



Laboratory Study of Nitrification and Denitrification in the BioSand filter

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Introduction

Water is a crucial element for life to exist, but in many locations clean drinking water is not easily accessible. The BioSand Filter (BSF) is used throughout the world to improve water quality. To date, many studies have examined the microbiological reduction capabilities of the BSF and proven its reliability and capability. Few studies have focused on chemical removal abilities of the BSF. Two field studies have recently focused on nitrification in BSFs:

- A 2010 study reported evidence of nitrification in BSFs, raising some concern (Murphy, et. al, 2010).
- In 2013, a follow-up study (Wu, et. al) suggested that the magnitude of the nitrification problem in BSFs is minor except in extreme circumstances. The experiment aims to add to the literature on nitrification and provide additional data on the severity of the problem.

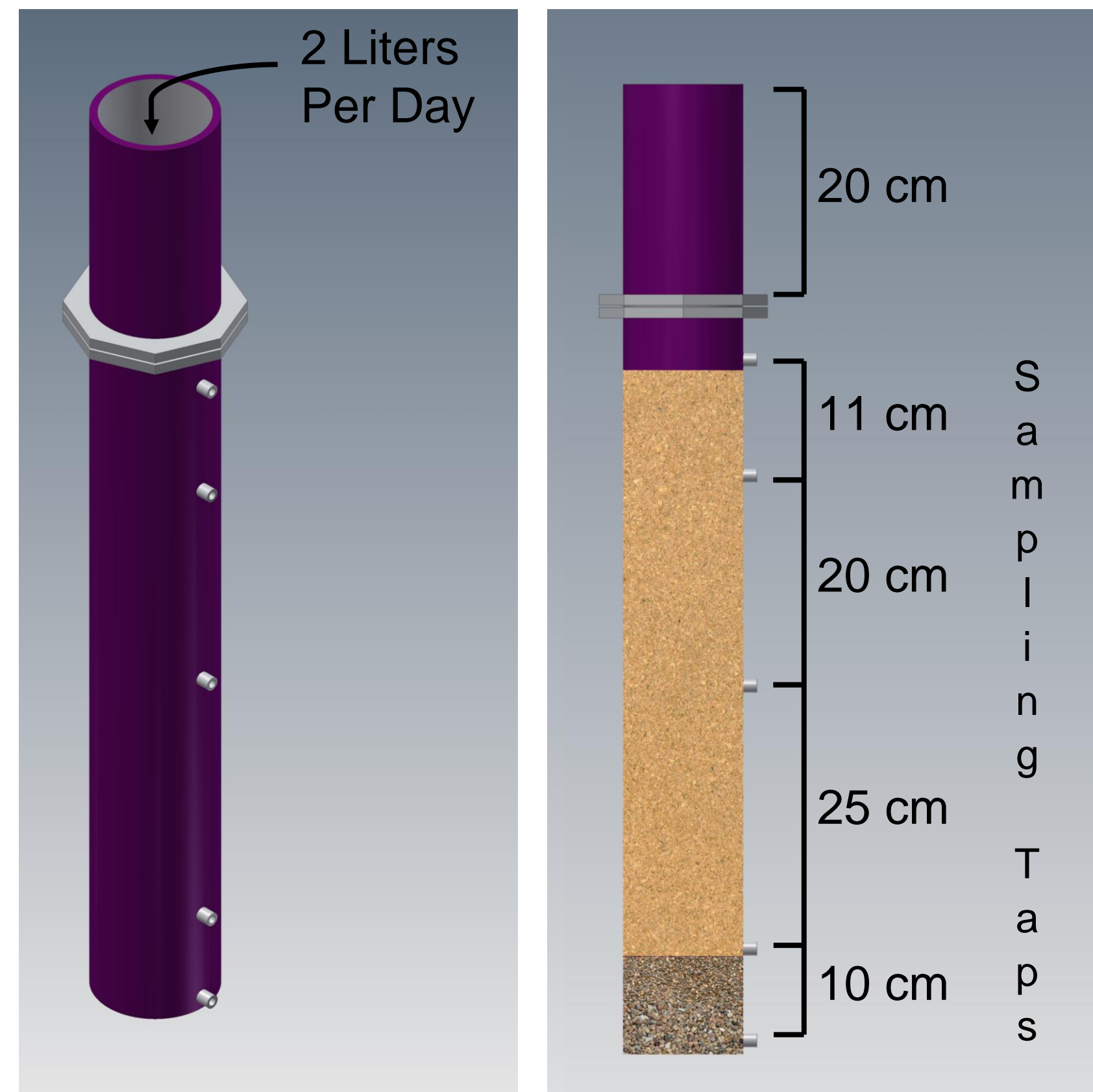
Construction of Bench Scale BSFs

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Materials and Methods



Influent water was collected from Cedar Creek (Abilene, Tx). Water was then spiked with Urea ($\text{CO}(\text{NH}_2)_2$) to ensure Ammonia was not a limiting factor. The spiking solution was prepared according to previous studies (Wu, et al. 2013).



