

DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

In recent years, there has been considerable interest in the use of biochar in agriculture. This is due to the fact that biochar added to soils improves soil fertility, yield and water retention in soil, and stimulates the growth of soil bacteria. Biochar use in agriculture is, however, to some extent limited due to the content of polycyclic aromatic hydrocarbons (PAHs) in the biochar. These compounds are toxic, carcinogenic and mutagenic. PAHs are formed in the biochar during its pyrolysis, and their content is determined by the applied conditions for the pyrolysis process as well as the feedstock used during pyrolysis. However, it is assumed that PAHs contained in biochar do not pose a threat due to their strong binding to biochar. However, during the pyrolysis process itself, but also under the influence of environmental factors (when biochar is added to soils) oxygen, nitrogen and sulfur derivatives of PAHs (O/N/S-PAHs) may be formed. They are characterized by greater solubility in water, mobility and assimilation by soil organisms and plants, but also toxicity, than PAHs. There is no information in the literature on the formation, fate and bioavailability of PAH derivatives in soils fertilized with biochar. The influence of PAH derivatives on the properties and quality of plant raw materials used in food production is particularly important in this respect.

Currently, there is no data on bioavailability or fate of O/N/S-PAHs in biochars, and especially in the context of different conditions for pyrolysis and applications for soils. It should be explained to what extent PAH derivatives are associated with biochar and whether they pose a real threat to the environment and human health in the conditions of agricultural use of biochar. The main objective of the project will therefore be to determine the transformations of PAHs and PAH derivatives in soils fertilized with biochars, their susceptibility to accumulation as well as the quality of plant materials grown on biochar-amended soils. This information is of great importance from the point of view of the quality of raw materials used in food production. These studies will be another important step, not only in understanding the environmental processes taking place during the agricultural use of biochar, but also providing more information on the fate of biochar during its use. Specific objectives include the following:

The specific objectives will cover the following issues (Work Packages):

1. Understanding of the effect of biochar aging on the bioavailability and ecotoxicity of O/N/S-PAHs and the formation of O/N/S-PAHs from parent PAHs and accumulation of O/N/S-PAHs in plants (WP1).
2. Understanding of the effect of environmental conditions on O/N/S-PAHs formation from parent PAHs regarding biochar properties (pyrolysis temperature, feedstock) (WP2).
3. Understanding of the effect of O/N/S-PAHs in fresh and aged biochars on the quality of plants grown on biochar amended soil in pot experiment (WP3) and field study (WP4).

The growing popularity of biochar available on the market, and sold as an “organic fertilizer” in the context of the formation of toxic compounds makes the undertaking of such research is extremely important. The answer to the questions asked in the project will allow you to verify the safety of using these materials, not only in the agricultural aspect (as a fertilizer), but above all, allow to indicate how much the use of biochar to soils affects the safety of human health (quality of raw materials used in food production).