Addition of fine biochar particles to coarse sandy soil to improve hydraulic properties

Esben Wilson Bruun[1**], Giulia Ravenni[2*], Dorette Müller-Stöver[1] , Carsten Tilbæk Petersen[1]

[1]*Department of Plant and Environmental Sciences, Copenhagen University, Denmark*
[2]*Department of Chemical and Biochemical Engineering, Technical University of Denmark, Denmark*
**ewb@plen.ku.dk *grav@kt.dtu.dk

DTU Chemical and Biochemical Engineering

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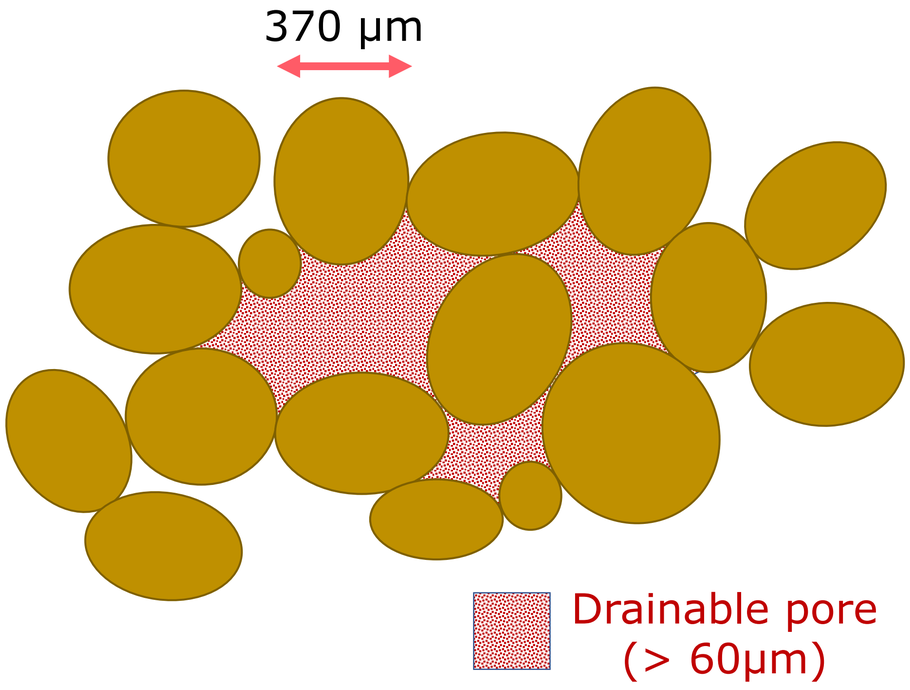


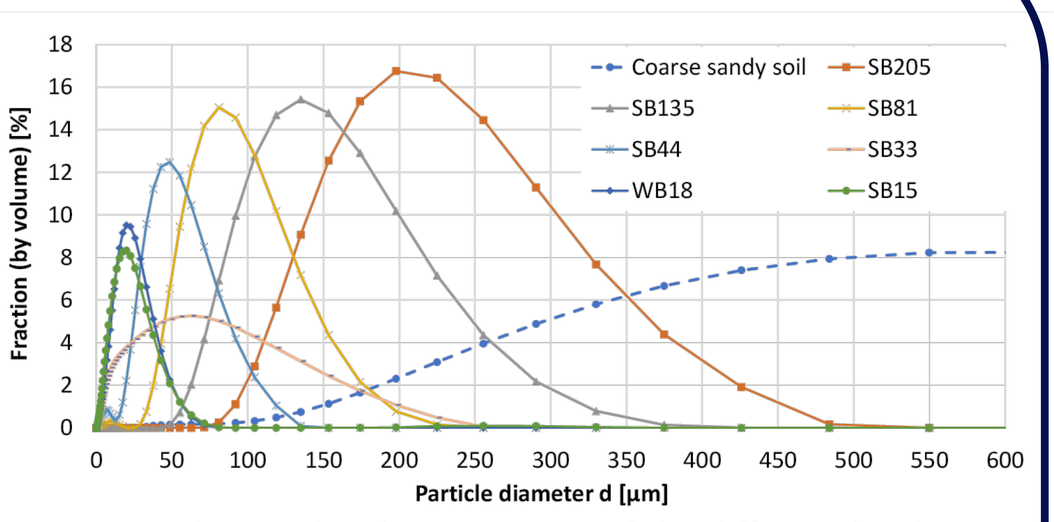
Coarse sandy subsoils make up 24% of Danish soils, and are problematic because of their large void volume fraction, leading to:

- ❖ Low water retention capacity
- ❖ High risk of nutrient leaching
- ❖ Low effective root depth (40-60cm)
- ❖ Reduced crop yield potentials

Can biochar particles fill large soil pores and improve the hydraulic properties of coarse sandy soils?

