FWEA 2020 ABSTRACT FOR PILE CLOTH DEPTH FILTRATION

Title: Enhanced Domestic Primary Wastewater Treatment Utilizing Pile Cloth Media Filtration for Operational Savings and the Impact on Downstream BNR Processes

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Theme: Water, Energy, Food Nexus

Topic: Treatment: Preliminary and Primary

Focus Area: Research & Development

References:
Caliskaner, O., G. Tchobanoglous, R. Young, Z. Wu, C. Paez, B. Davis, T. Reid, B. Mansell, P. Ackman, J. Dyson (2018) " Full Scale and Demonstration Scale Primary Filtration Projects Show Great Promise," Proceedings of the 2018 Water Environment Federation Technical Exhibition and Conference, New Orleans, Louisiana.

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Keywords: Carbon Diversion, Primary Filtration, Pile Cloth Depth Filtration

Learning Objective: Learning of an innovative advanced primary treatment technology to increase carbon diversion and be able to still achieve BNR.

Abstract: [maximum 1100 words]

Introduction

After extensive use of pile cloth media filtration in tertiary applications for over two decades, pile cloth media filtration has now been adapted for primary domestic wastewater treatment. This new solution has emerged as a promising technology due to its proven performance and operational advantages compared to existing treatment processes. Primary filtration utilizing pile cloth media filtration technology offers a small footprint and is capable of treating extremely high solids while providing high quality effluent without the use of chemicals. The improved effluent quality reduces TSS and BOD loading to the secondary process resulting in reduced aeration costs and more capacity within the existing secondary treatment process or a smaller system. Additionally, the waste stream from the filtration process can be directed to thickeners, then to anaerobic digesters for increased gas production. One big question is the impact to downstream biological process due to the high removal percentage of carbon, the focus of the paper will be on the impact to a biological process on nitrogen and phosphorus removal.

Methodology

To validate the impact of pile cloth media filtration on downstream BNR processes, Aqua-Aerobic Systems, Inc. (AASI) installed a pile cloth media pilot with specific changes to handle the primary influent and followed it with an SBR pilot at the AASI Research & Technology Center which is located at the Rock River Water Reclamation District (RRWRD) in Rockford, IL. The pilot treatment train was operated to provide a primary effluent with high carbon removal to feed the SBR pilot while operating under conditions of 5 cycles per day and a target total nitrogen (TN) of less than 5 mg/L. To verify the performance and operational savings, the pilot study test plan was developed to test and monitoring the following parameters:

- Influent and Effluent TSS, BOD, COD, TN, etc.
- Unit Loadings (SLR and HLR), Backwash Frequency, Operation Parameter, etc.)
- Backwash and Solids Waste Characteristics, etc.

The treatment scheme consists of screening and grit removal before the piloted primary filtration system.

Status

Many primary filtration pilot studies have been conducted on raw domestic wastewater and primary clarifier effluent throughout the country and are continuing. The studies have shown pile cloth media filtration achieves TSS and BOD5 removals of >80% and >50%, respectively, versus primary clarification which typically achieves about 60 to 65% TSS and 25 to 45% BOD5 removal. This increased TSS and BOD5 removal indicate the potential for this new primary filtration system to reduce energy demands in secondary treatment processes and increase gas production in digestion systems. It also is a concern whether there is enough carbon for BNR processes. The pilot work completed in summer of 2019 shows the same removal as other primary studies and the SBR was able to achieve the TN target effluent goal, but biological P-removal removal was inconsistent. For control purposes, the SBR pilot unit was operated with raw influent for a period of time to prove BNR worked and being able to see the difference and impact of advanced primary treatment on the BNR process.

Discussion of Pilot Operating Data and Impact on BNR process

The figures included are some of the pilot operating data and performance from the study on the impact to the biological BNR process. The paper will cover work conducted so far in the pilot study and ongoing study results from the testing that continues. Figure 1 depicts the TSS removal achieved with pile cloth media filtration which was feeding the SBR system. The average removal of TSS was 92%. Figures 2 shows the TN removal achieved at different conditions during the study. The average TN while operating

with pile cloth media filtration as pretreatment to the SBR was approximately 5 mg/L. Figure 3 shows the inconsistent performance of biological P-removal. During the testing, it was determined that the control of the cycles times and stages needed to be varied and special attention was needed to prevent over aeration due to the reduced carbon load. Initial data is showing reduced aeration cycle times which will result in an aeration savings. Testing is continuing and is looking at optimization of the SBR cycle times followed with the investigation of fermentation as carbon source to be adding during the react-fill phase for bio-P removal. The initial phase of work is complete. The continuing work is scheduled to be complete in September 2020.

