



Corncob-Amended Woodchip Bioreactors Showed Improved Nitrate Removals in a Pilot-scale Study

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Woodchip denitrification bioreactors are an effective practice to reduce nitrate-nitrogen export from tile drainage. However, there are challenges for wide-scale implementation due to limited woodchip supply and rising woodchip costs. Corncob, a locally available carbon source, was investigated as a potential alternative. Additionally, there are opportunities to improve nitrate removal using corncobs, which has been demonstrated in lab studies. This work aimed to evaluate nitrate removal using pilot-scale corncob-amended woodchip bioreactors.

Materials and Methods

Six of the nine pilot-scale woodchip (WC) bioreactors installed at the Agricultural Engineering/Agronomy (AEA) Research Farm were amended with corncobs (CC) in 2018 (Figure 1). After modification, three bioreactors contained 25% CC + 75% WC, three bioreactors contained 75% CC + 25% WC, and three unamended bioreactors contained 100% WC. The flow conditions were adjusted to achieve treatment times of 2-, 8-, and 16-hours. Water samples were collected at each bioreactor inlet and outlet, and were analyzed for nitrate concentrations to calculate the percentages of nitrate removed.



Figure 1. Pilot-scale bioreactors were amended with corncobs in 2018.

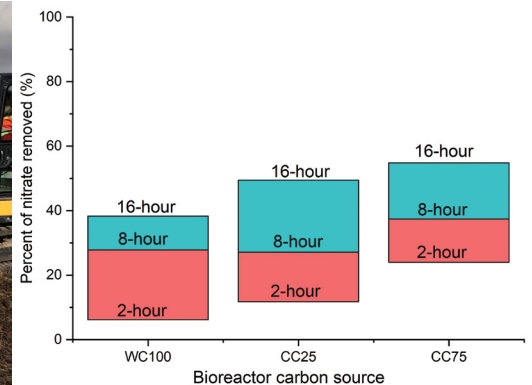


Figure 2. Percentage range of nitrate removed using 100% woodchip bioreactors (WC100), 25% CC + 75% WC bioreactors (CC25), and 75% CC + 25% WC bioreactors (CC75) at different treatment times.

Results and Discussion

2019-2022 data showed that bioreactors with larger amounts of CC can remove higher percentages of nitrate. Additionally, the percentages of nitrate removed were higher at longer treatment times (at the expense of lower treatable daily flow volumes). In this study, the bioreactors containing only WC removed 6-38% (varied depending on treatment time) of the nitrate (Figure 2). When 25% of CC was added, the bioreactors can remove 12-49% of the nitrate. Finally, the bioreactors containing 75% CC removed 38-55% of the nitrate.

Acknowledgments

This research was supported by the Iowa Nutrient Research Center.