Long-term effects assessment of biochar to remediate heavy-metals contaminated soils,

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LONG-TERM EFFECTS ASSESSMENT OF BIOCHAR

TO REMEDIATE HEAVY-METALS CONTAMINATED SOILS

Frédéric REES[1], Jean-Louis MOREL[1], Marie-Odile SIMONNOT[2]

[1]*Université de Lorraine/INRA, Laboratoire Sols et Environnement, 54500 Vandœuvre-lès-Nancy, France*
[2]*CNRS, Laboratoire Réactions et Génie des Procédés, 54000 Nancy, France*

Biochar, the residual solid of biomass pyrolysis, has recently drained considerable attention as a potential carbon sequestration agent in soils due to its high recalcitrance to biodegradation as long as a low-cost soil quality improver to increase plant growth [1]. Recent studies suggest also biochar ability to immobilize heavy metals in soils and thus to reduce the toxic impact of these elements [2–4]. However, the sorption mechanisms and reversibility degree of biochar effects for the remediation of contaminated soils are still unclear and must be addressed to evaluate potential risks of biochar use in these soils[5].

In a first attempt to evaluate biochar capacity to immobilize metals in solution, we set up batch sorption studies of cationic trace elements (Cu, Cd, Ni, Zn, Pb) on an alkaline biochar produced at about 450°C from conifers and deciduous wood. Kinetics results show that sorption speed is low and particles-size dependent, which may be attributed to limiting diffusion of metal inside biochar particles. Adsorption/desorption experiments with initial metal concentration of 10-500 µmol/L reveal different sorption trends depending on the elements: Freundlich-type isotherms of Cd and Zn are identical while Cu and Pb show a much higher affinity for biochar and Ni the lowest of all five elements. On the other hand, hysteresis with desorption isotherms reveal a marked sorption irreversibility especially for Cu and Pb. However, the sorption dynamics of heavy-metals on biochar remains complex and several environmental parameters have to be taken into account, *e.g.* the influence of pH variations of the system in order to mimic possible long-term acidification of contaminated soils amended with biochar.

In a second time, we will discuss the results of continuous solution analysis in column experiments with biochar alone and biochar-amended contaminated soils leached with different extracting solutions to describe the actual sorption dynamics on biochar of heavy-metals originating from historical atmospheric pollution by smelters in order to assess biochar potential for long-term remediation of contaminated sites.

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