Conclusion

Pile cloth media filtration has emerged as a promising technology due to its proven performance and operational advantages. Also, the completed and ongoing work looks promising that BNR can be achieved with reduced influent carbon conditions for TN removal without the addition of supplement carbon. Carbon addition may be necessary if bio-P removal is desired. Since pile cloth media filtration removes high levels of TSS and BOD, the waste from the process can be used in primary fermentation to provide any supplement carbon requirements.

Images/Tables

Figure 1:

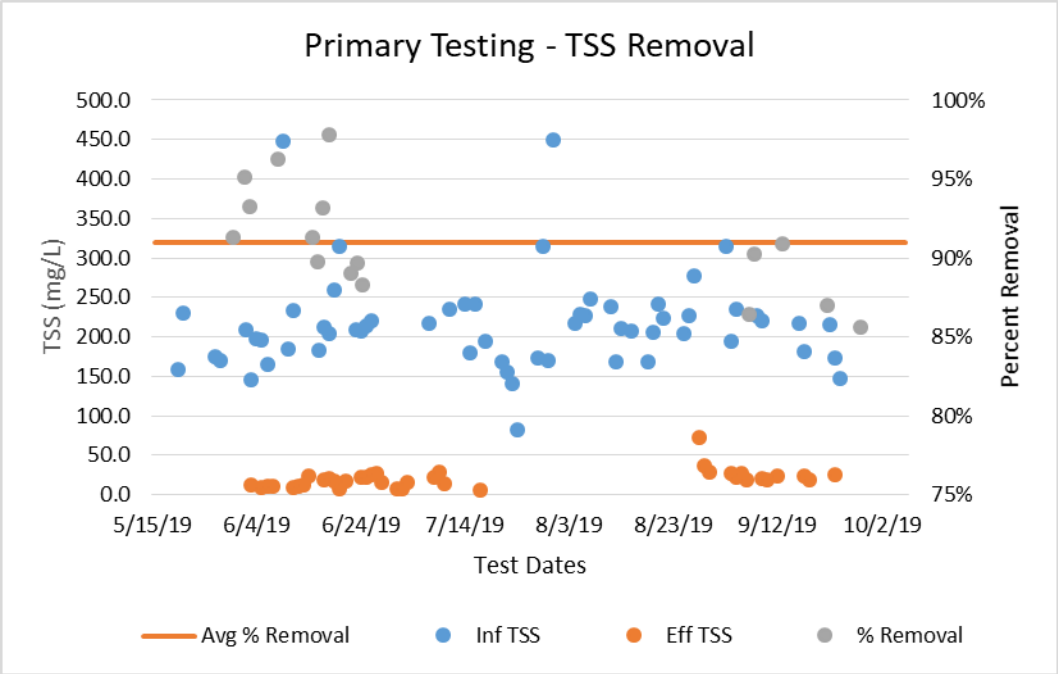


Figure 2:

