CORONA ENVIRONMENTAL CONSULTING

WATEROPOLIS

Evaluation of Ceralite-A as Ammonia Removal Biological Treatment Support Media

Project Description

A novel biological oxidation filtration treatment process was evaluated for removal of ammonia from a California groundwater source. In addition to ammonia, this groundwater had other contaminants such as iron, manganese, methane, hydrogen sulfide odor, color, high organic carbon, etc. As such, more conventional treatment processes such as breakpoint chlorination were deemed infeasible, and biological treatment was the preferred treatment alternative.

A ten-month extended pilot study was conducted to evaluate the proposed biological oxidation filtration process, and to develop design criteria for a full-scale system. The process train consisted of aeration (dissolved oxygen augmentation), chemical addition (peroxide, phosphate, etc.), biological filtration, and post-filter disinfection. Several filter media were evaluated including Ceralite-A, dual media (anthracite/ sand), and granular activated carbon (GAC). The filter design criteria during the steady-state operation of the pilot is shown in Table 1.

Pilot Test Results

Biological Treatment Performance:

Figure 1 shows the performance of the different media in supporting growth of microorganisms such as nitrifying bacteria. Complete nitrification (i.e. conversion of ammonia to nitrate) in the filter with Ceralite-A media was observed within ten weeks of startup. This was quicker than both the GAC and dual media filters. Complete nitrification was never achieved in the dual media filters. In contrast, steady state performance with complete nitrification could be maintained within the Ceralite-A filter for more than eight weeks of continuous filter operation.

Filtration Performance:

Filter head-loss over a representative 96-hour duration is shown in Figure 2. For pilot operations, the backwash triggers were set as: a maximum filter run time of 48 hours, or a terminal head-loss of 1 foot (of water), whichever is achieved earlier. The dual media filter wasn't able to reach a 48-hour filter run without exceeding terminal head-loss. Both

Table 1 Media Design for Biological Oxidation Filtration Pilot Testing

Media	Ceralite-A	Dual Media (Anthracite/ Sand)	Granular Activated Carbon
Media Size (mm)	1.2 – 1.6	0.9 – 1.0	1.0 – 1.2
Media Depth (inches)	30	Anthracite – 18 Sand - 12	30
Hydraulic Loading Rate (gpm/ ft^2)	3	2	3
Empty Bed Contact Time (min)	12	18	12
Backwash Rate (gpm/ft^2)	12	12	12
Backwash Duration (min)	8	8	8
Backwash Frequency (hours)	48	48	48

the Ceralite-A and the GAC media were consistently below the terminal head-loss criteria, but on average the head-loss in the Ceralite-A filter was 25-30 percent lower than the GAC filter. Filtered water turbidity in the Ceralite-A filter was typically higher than both the dual media and GAC filters, but the turbidities were within acceptable limits. Higher filtered water turbidity was anticipated in the Ceralite-A filters, given the higher effective size of the Ceralite-A media compared to dual media and GAC.

Figure 1 Comparison of Filter Media in Supporting Biological Growth

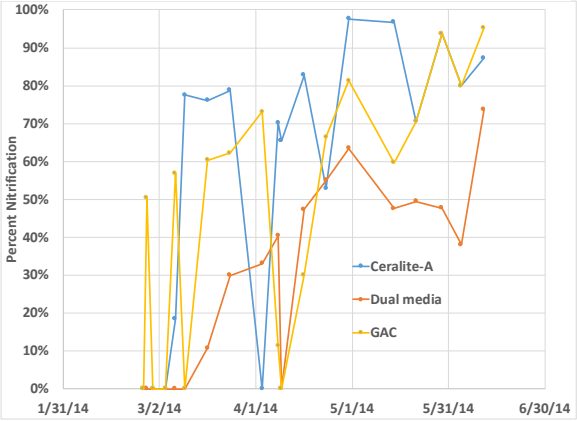
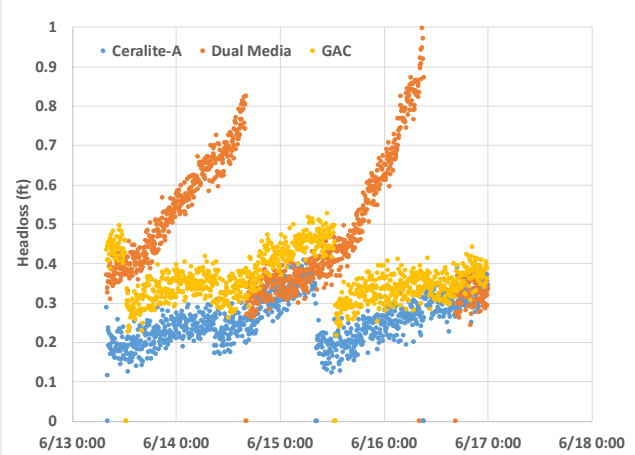


Figure 2 Comparison of Filter Media Head-loss



Conclusions:

This pilot testing demonstrated that:

- ***Ceralite-A was the best performing media for the support and growth of microorganisms such as nitrifying bacteria.***
- Complete nitrification could be achieved within 10 weeks from start-up in the Ceralite-A filter. Consistent nitrification performance was demonstrated for the subsequent 8 weeks of filter operations.
- ***Ceralite-A filter demonstrated the lowest head-loss over a 48-hour run time.*** Filter effluent turbidity in the Ceralite-A filter was higher than the dual media and GAC filters, however, the filtered water turbidities were well within acceptable limits.

Acknowledgements:

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Contact Information:

If you would like more information regarding Ceralite-A, or its application in a biological oxidation filtration treatment process for ammonia removal, please contact:

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