# *Biochar Infiltration Columns for Removal of Antibiotic-Resistant Bacteria in Stormwater*

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## BACKGROUND:

- Antibiotic resistance is "one of the biggest threats to global health, food security, and development today."[2]
- Biochar is an inexpensive adsorbent, and its removal capacity is variable.

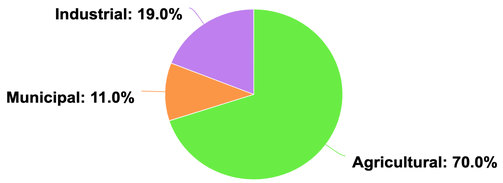


Figure 1: Global fresh water withrawals[1]

## METHODS:

- Stormwater is collected from the OSU-Benton County Green Stormwater Infrastructure Research Facility (OGSIR). It is filtered through 45$\mu m$ pore filters to remove sediment. It is spiked with *Escherichia coli* to achieve a concentration of 5 logs of *E. coli* in 100mL of stormwater, and the bacteria is given time to acclimate to the synthetic stormwater.

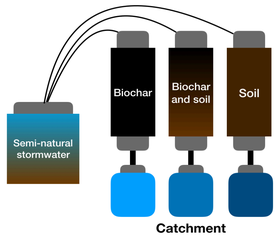


Figure 2: Column set-up schematic

- Influent and effluent samples are collected and tested on m-TEC agar plates for *E. coli* quantification.

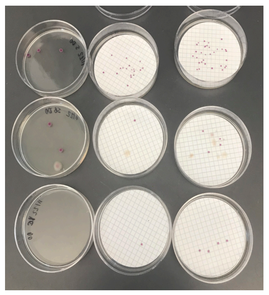

Figure 3: From top to bottom, the m-TEC plates show the *E. coli* count in the effluent from the soil, soil and biochar, and biochar column. The volume of water on the plates increases from left to right. The number of *E. coli* colonies decrease as the amount of biochar in the columns increases.

# **Biochar columns** may be an inexpensive and effective method to **remove antibiotic-resistant bacteria** from stormwater.

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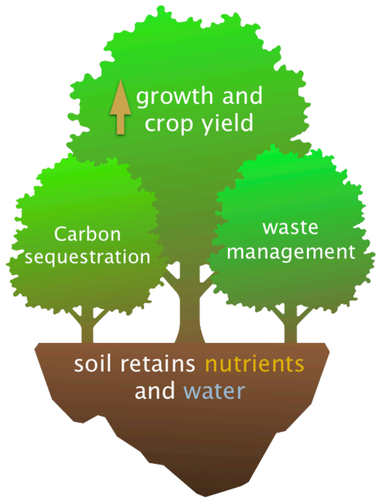


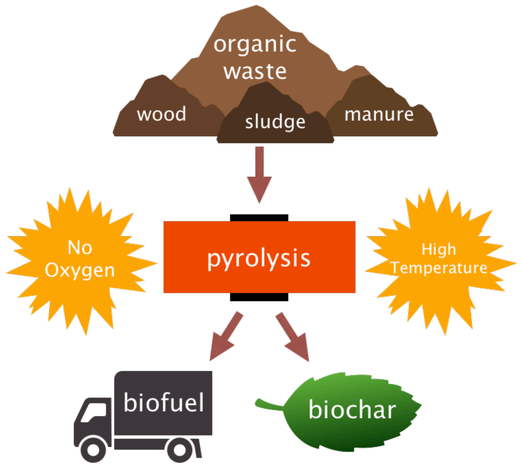


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## COLUMN TEST RESULTS:

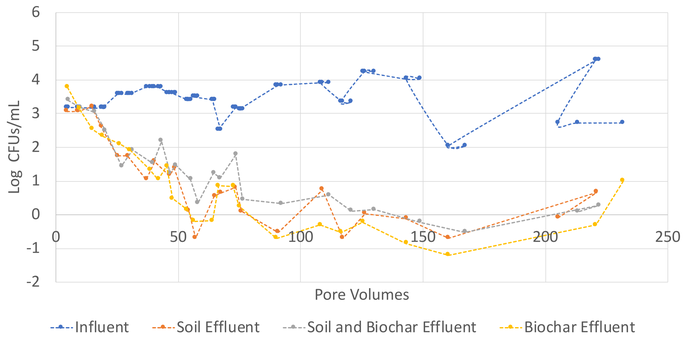



Figure 4: Removal performed by columns without antibiotic resistant *E. coli* present. Removal was measured in terms of comparing the influent CFU/mL to the effluent CFU/mL for each column. Removal by all of the columns increased over time except for a small decrease at the end.

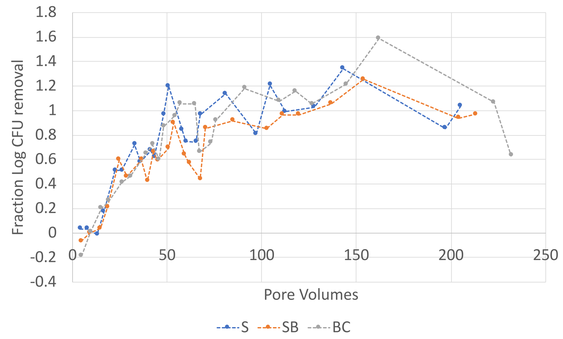
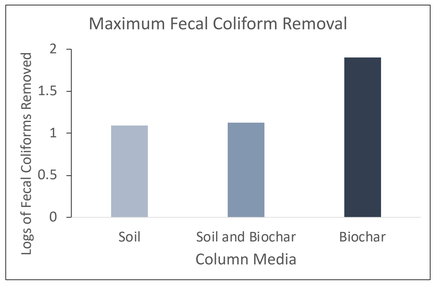



Figure 5: Removal performed by each column as a percentage of the influence CFU/mL. The fraction removed increased as the experiment continued except for a small decrease at the end.

## PRELIMINARY TESTING




This short test with a similar column configuration showed that the biochar was most effective at removing all fecal coliforms. The biochar column removed between 1 and 2 logs of fecal coliforms for 4 days. The soil and biochar mixture and the plain soil removed 1 log for one day but were exhausted before day 2.

## FUTURE WORK:

- Run column tests to track adsorption and release of antibiotic resistant *E. coli.*
- Adjust the ratio of soil to biochar to determine what is most useful in a soil amendment.
- Investigate other biochars and media.

## REFERENCES:

1. *AQUASTAT - FAO's Information System on Water and Agriculture.*
2. "Biochar-International." Biochar, biocharinternational.
3. "Antibiotic Resistance." World Health Organization, World Health Organization, 5 Feb. 2018.
4. "CLSI M100." *CLSI EClipse Ultimate Access - Powered by Edaptive Technologies*

## ACKNOWLEDGEMENTS:

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