PASSIVATION OF CONTAMINATED BIOCHARS BY TAR CONVERSION OVER THEIR SURFACE

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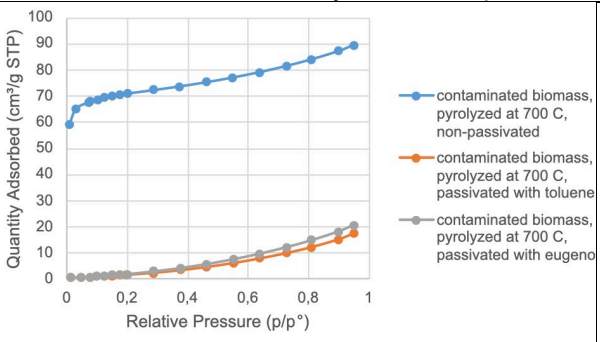
Converting biomass harvested from a contaminated land into unreactive biochar which could be then safely stored underground while still maintaining its intrinsic CO_2-sequestering properties is a concept that might result in both improved soil quality and reduced levels of greenhouse gases emitted to the atmosphere.

Passivation of contaminated biochars by tar conversion over their surface was attempted. The examined biochars were prepared from birch wood pellets at three different temperatures (500ºC, 700ºC, 900ºC), in order to determine the influence of temperature on heavy metal retention in the carbonic matrix. Moreover, a portion of the biochar produced at 700ºC was then submitted to further activation by steam gasification. Conversion of two model tars (toluene, eugenol) was analysed and additionally tests with in-situ generated tar, derived from beech wood chips pyrolysis, were performed.
The amount of the converted tar as well as the conversion products were characterised by means of GC-FID. To confirm the passivation and assess its efficiency, morphology and surface area of the pores were examined by fitting dual 2D-NLDFT model to the N_2 and CO_2 adsorption isotherms (*Figure 1*). To evaluate the passivation effect, SEM-EDS and ICP analyses of both pristine and passivated biochars were performed (*Table 1*).



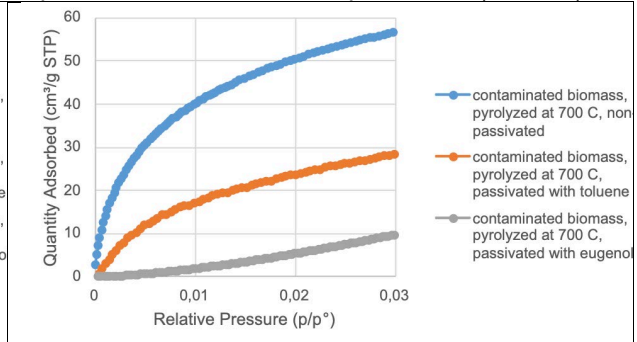


Figure 1 – Adsorption isotherms for pristine and passivated biochars: N_2 measured at 77 K (left), CO_2 measured at 273 K (right)

Biochar sample	Pb [wt.%]	Zn [wt.%]
clean biomass, pyrolyzed at 700ºC, non-passivated	0.02	0.08
contaminated biomass, pyrolyzed at 700ºC, non-passivated	0.13	0.30
contaminated biomass, pyrolyzed at 700ºC, passivated with toluene	0.07	0.05

Table 1 – SEM-EDS analysis results

Both N_2 and CO_2 adsorption isotherms for passivated biochars are significantly lower than in case of pristine biochar, which corresponds to the decay of micro- and mesopores during the passivation process. In case of samples passivated with eugenol the decline is observed even at the ultramicropores level (*Figure 1*).

The SEM-EDS analysis (*Table 1*) confirmed that the contamination on the surface of passivated biochar was lower than for non-passivated sample, however still greater than the respective values found for non-passivated biochar derived from clean biomass.

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