

Contrasting effects of biochar (freshly added or aged) on the adsorption of two herbicides in soil

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There is a growing trend of biochar application for soil properties improvement. In general, biochars have big surface area and are capable of stabilizing organic chemicals such as pesticides in soil, alter water retention and increase soil pH and cation exchange capacity. However, the ageing process can change properties of the biochar surface and, consequently, its efficacy in herbicide adsorption. The commercially produced biochar (Skogens kol), which was made from a mixture of hardwood and softwood by slow pyrolysis at a temperature of about 380-430 $^{\circ}\text{C}$, was used for the experiment. Two soils with different texture (sandy and clayey), both sampled in Sweden (Uppsala and Länna), were studied. Soils were amended with a range of biochar concentrations (from 1 to 30% per g soil dry weight). The adsorption of two herbicides (diuron and glyphosate) was tested and compared to the adsorption in unamended soils. A biochar ageing experiment was conducted in the laboratory with four sandy soil-biochar mixtures; the adsorption of herbicides was measured also for these aged samples. Soil pH increased with biochar addition and further with ageing of the biochar. Diuron adsorption was positively related to the percentage of biochar added in both soils, while glyphosate adsorption was negatively influenced by biochar addition in sandy, but not in clayey soil. Ageing of soil-biochar mixtures reduced the adsorption of both herbicides, which can be explained by the soil pH increase or potentially changes occurring at the biochar surface such as competitive adsorption of organic matter. The ageing effect on biochar properties should be studied further.