REACTIVITY OF BIOCHAR
OBTAINED BY PYROLYSIS OF WASTELAND BIOMASS

Available POST-DOC position at CNRS Nancy
18 months, from October 2014

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LORVER is a project supported by Lorraine Region and European Union (FEDER) whose purpose is creating a production sector of non-food plant biomass grown on industrial wastelands (www.lorver.org). Depending on the soil, the produced biomass may contain heavy metals (Cd, Zn, Ni…). The combustion of this type of biomass produces ashes that cannot be used for agricultural amendment (Chalot et al., 2012). LORVER project aims to pyrolyse the biomass to produce syngas and biochar. A pilot plant unit (50 kg/h), based on an original pyrogasification process, has been built in 2013 by Sea Marconi company on their site of Homécourt (one hour from Nancy).

The goal of this post-doc position is to study the biochar reactivity in view of their use and end-of-life.

The produced bio-char will contain the main part of the heavy metals of the biomass (Al Chami et al., 2014). Besides the biochar use for contaminated soil amendment that is studied in LORVER project (Rees et al., 2014), other original uses are feasible and should be studied carefully. Indeed, the heavy metals finely distributed in the carbon matrix may give some special surface reactivity to biochar for catalytic reactions.

Whatever the use of biochar, their end-of-life should be treated carefully. Dufour (2013) proposed the geological sequestration of biomass char in former coal mines. In the case of LORVER biochar, this would induce a carbon sink, but also a heavy metals sink. To validate this concept from the scientific point of view, it is necessary to simulate experimentally the stability of biochar on century timescale. This stability is linked to the biochar surface reactivity towards the molecules that are in the mines and to the lixiviation of heavy metals by water. Their reactivity will be compared with the ones of coals and neat biochars.

Analytical technics will be: CHNS, ICP-MS, SEM-EDX, TEM-EDX, spectroscopic methods (XRD, XPS, Raman, etc.), nitrogen sorption, TPO, calorimetry, catalytic fixed bed, lixiviation setup, etc.

Requirements

Minimum studies: PhD in solid-state chemistry or catalysis. Excellent written and oral communication skills in English (B2 or C1 level). Knowledge of French (B1 level).
Desired requirements: Autonomy in research, ability to work in team, passion for research, will and ability to communicate scientific results, interest for environmental applications
Contract type: Postdoctoral researcher
Salary: 2500 € / month (before tax)

References

Al Chami, Z., Amer, N., Smets, K., Yperman, J., Carleer, R., Dumontet, S., Vangronsveld, J. Evaluation of Flash and Slow Pyrolysis Applied on Heavy Metal Contaminated Sorghum Bicolor Shoots Resulting from Phytoremediation. Biomass and Bioenergy (2014), 63, 268.

Chalot M., Blaudez D., Rogaume Y., Provent A.-S., Pascual C., Fate of Trace Elements during the Combustion of Phytoremediation Wood, Environmental Science & Technology (2012), 46, 13361−13369

Dufour A., Geological sequestration of biomass char to mitigate climate change, Environmental Science & Technology (2013), 47 (18), 10106-10107

Rees F., Simonnot M. O., Morel J. L., Short-term effects of biochar on soil heavy metal mobility are controlled by intra-particle diffusion and soil pH increase, European Journal of Soil Science, (2014), 65, 149–161