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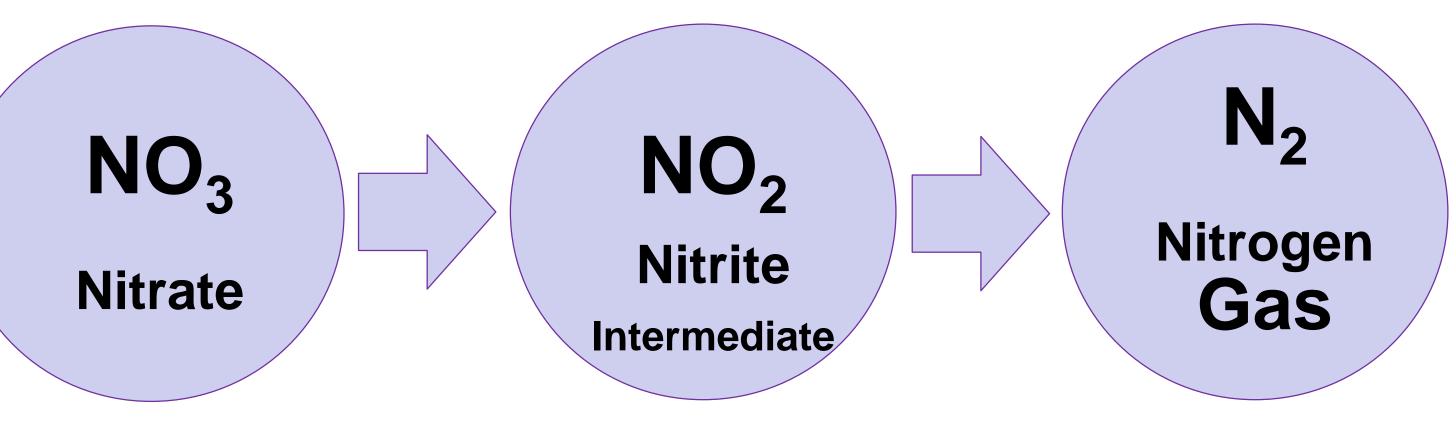


# Wastewater Denitrification Using BHN-Probiotic Solutions as an Alternative External Carbon Source



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# Background



Reducing the amount of Nitrate found in wastewater is a crucial step for wastewater treatment plants, and denitrification is an essential biological step that could be rate-limiting. To reach the stringent nutrient discharge standards, treatment plants commonly use methanol as an external carbon source; however, there are many safety issues that can arise from using methanol. This problem prompted the study to find and compare other sustainable and environmentally-friendly carbon sources that could potentially be used by wastewater treatment plants as a replacement for methanol, while still maintaining low nitrogen levels. For this study five different carbon sources were evaluated: MicroC, methanol, acetate, product 201 and 203 from BHN – Probiotic Solutions ®.

# **Objective**

To compare the denitrification kinetics and rates of BHN-Probiotic Solutions to those of Methanol and Micro C.



**Figure 1.** Inoculum separated into seven samples.



**Figure 2.** Inoculum samples on stir plate.

## Methods

## **Denitrification Tests**

1. Inoculum is divided into seven samples and is degassed using Nitrogen.
2. Nitrate is added to the inoculum, along with the respective carbon source for each bottle.
3. A 20mL sample is pulled from each bottle for a t=o hour sample.
4. Inoculum bottles are stored on stir plate at 125°C.
5. 20 mL samples are filtered using a 0.2μm filter.

• 1. 20 mL sample is pulled from each bottle at its correlating time.

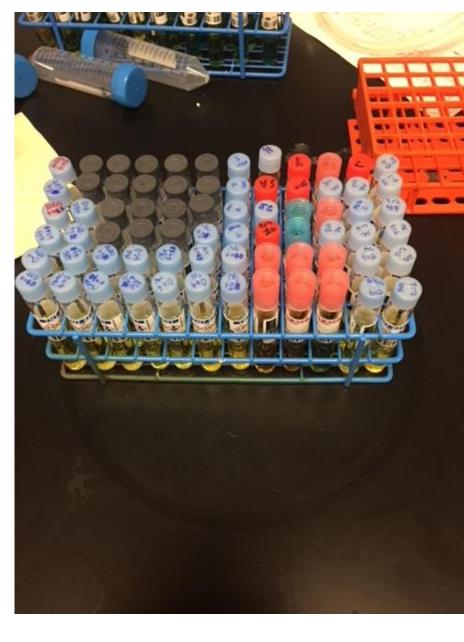
2. Samples are filtered.

• 1. 20 mL sample is pulled from each bottle at its correlating time.
2. Samples are filtered.
3. Filtered samples for hours 0-1 are prepared for Chemical Oxygen Demand, COD test.
- COD is measured using a HACH COD kit.

