



Evaluation of Physicochemical Treatment Technologies for Landfill Leachate Induced Dissolved Organic Nitrogen (DON)

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Background

- According to Howarth (2004), 12–33% of nitrogen contamination in rivers is caused by nitrogen found in wastewater.
- Dissolved organic nitrogen (DON) typically makes up 15% of total dissolved nitrogen in leachate and around 65% of total dissolved nitrogen in wastewater effluents (Qasim, 1999)

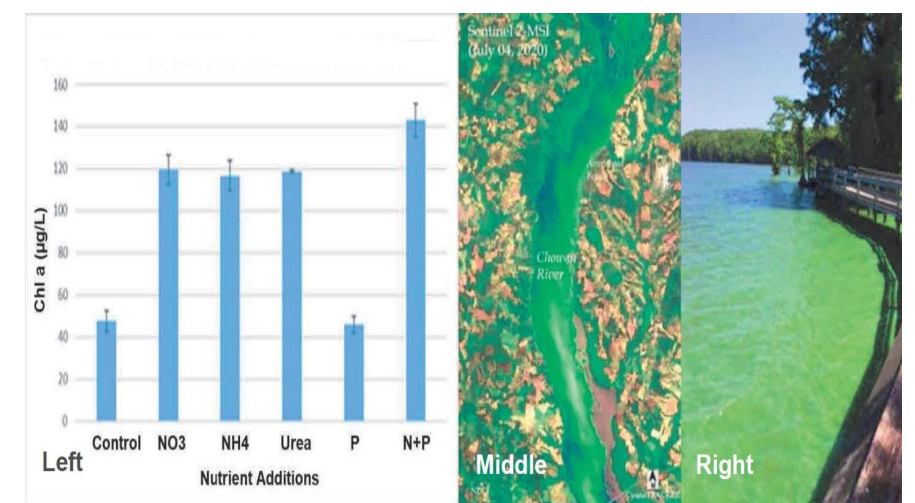


Figure 1: The effects of cyanobacterial blooms on the Chowan River, North Carolina, as measured by in-the-field bioassays (left) and Sentinel 1 satellite imagery (middle), and coastline imagery (right) in July 2020.

- The purpose of this study is to investigate the association between DON discharge from land-based waste sources and the development of algae in receiving water bodies.
- Since conventional biological treatment can't remove DON efficiently (Mantas and Sedlak, 2008), we decided to investigate the treatability of DON caused by landfill leachate using physicochemical treatment technologies..
- The effects of DON on Harmful algal blooms (HABs) were evaluated using the Algal Bioassay facility at the Institute of Marine Science at the University of North Carolina in Chapel Hill.

