Geophysical Research Abstracts
Vol. 16, EGU2014-4778, 2014
EGU General Assembly 2014

Quantification of Biochar's 'Stable' Carbon on Centennial Timescales

Anna McBeath and Michael Bird

Centre for Tropical Environmental and Sustainability Science, School of Earth and Environmental Sciences James Cook University, Cairns, Australia

A basic requirement for any biochar offset methodology is for the carbon in biochar to be stable and remain sequestered on centennial timescales. It is well known that a variable component of most biochar is labile (degradable on annual/decadal timescales) and hence only a proportion of total carbon in biochar provides long-term carbon sequestration. This stable fraction of biochar is in the form of polycyclic aromatic carbon (PAC) but small ring size compounds (<7 rings) are known to be degradable and hence are not 'stable' for the purposes of carbon sequestration (Kanaly and Harayama, 2000). While other techniques identify PAC within the total amount of aromatic carbon (e.g. NMR, IR spectroscopy), only hydrogen pyrolysis (hypy) directly quantifies 'stable' PAC with a ring cluster size greater than 7 (Ascough et al., 2009; Ascough et al., 2010), which is very likely to be stable in the environment on at least centennial timescales. Hence, hypy is uniquely positioned as a technique with which to directly quantify 'stable' biochar carbon for use of biochar as a carbon offset.

We have recently produced biochar thermosequences from 18 commonly used feedstock types used in Australia at 10 pyrolysis temperatures ranging from 300-900°C, under controlled laboratory conditions. The novel hypy method was used to directly determine the size of the 'stable' PAC pool in each biochar in order to better define the relationships between feedstock, pyrolysis temperature and the amount of carbon within each type of biochar that is likely to contribute to long-term carbon sequestration. Moreover, this has led to the development of prediction models that relate common feedstock types and pyrolysis conditions to the 'stable' PAC content in biochar. It is hoped that the development of this simple methodology will enable land managers to rapidly and simply determine the carbon offset potential of prospective biochar products.

References

Ascough P.L., Bird M.I., Brock F., Higham T.F.G., Meredith W., Snape C.E., Vane C.H. (2009) Hydropyrolysis as a new tool for radiocarbon pre-treatment and the quantification of black carbon. Quaternary Geochronology 4:140-147.

Ascough P.L., Bird M.I., Meredith W., Wood R.E., Snape C.E., Brock F., Higham T.F.G., Large D.J., Apperley D.C. (2010) Hydropyrolysis: Implications for radiocarbon pretreatment and characterization of Black Carbon. Radiocarbon 52:1336-1350.

Kanaly R.A., Harayama S. (2000) Biodegradation of high-molecular-weight polycyclic aromatic hydrocarbons by bacteria. J Bacteriol 182:2059-2067.