• 1. 20 mL sample is pulled from each bottle at its correlating time.
2. Samples are filtered.
3. 30 mL sample is pulled and filtered to measure TSS and VSS

T= 3 Hours

- 1. 20 mL sample is pulled from each bottle at its correlating time.
- 2. Samples are filtered.
- 3. Filtered samples for hours 2-3 hours are prepared for COD, pH, total suspended solids (TSS), volatile suspended solids (VSS), and NH<sub>3</sub>-N test.
- NH<sub>3</sub>-N was measured using a HACH DR 2800 kit.
- TSS and VSS were determined by weight according to Standard Methods.



**Figure 3.** HACH kit COD vials prepared for reading.



**Figure 4.** HACH digital reactor block for COD digestion.

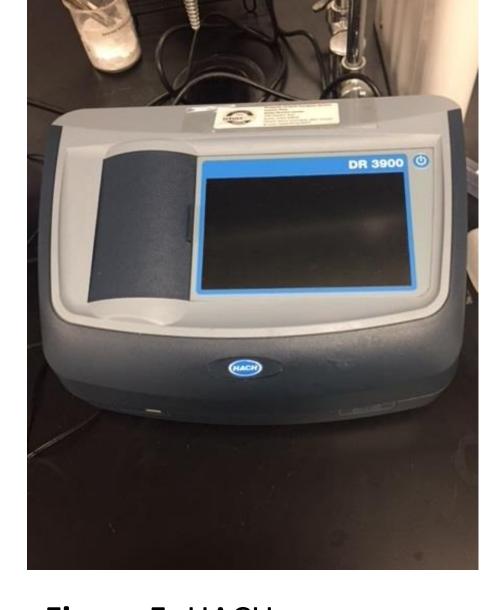


Figure 5. HACH spectrophotometer used for reading COD levels.