Acknowledgements

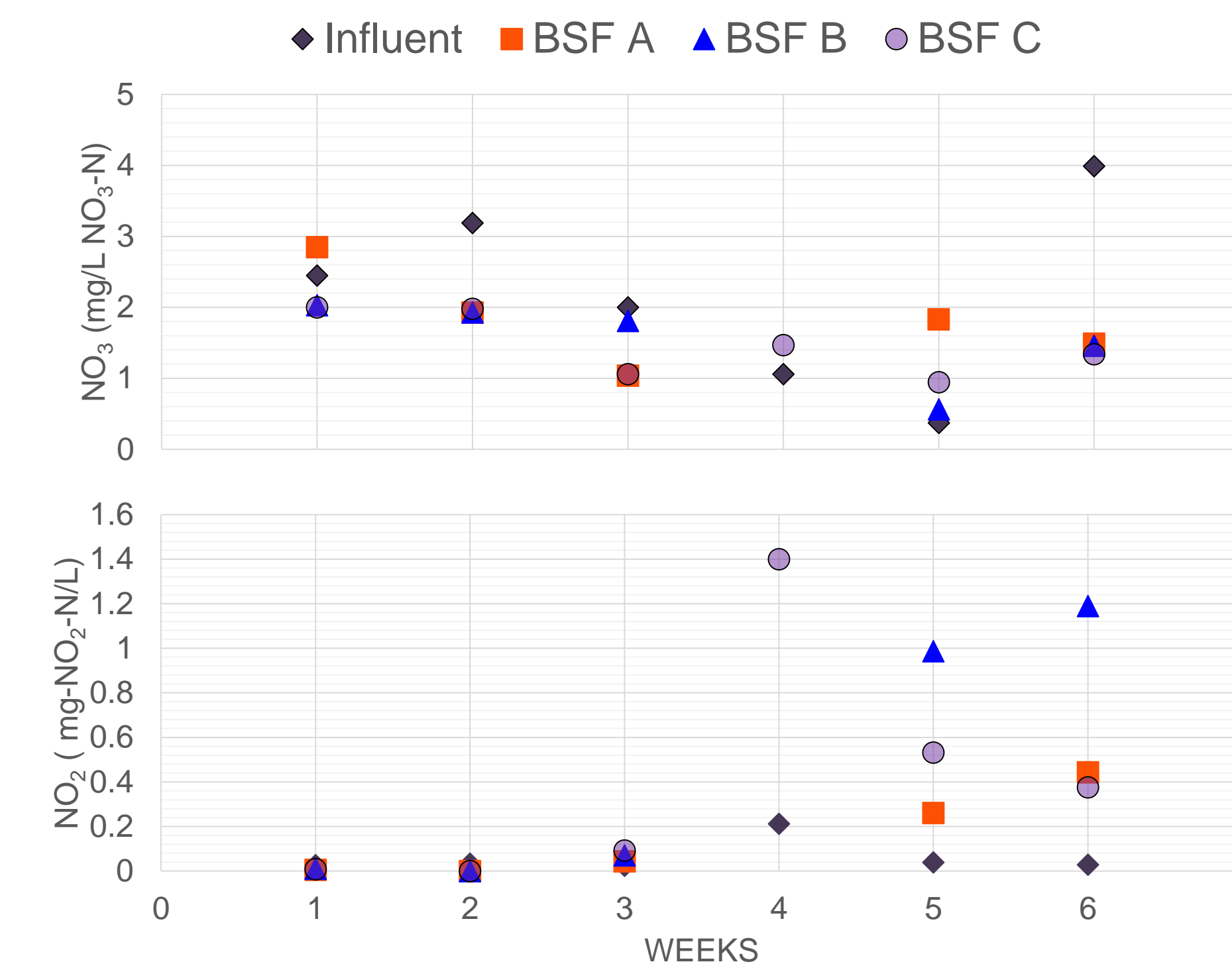
We would like to thank the ACU Office of Undergraduate Research and Premier Silica for supporting this work.