Research Methodology

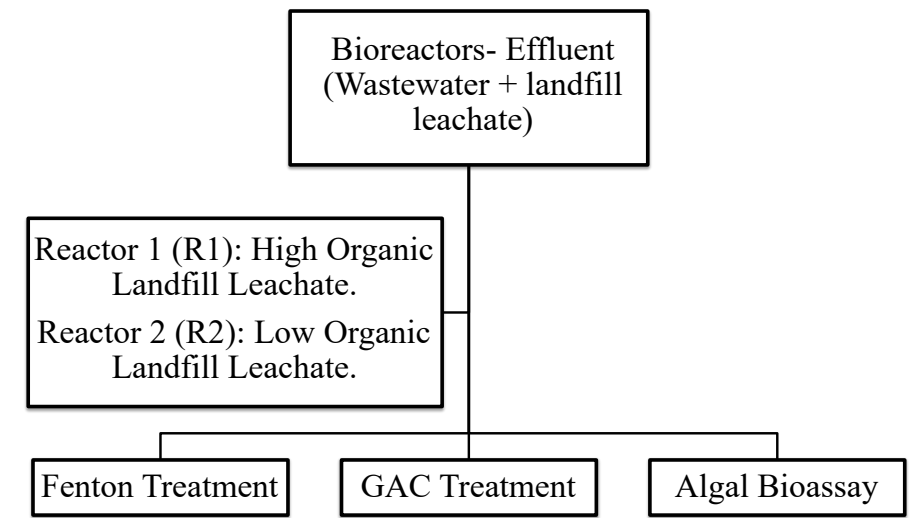


Figure 2: Experimental Plan

Research Methodology

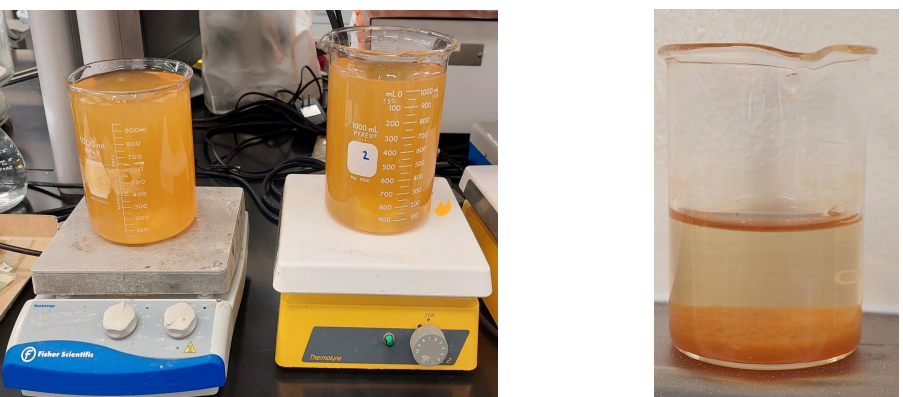


Figure 3: Rapid mixing and settled supernatant in Fenton Treatment



Figure 4: GAC treatment: Mixing at 200 rpm in incubator shaker

Results

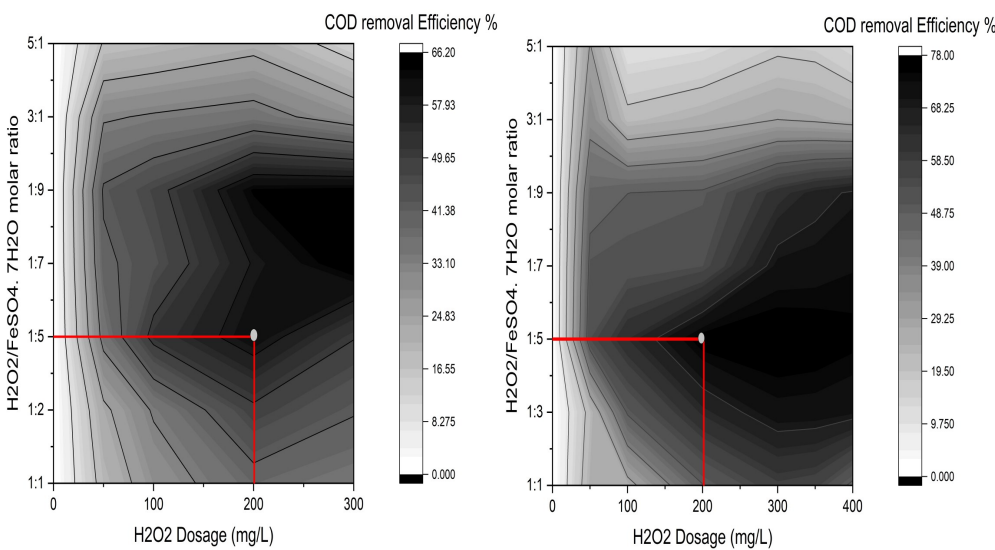


Figure 5: Optimum dosage: 200mg/L H₂O₂ and 1000mg/L FeSO₄.7H₂O. Fenton Treatment of Reactor 1 (Left) (66% COD Removal) & Reactor 2 (Right) (75.8% COD Removal).