## Results

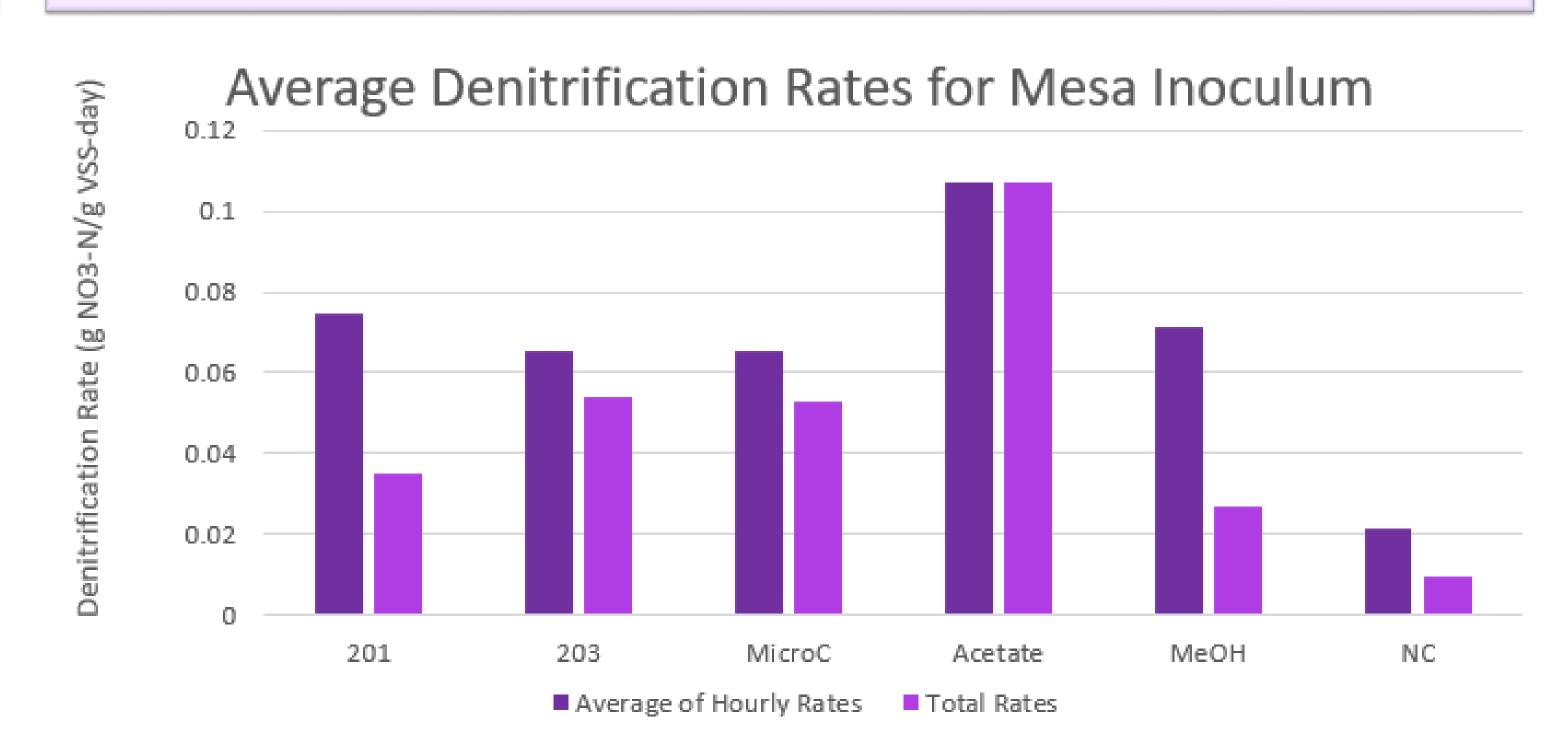


Figure 6. Average Specific Denitro Rates for Mesa

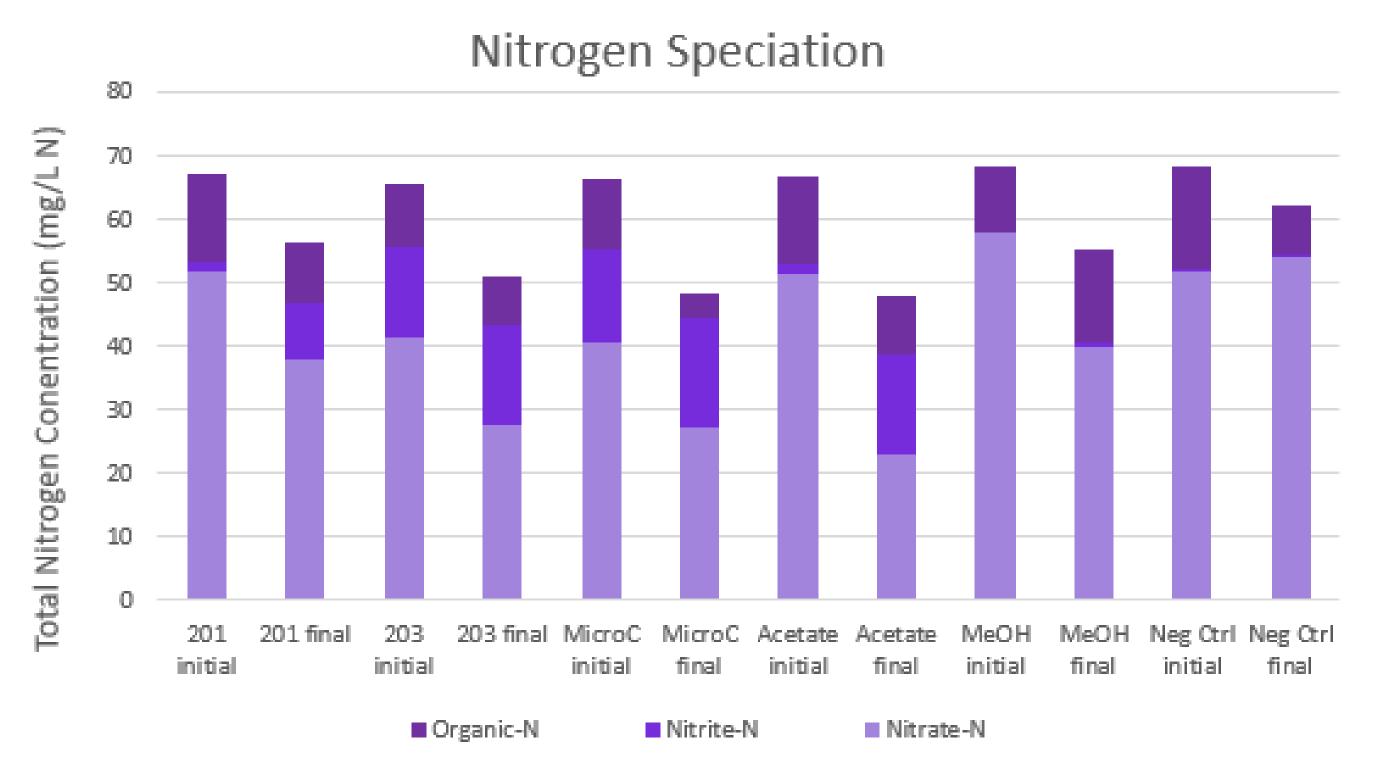


Figure 7. Nitrogen Speciation for 1/19/19

Reasons for errors could include: differences in inoculum, inaccuracies in carbon source measurements due to viscosity, and improper inoculum mixing.

## Conclusion

- 201 has a greater hourly rate than 203
- 203 has a greater overall rate than 201
- The speciation graph shows that 203 converted more nitrate into nitrite

# Acknowledgements

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