

## SORPTION OF HEAVY METALS ON MODIFIED BIOCHARS

**Reinhart Van Poucke, E. Meers, F. Tack**

*Department of Applied Analytical and Physical Chemistry, Ghent*

*[Reinhart.vanpoucke@ugent.be](mailto:Reinhart.vanpoucke@ugent.be)*

**Keywords:** Biochar; remediation; modifications

### Introduction

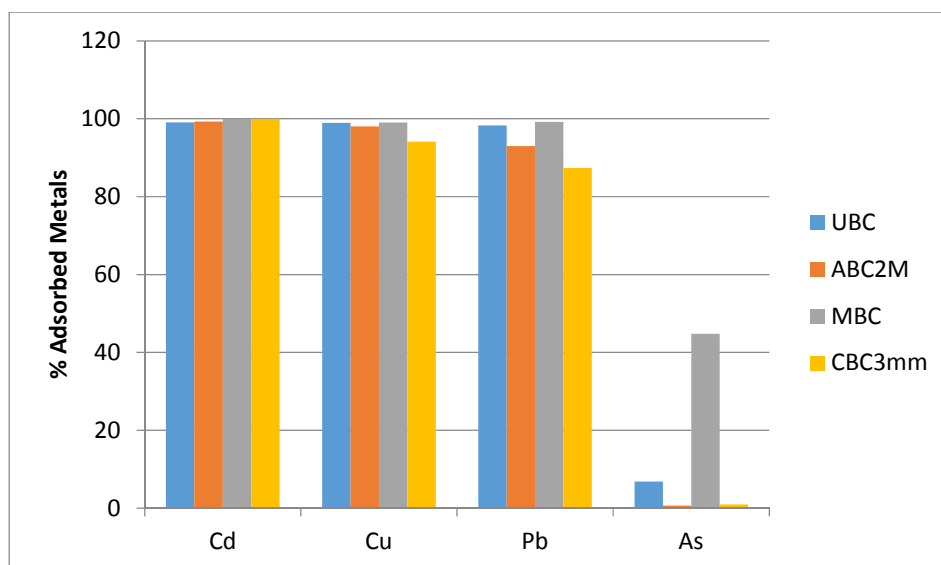
In the Campine region in Flanders, one hundred years of non-ferric metal smelting activities caused Cadmium and Zinc concentrations to reach problematic levels. Crops, especially species such as *Spinacia oleracea*, grown in this region will exceed the European food and feed standards. Heavy metal contamination poses serious problems to ecosystems and human health. Exposure to Cd causes toxicological effects to the kidneys, liver, lungs, immune and reproductive systems. This element is also listed as human carcinogenic by the International Agency for Research on Cancer.

### Methods

Biochar derived from holm oak, pyrolysed at 650°C was studied to immobilize the heavy metals. Modifications with KOH, chitosan and potassium permanganate were compared with the untreated biochar. First, shaking tests were conducted to evaluate the effect of the modifications on the sorption of solutions spiked with 20 mg/L Cd, As, Zn and Pb. Secondly, the immobilization capacity of the biochars on soil extracts was investigated.

### Results

In figure 1 the percentage is plotted for the adsorbed metals (removal efficiency) from 20 mg/L-spiked-water solution. This was repeated for all metals. The following code was used to indicate the different kinds of biochar used: UBC: untreated biochar, ABC2M: KOH 2M treated biochar, MBC: MnO treated biochar and CBC3mm: chitosan modified biochar with 3 mm particle size.



**Figure 1.** Removal efficiency (%) for different elements for different biochars

## Conclusion

Results show that the all biochars (even the not-modified char) removed more than 92% of the Cd, Zn and Pb, except the chitosan modified biochar removed 87% of the Pb. The biochars had less affinity with As. Only the  $\text{KMnO}_4$  modified biochar managed to remove 45%, which is five times more than the other biochars. Furthermore, it was observed that particle size of the biochar has important repercussions on the sorption characteristics. The removal can increase 40% when material of smaller particle size is used.