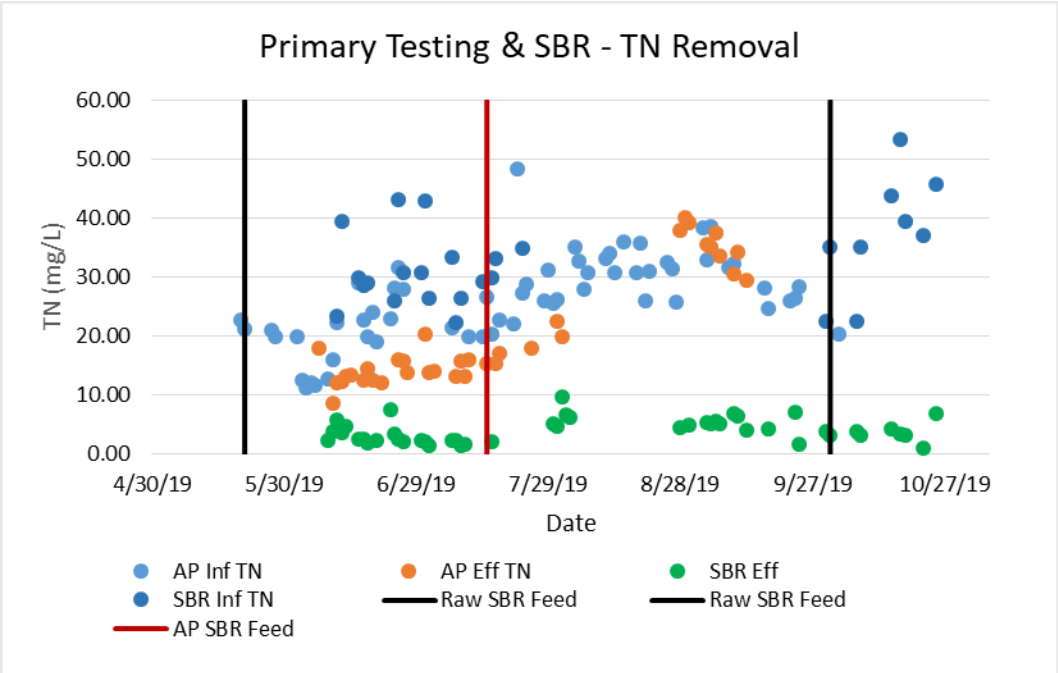
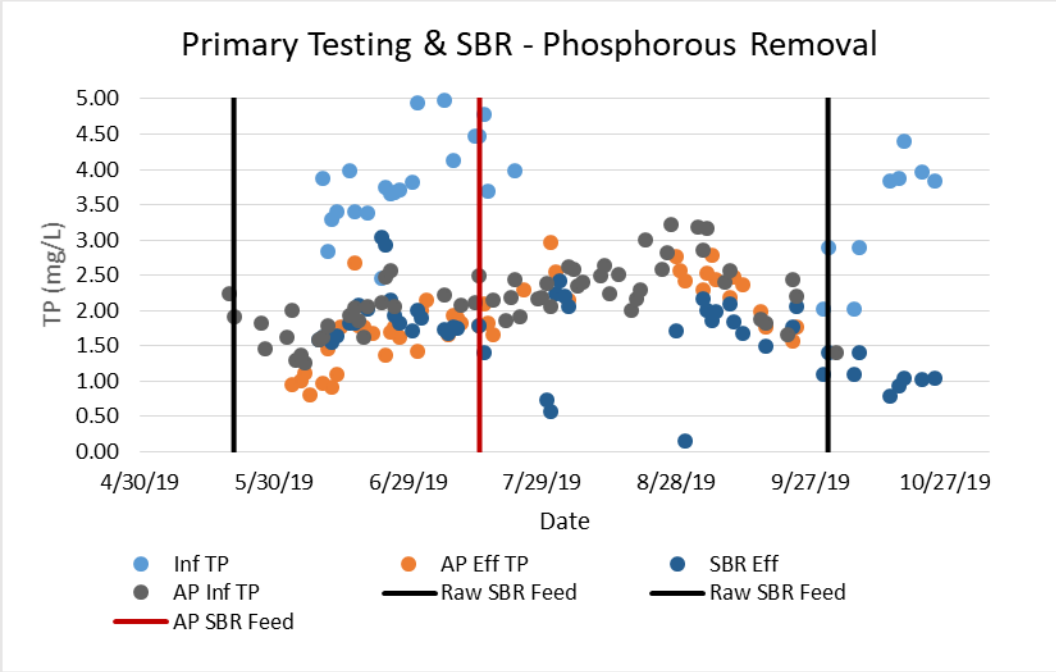


Figure 3:


Primary Testing & SBR - Phosphorous Removal
TP (mg/L)
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
4/30/19
5/30/19
6/29/19
7/29/19
8/28/19
9/27/19
10/27/19
Date
Inf TP
AP Inf TP
AP SBR Feed
AP Eff TP
Raw SBR Feed
SBR Eff
Raw SBR Feed