Ecotoxicity of biochars from organic wastes focusing on their use as soil ameliorant

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Biochars are produced from organic materials by pyrolysis and are used as soil amendment. According to the feedstock type and the conditions of pyrolysis the properties of the biochars can differ widely. If we apply biochars derived from organic waste materials as soil ameliorant it is important to assess the hazards and the risks of their application.
In this study we assessed the physical, chemical, biological and ecotoxicological properties of 20 biochars from various producers. Our aim was to assess their applicability as soil amendment prior to microcosm and field trials and to choose the best biochars able to improve the quality of degraded soils. The biochars were produced in a PYREG® type pyrolyser at temperatures between 450 and 700 °C during 15-20 min residence time. The feedstocks were grain husks, paper fiber sludge, digestate, wood screnningss, miscanthus, vine, black cherry, natural biomass, straw, hazelnut shells, olive stones and meadow. Some biochars were post-treated with compost, organic liquid or stone powder. To assess the potential benefits and risks of their application to soil we measured their water holding capacity, pH, EC, metal content, microbial activity and toxicity for bacteria (*Aliivibrio fischeri*), plants (*Sinapis alba* and *Triticum aestivum*) and animals (*Folsomia candida*). The collected data will be introduced into the "Terra Preta" Biochar Database, which is an on-line resource for biochar properties and case studies on biochar utilisation for soil improvement.
The biochars from mixed organic wastes with minerals and the biochar made from vine had elevated toxic metal content that indicates the potential risks of their application. However, these biochars were the richest in potassium. The biochars from straw and natural biomass were toxic both for plants and animals. The grain husk biochars with fiber sludge, the black cherry biochar and the biochar from wood screenings seemed to be the most promising soil ameliorants as they ensured favourable conditions for plants, bacteria and soil living animals.

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Suggested topic: Theme 2. Soil, groundwater and sediment in the biobased, circular economy