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Application of optimized oil palm empty fruit bunches biochar for removal of herbicide residues from agricultural soils

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Excessive application of agro-chemicals is considered as a major factor behind undesired environmental problems. Imidazolinones are a family of herbicides that show high biological activity. Their high leaching potential and persistence make them probable risks to ecosystems. Currently, a mixture of two members (imazapic and imazapyr) of this family is used in agricultural fields. Stabilization of pesticides using biochar, a carbon-rich bio-sorbent, is an efficient strategy to protect environment against pesticides contaminations. In the present study, attempts have been made to evaluate effects of optimized biochar produced from oil palm empty fruit bunches (EFB) on behavior of imazapic and imazapyr herbicides in soil. Pyrolysis variables were optimized using response surface methodology (RSM) technique to maximize biochar sorption efficiency. Effects of the optimized biochar as soil modifier were then evaluated on the herbicides leaching. The herbicides photo- and micro- degradations in the amended soil were also studied during 70 days. Temperature of 300°C, heating rate of 3°C/min, and time of one hour resulted in optimum condition to maximize biochar sorption capacity. Amendment of soil with the optimized biochar significantly increased its sorption capacity and decreased sorption reversibility. Leaching potential of the soil reduced considerably in presence of the biochar and amounts of the retained herbicides increased in soil. Degradation experiments showed that presence of the biochar in soil can reduce herbicides photo-degradations rate significantly. Unlike photolysis, micro-degradation of herbicides generally increased with the biochar application. As conclusion, optimized EFB biochar have the potential to protect environment against risks posed by the herbicides.

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