Results

Table 1: Water Quality Data Averages

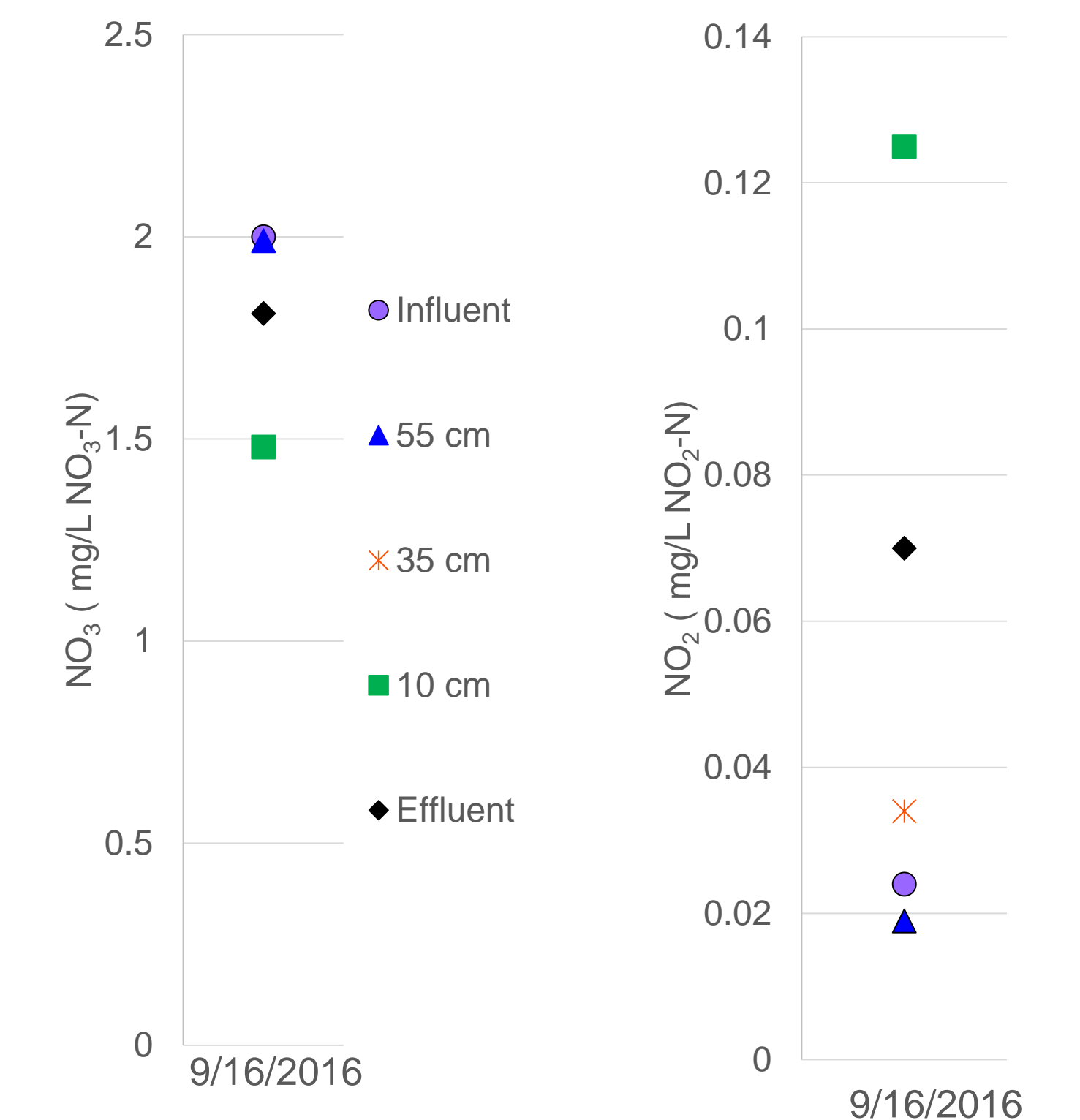
Water Quality Parameter	World Health Organization Guideline	Influent	Average Effluent
Alkalinity (mg/L as CaCO_3)	-	192.25	334.60
pH	6.5-8.5	8.16	8.69
Turbidity (NTU)	5	17.79	0.88
Nitrate (mg-N/L)	11	2.00	1.57
Nitrite (mg-N/L)	0.9	0.08	0.33
Ammonia (mg-N/L)	-	> DL	> DL

Nitrate and Nitrite



Influent and Effluent nitrite and nitrate water sample concentrations from three BSFs, over course of 6 week experiment

Profile Graph



Influent and effluent nitrate and nitrite concentrations at different sampling taps for BSF B on 9/16/2016.

Conclusions

- Data indicates that nitrification is not occurring even when ammonia is not limiting factor.
- Results further support Wu study in that it suggest that the magnitude of the nitrification problem in BSFs may be minor.

References

- Murphy, H. M., McBean, E. A. & Farahbakhsh, K. 2010 Nitrification, denitrification and ammonification in point-of-use biosand filters in rural Cambodia. J. Water Health 8 (4), 803-817.
- World Health Organization (WHO) 2011 Guidelines for Drinking water Quality, 4th edn. WHO, Geneva.
- Wu, S.K., Smith, K., Hofmann, R., and Cantwell, R.E., 2013. Journal of Water Supply: Research and Technology - Aqua Sep 2013, 62 (6) 359-366;