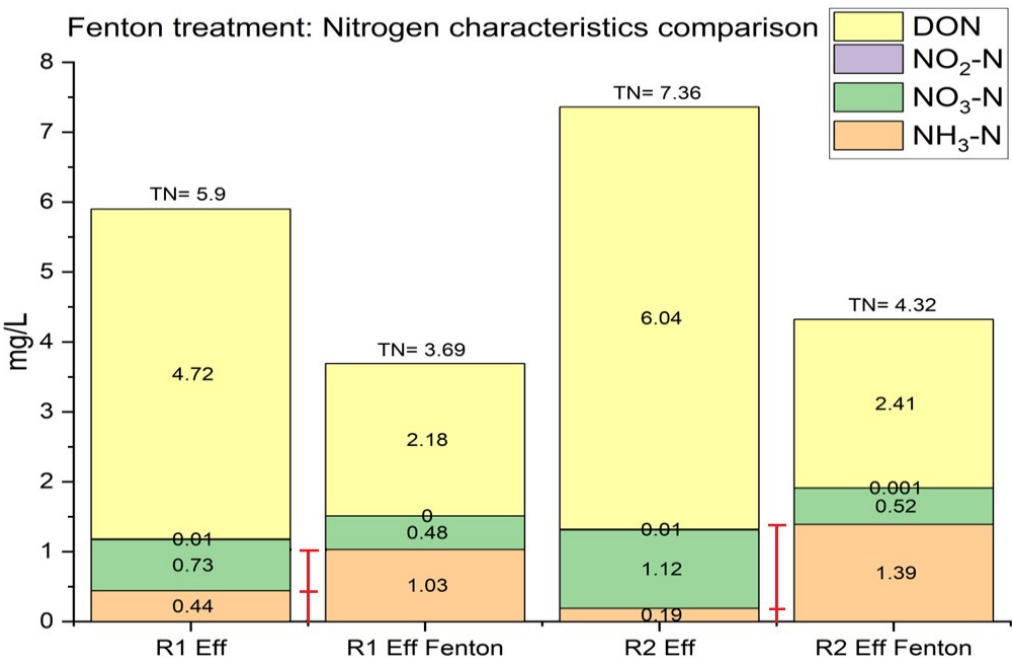


Figure 6: Fenton treatment chemical analysis

Results

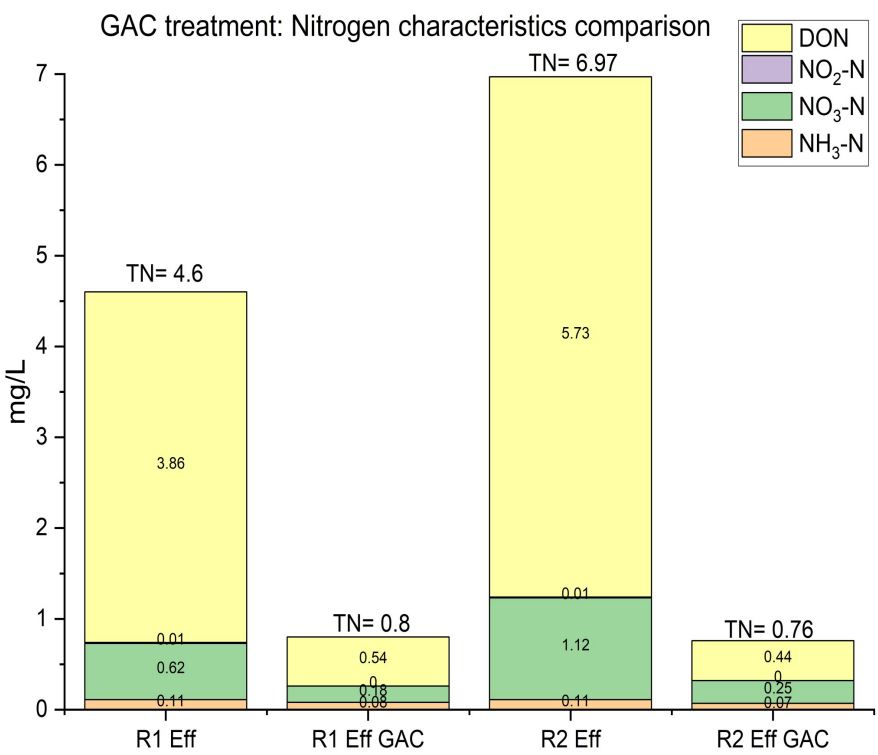


Figure 7: GAC adsorption chemical analysis

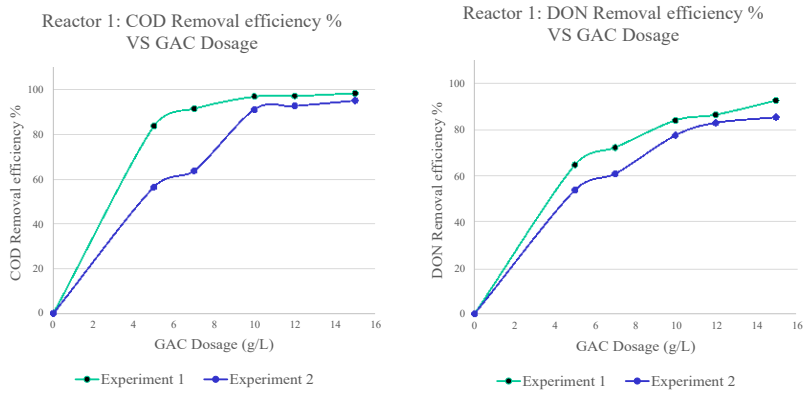


Figure 8: Optimum dosage: 10 g/L. GAC treatment of Reactor 1.

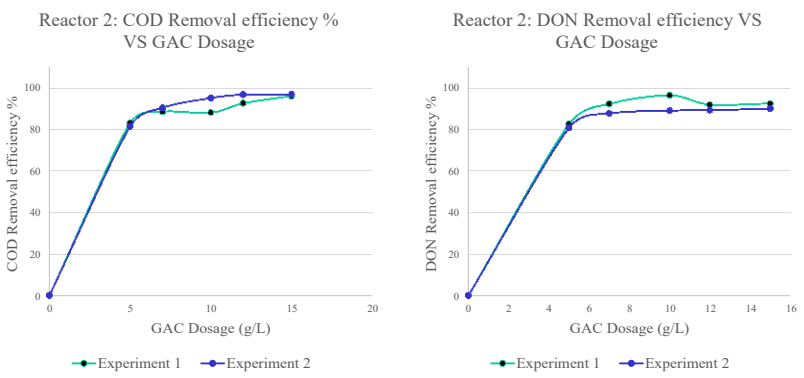


Figure 9: Optimum dosage: 10 g/L. GAC treatment of Reactor 2.

