
BIOREACTOR PERFORMANCE SUMMARY

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FROM: ALEX BUSEMAN
SUBJECT: BIOREACTOR MONITORING AND PERFORMANCE SUMMARY
DATE: 11/11/2024
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BACKGROUND

The Henning bioreactor was constructed on September 8th, 2010, making it fourteen years old. The bioreactor has 75'×12'×4.5' dimensions and drains about 30 acres. The bioreactor was periodically monitored from September 2010 to July 2024 for nitrate removal.

METHODS

Water samples were collected biweekly at the inlet and outlet control structures. These samples were analyzed for nitrate concentrations at the Iowa Soybean Association water quality lab. ISA staff organized and compiled old files containing data from the last decade.

NITRATE REMOVAL

From 2010 to 2024, nitrate removal ranged from 11.88 to 98.32% and averaged 64.94% (median = 72.00%). The median annual nitrate removal observed from each sample year shows us how the nitrate removal performance has changed over time (Figure 1). In 2024, the average nitrate removal was 50.70% and the median was 43.02%. This is within range of average bioreactor performances in Iowa which is exceptionally good for this bioreactor's age. When bioreactors get more than a decade old, it is important to assess flow-weighted nitrate removal because a bioreactor's performance is influenced by its ability to conduct flow through the chamber. In 2024, this was measured to be 0.38 pounds of nitrate per day on average. This rate is below average and could signify that flow is becoming restricted and slowing down inside the chamber. This phenomenon is not uncommon for bioreactors at this age.

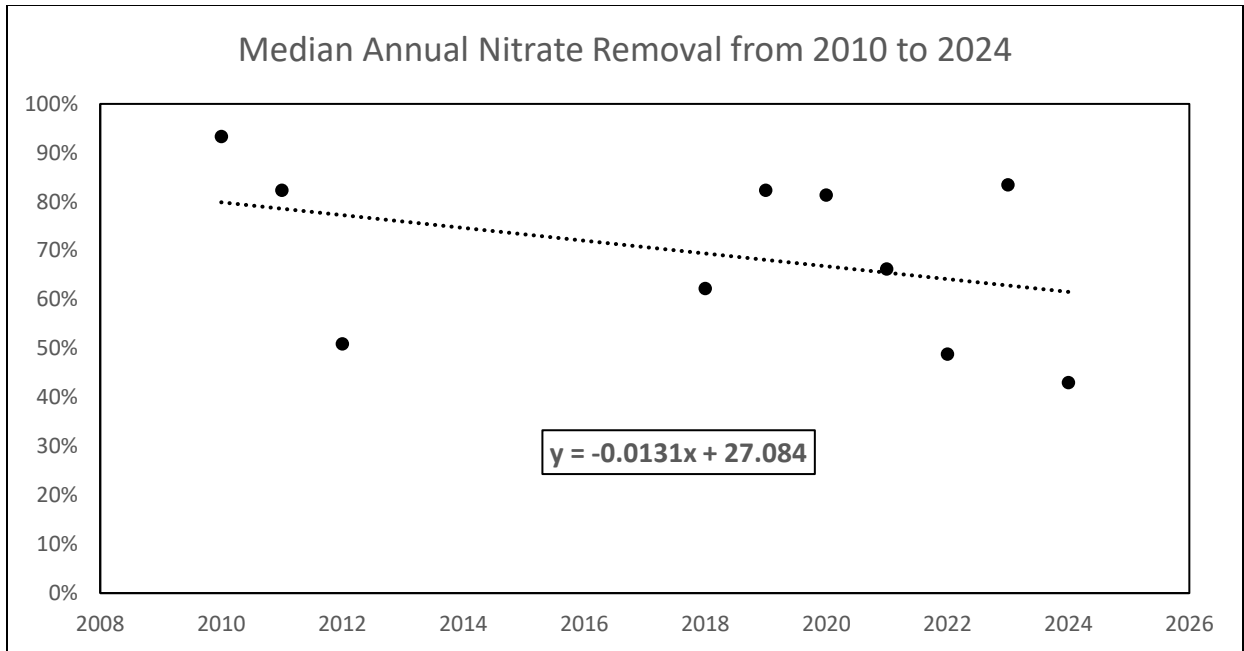


Figure 1. Median annual nitrate removal from 2010 to 2024.

COMMENTS AND RECOMMENDATIONS

The 2010 bioreactor has shown consistent removal efficiency in nitrate removal over time. Recent observations of inadequate flow-weighted nitrate removal could mean that flow is being restricted inside the chamber. The subsidence, which is the surface area above the chamber sinking, is also observed at this site which increases the chance of flow restrictions. Subsidence is a common occurrence for all bioreactors, especially at extended ages. When it occurs, it just means that your bioreactor might be ready for a woodchip recharge. A woodchip recharge essentially resets the lifespan of the bioreactor by replacing the aged woodchips with a fresh batch. Although a recharge does not seem necessary now, one may be within the next couple of years. The best way to know if a recharge is needed is by checking the site after a heavy rain. If there is water bypassing at the inlet structure, but no flow at the outlet structure, it means that the bioreactor's flow is fully restricted, and a recharge is needed. ISA would be happy to help with any technical assistance and monitor the bioreactor as it continues to age. When a recharge is necessary, we can connect you with existing NRCS funding opportunities to pay for it.