DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

Biochar (charcoal-like product) is a carbon-rich material obtained by pyrolysis, i.e. thermal degradation carried out in the temperature range from 300^{o}C to 700^{o}C under conditions of limited oxygen access or under anaerobic conditions, of biomass and more recently waste. This material can be used for soil fertilization, rehabilitation or remediation. Biochars may however contain hazardous contaminants which call into question their common use. These contaminants immediately after the production process are strongly bound to biochar. However, biochar after application to soil is exposed to action of a range of environmental factors (variable temperature, humidity, oxygen access) and to microbial activity. They can lead to changes in its structure, which are usually termed as aging. This can result in the release of contaminants primarily strongly bound to biochar, thus not bioavailable for organisms. When released to soil, these contaminants may, on the one hand, be taken up by plants, which in effect may lead to contamination of animal feed. On the other hand, they may be leached from the soils leading to contamination of aquatic ecosystems. This issue is particularly important in the case of biochar derived from waste materials (e.g. sewage sludge) that contain a range of various contaminants.
The main aim of research will be to determine the toxicity and persistence and intensity of biochar-contaminant interactions as affected by simulated biochar aging processes. Aging (chemical, physical, biological and enzymatic) will undergo biochars made from willow and sewage sludges. Polycyclic aromatic hydrocarbons (PAHs) and polybrominated diphenyl ethers (PBDEs) and heavy metals were selected for testing. Previous studies show that heavy metals come from the material that was used for biochar production, whereas PAHs are formed additionally during pyrolysis. Therefore, even biochars obtained from materials not containing PAHs, like for example plant biomass, will be contaminated by these compounds. In turn, research on the content of polybrominated compounds in biochar has not been undertaken yet. PBDEs are added to many plastics to reduce their flammability. They exhibit toxicity similar to that of other organic halogen compounds such as, e.g., polychlorinated biphenyls. Atmospheric deposition is considered to be one of the main sources of environmental pollution, whereas in the case of sewage sludge it is wastewater from plants producing PBDE technical mixtures as well as from plastics and textile plants. Therefore, their presence in particular in sewage sludges (as well as the presence of PAHs) is inevitable. Pyrolysis of PBDEs showed that they can be a source of polybrominated dibenzodioxins and dibenzofurans, whose toxicity is comparable to that of their chlorine analogs. For this reason, the changes that occur during aging of biochars made from sewage sludges should be given special attention. In this project, changes in the biochar structure during aging will be confronted with changes in the content of these compounds and the results of ecotoxicological tests to determine the risk for various groups of organisms associated with the presence of these compounds in biochars, particularly when their availability increases as a result of aging of these materials, especially in the case of the increase of their availability due to aging of these materials. The effect of biochar aging on its efficiency in immobilization of organic (PAHs) and inorganic (heavy metals) contaminants and the effectiveness of reducing the toxicity of soils contaminated with these compounds will be also determined. Results obtained under this project will expand the current knowledge on long-term environmental consequences associated with biochar application.