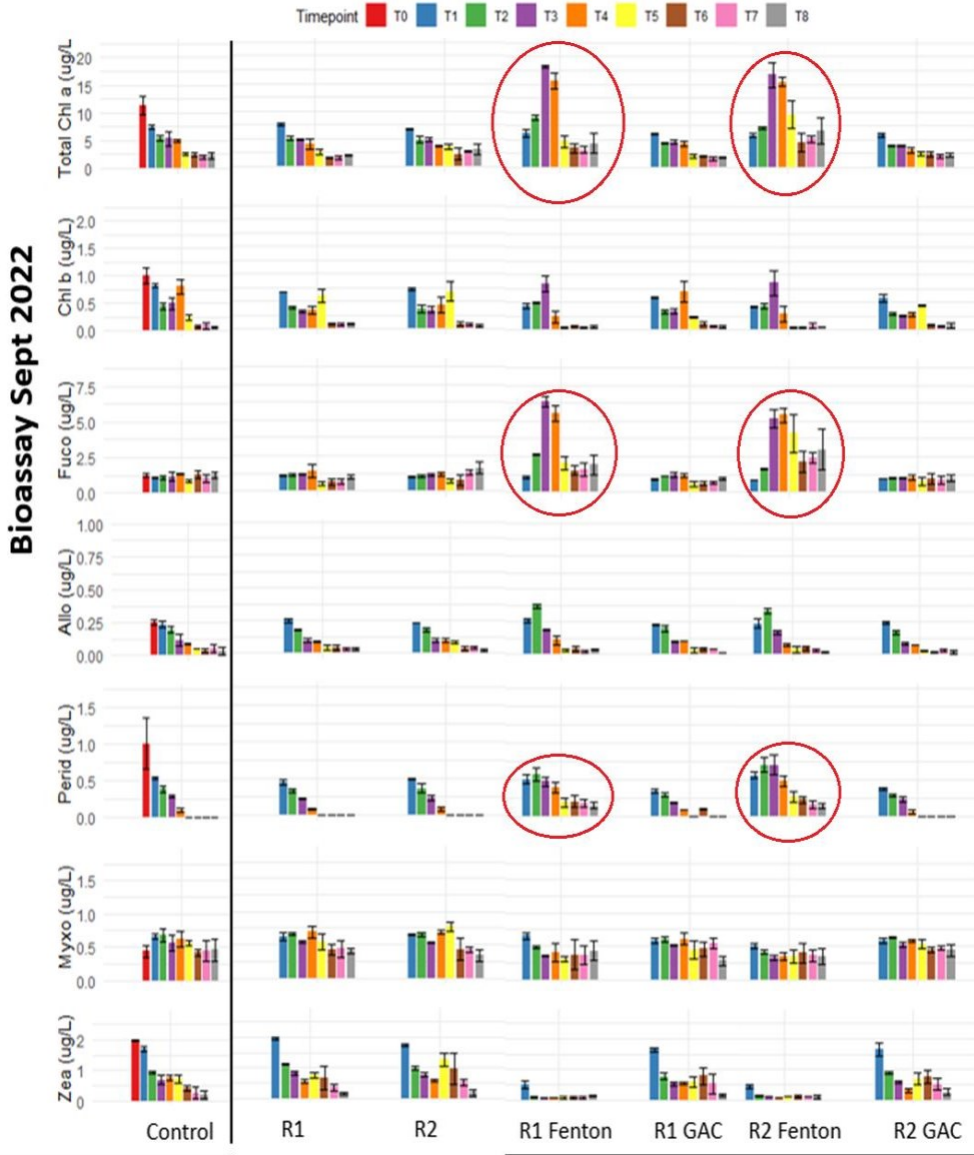


Figure 10: Algal Bioassay report (HPLC analysis)

References

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Acknowledgement

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Conclusion

- For R1, Fenton treatment reduced 66±9.2% COD and 52.4 ±8.7% DON and GAC removed 94.4±4.9% COD and 85.9 ±4.6% DON.
- For R2, Fenton treatment removed 75.8±6.6% COD and 60.3 ±3.2% DON and GAC removed 92.2±4.3% COD and 92.3 ±3.7% DON.
- DON was converted to inorganic nitrogen (NH₃-N) by the Fenton process during the removal process. Whereas GAC adsorption simply removed all type of species without transforming any of them in the process..
- Data from the algal bioassay supported the chemical analysis. A significant quantity of algae were stimulated in the Fenton-treated sample.
- On the other hand, algal bioassay did not reveal any appreciable variation in algal growth caused by DON from the R1, R2, and GAC treated samples.