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Modification of biochar for functionality improvement in soils

Kor Zwart (1), Peter Kuikman (1), Anrew Ross (2), Chibi Takaya (2), Surjit Singh (2), Pelin Kocaturk (1), and Rian Visser (3)

(1) Alterra, Wageningen UR, Netherlands , (2) Faculty of Engineering, University of Leeds, UK, (3) ECN, Petten, Netherlands

Application of biochar to soils is generally considered and practiced in order to improve specific soil functions such as CEC, moisture and nutrient retention and providing additional habitat for micro-organisms. Improvement of these soil functions should lead to a higher crop yield. This would be added value to the long term sequestration of carbon in soils and contribution to renewable energy from producing and using biochar. The concept of using biochar for soil amendment is predicated on biochar behaving in a similar manner as soil organic matter (SOM) does. However, if one critically compares the properties of biochar with the properties of SOM, it is evident that biochar is rather different from SOM [Zwart, 2013 ;Zwart & Kuikman, 2013].
We have has produced a range of biochar from different feedstock using pyrolysis, gasification and hydrothermal carbonisation resulting in chars with significantly different properties. The project also investigates and tested several possibilities for improving the functionality of biochar in soils by either(i) selection of feedstock, (ii), selection of processing conditions and (iii) chemical and physical modification of biochar during and after the production process.
Post modification includes the chemical treatment of biochars with either H_2O_2, KOH, H2SO4 and transitional metals such as Fe and investigates their effect on surface functionality, porosity, surface area, CEC and phosphate sorption. The influence of the addition of chemical modifiers and oxidants during pyrolysis and gasification has also been investigated and their effect on surface functionality determined using similar techniques. The influence of the original biomass structure on the morphology of the resultant biochars has been investigated using scanning electron microscopy.