Snapshot Report

Aerobic Wastewater Pond Trickling Filter

Full Project Title

Project Code
2020-1091

Prepared by
Mike Spence

Date Submitted
21/07/21

Project Description

The objectives of the project were:

- Identify current industry practice for the removal of Nitrogen from aerobic pond wastewater by the use of Trickling Filters (TF).
- Characterise wastewater parameters.
- Construct a TF.
- Compare two media types use in the TF.
- Measure performance and commission and validate trickling filter.
- Prepare design parameters based on volume and waste characteristics.

Project Content

Based on previous AMPC research and an extensive literature review a TF was constructed using Cold Room Panels (CRP) and spaced media to allow aeration using: Plastic moulded blocks (cross flow) PVC (commonly used in cooling towers); and fragmented Hebel lightweight concrete. Flow rate was varied to simulate varying recommended conditions.

Project Outcome

The net result was that no N was removed and, on reflection of the literature and design, it was concluded that aeration was more of a key factor than depth of media or flow rate. It appears that the literature examples and trials are not readily translatable across industries or specifically, waste streams.

However, it was also found that the high Ammonia in the presence of Phosphorus and Potassium created Struvite by means of mechanical energy as the flow passed over the media. It was likely that reject water from the on-site Reverse Osmosis plant increased the available K but the overall effect of high EC on a TF has not been reported in the literature; it is felt that this also may be a contributing factor.

The build-up of Struvite was such that any biological organisms or bacteria would appear to have been covered by the Struvite. Total P had reduced greater than the minimal Total N values indicating an interesting phenomenon when high EC levels are experienced in the wastewater.

Benefit for Industry

As a stand-alone TF under the circumstances encountered it would not be of value as initially hoped. The potential remains as a low capital and operational cost method to reduce TN in wastewater but requires further investigation. A major observation, post-trial, is that there is a great variation in published data with little data on denitrification. Maybe, rather, there is data but the source and nature of the wastewater and the applicability to non-similar inputs is not transferable. The majority of papers are directed at BOD reduction and the mechanisms supporting microbiological growth to achieve that reduction and is also the same for Nitrogen removal.

A fully controlled laboratory examination of inputs and outputs to identify cause and effect would be highly desirable.

Useful resources

1. GHD Pty Ltd. Trickling Filter Technology for Treating Abattoir Wastewater. Australian Meat Processor Corporation. Project code: 2014 /1016, April 2015.

2. Trickling Filter – 4 http://web.deu.edu.tr/atiksu/ana52/ani4050-2.html (2020)

3. United States Office of Water EPA 832-F-00-015 Sep 2000

4. **TF Process**.
https://nptel.ac.in/content/storage2/courses/105104102/Lecture%2028.htm#:~:text=The%20hydraulic%20loading%20rate%20is,adopted%20in%20low%20rate%20filters (2020)
5. Sheng-Peng **Sun**, Carles Pellicer i Nacher, Brian Merkey, Qi Zhou, Si-Qing Xia, Dian-Hai Yang, Jian-Hui Sun, and Barth F. Smets. Effective Biological Nitrogen Removal Treatment Processes for Domestic Wastewaters with Low C/N Ratios: A Review. ENVIRONMENTAL ENGINEERING SCIENCE, Volume 27, Number 2, **2010**.
6. DJ Nozaic and SD Freese. PROCESS DESIGN MANUAL FOR SMALL WASTEWATER WORKS. Water Research Commission, Waterscience CC. WRC REPORT NO. TT 389/09 APRIL 2009.