Characterization and assessment of PAH content in spent char to be used for soil amendment and carbon sequestration

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Char and the solid by-product of biomass gasification, which is rich in recalcitrant carbon and has a good carbon sequestration potential if amended in soil as gasification biochar (GB). This may benefit the overall carbon balance of the process while improving soil quality [1-3]. At the same time, previous studies have shown the eligibility of GB as a substrate for producer gas upgrading through tar conversion [4,5]. This application would benefit the economy and the environmental impact of gasification. In this work, the properties of fresh GB (as received) and spent GB (used in gas treatment tests) have been investigated to establish if the material may still be suitable for soil application after being used for the treatment of tar-rich producer gas.

**Result highlights**

**Elemental Composition (CHNS)**

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Gasification char has promising characteristics for gas treatment and soil application for carbon sequestration purposes. When fresh GB is used for producer gas treatment at 800 °C for 2 hours, the following effects are observed:

- Carbon content increases
- DFT pore volume decreases
- BET specific surface area decreases
- PAHs contamination decreases
- Specific surface area and porosity were found to decrease during gas treatment; nonetheless spent chars maintained acceptable surface properties. In addition, the PAHs contamination assessment suggests that gas treatment application of GB may make it safer for soil application and carbon sequestration.

**Conclusion**

Gasification char has promising characteristics for gas treatment and soil application for carbon sequestration purposes. When fresh GB is used for producer gas treatment at 800 °C for 2 hours, the following effects are observed:

- PAHs contamination decreases
- BET specific surface area decreases
- DFT pore volume decreases
- Carbon content increases

Specific surface area and porosity were found to decrease during gas treatment; nonetheless spent chars maintained acceptable surface properties. In addition, the PAHs contamination was found to decrease below the limit for premium grade biochar [8]. The carbon recalcitrance is expected to be higher for spent chars, as they contain soil black carbon derived from vapor phase tar. This form of carbon is considered as particularly stable [7]. The PAHs contamination assessment suggests that gas treatment application of GB may make it safer for soil application and carbon sequestration.