soil. Moreover time needed to reach equilibrium are much higher than the average hydraulic retention during a flood event. Desorption from ditch soil is moderately hysteretic while it is greatly hysteretic for biochars. Time doesn't seem to be a factor influencing desorption. SPRI indicator gives us an idea on the effectiveness of our biochars in a ditch flood context.