Geophysical Research Abstracts
Vol. 17, EGU2015-512, 2015
EGU General Assembly 2015

Characteristics of and sorption to biochars derived from waste material

Huichao Sun, Melanie Kah, Gabriel Sigmund, and Thilo Hofmann
Department of Environmental Geosciences, University of Vienna, Vienna, Austria (huichao.sun@univie.ac.at)

Biochars can exhibit a high sorption potential towards heavy metals and organic contaminants in various environmental matrices (e.g., water, soil). They have therefore been proposed for environmental remediation purposes to sequester contaminants. To date, most studies have focused on the physicochemical and sorption properties of mineral phases poor biochars, which are typically produced from plant residues. Only little knowledge is available for biochars derived from human and animal waste material, which are typically characterized by high mineral contents (e.g., sewage sludge, manure). Using human and animal waste as source material to produce biochars would support the development of attractive combined strategies for waste management and remediation. The potential impact of mineral phases on the physicochemical and sorption properties of biochars requires further studies so that the potential as sorbent material can be evaluated.

With this purpose, different source material biochars were produced at 200°C, 350°C and 500°C, to yield a series of biochars representing a range of mineral content. The derived biochars from wood shavings (<1% ash), sewage sludge (50-70% ash) and pig manure (30-60% ash), as well as a commercial biochar derived from grain husks (40% ash), were extensively characterized (e.g., element composition, surface area, porosity, Fourier transform infrared spectroscopy). The contents of potentially toxic elements (i.e. heavy metals and polycyclic aromatic hydrocarbons) of all materials were within the guidelines values proposed by the International Biochar Initiative, indicating their suitability for environmental application.

Single point sorption coefficients for the model sorbate pyrene were measured to investigate the effect of mineral content, feedstock, pyrolysis temperature, particle size fractions and acid demineralization on sorption behavior. Overall, sorption of pyrene was strong for all materials ($4 < \text{Log Kd} < 6.5$ L/kg). Sorption generally increased with increasing pyrolysis temperature but there was no effect of particle size on sorption affinity. For mineral phase rich biochars, sorption generally increased after acid demineralization.

When considering all materials together, the sorbent aromaticity (hydrogen-carbon ratio) was the most important factor controlling sorption of pyrene. Overall, the study demonstrates that biochars derived from human and animal waste material and exhibiting high mineral contents have potential for remediation applications.