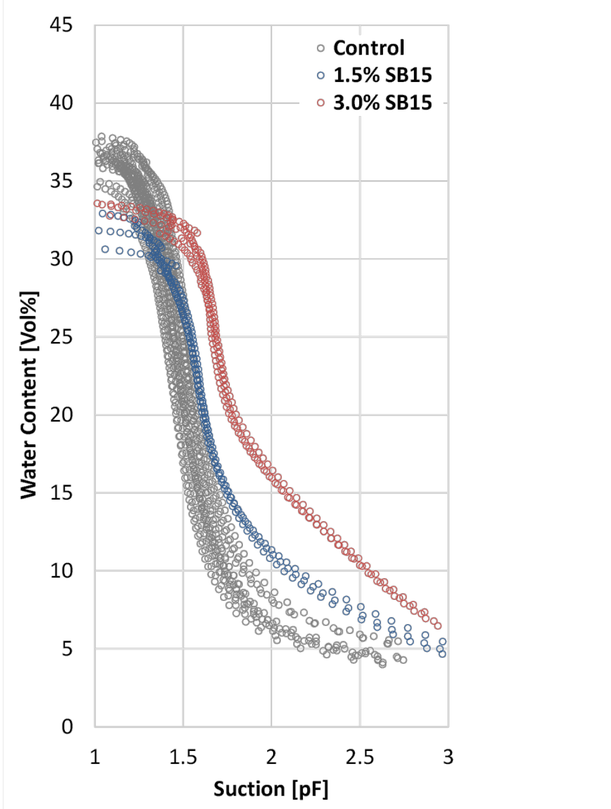
Experimental

- ❖ Straw and wood pellets (1.5 kg/h) were pyrolyzed in an electrically heated screw pyrolyzer
- ❖ Pyrolysis ran at 600 °C, with 30 min residence time
- ❖ The obtained biochar was ground and sieved to obtain different particle size fractions
- ❖ Different fractions were mixed with coarse sandy soils at rates of 1.5% and 3.0%
- ❖ Hydraulic properties of the soil-biochar mixtures were assessed

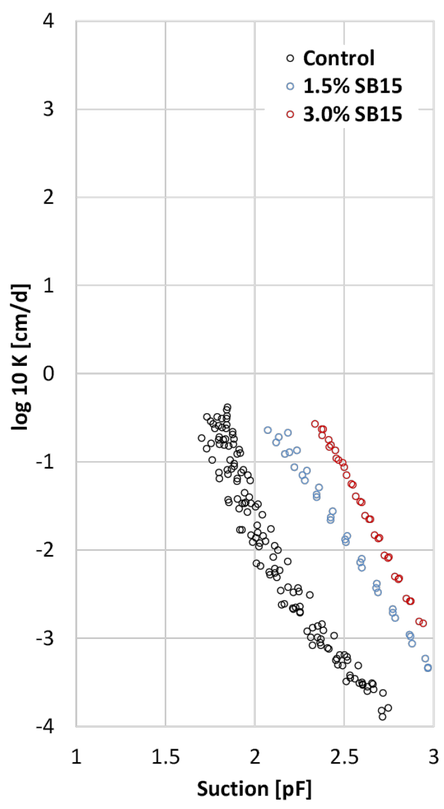


Particle size distribution curves of the different biochars used in the experiments and of the coarse sandy soil

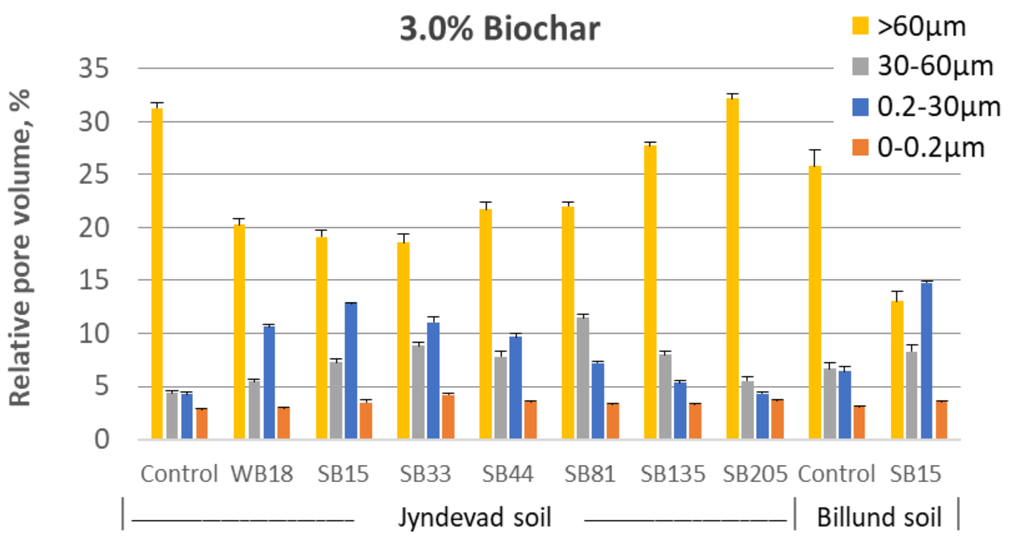
Results



Soil water retention as a function of suction, with different dosages of the smallest straw biochar particles (15 µm median particle size)



Unsaturated hydraulic conductivity as a function of suction



Relative volume (vol%) of soil pores with different equivalent diameters, after amendment with biochar in different particle size

Fine biochar particles applied to coarse sandy soil caused:

- ❖ Decrease in the fractional volume of drainable pores (>60µm) by up to -13.5%
- ❖ Up to two-fold increase in water retention at suction pF 1.7 (field capacity), accompanied by a significant increase in unsaturated hydraulic conductivity

The greatest effects were observed at the highest biochar application rate (3%) and with the finest particles (≤ 44 µm)