MicroC™ Premium Carbon Sources

WASTEWATER TREATMENT CASE STUDY
Littleton Englewood Waste Water Treatment Plant
Englewood, Colorado

Littleton Englewood WWTP:
Migrating Methanol fed Tetra® Denite® Biofiltration Systems to MicroCglycerin™

Littleton Englewood - Tetra® Denite® Filter System

Municipality: Englewood, Colorado
Facility: Littleton Englewood WWTP
Flow Design / Actual: 50 MGD / 21 MGD
Case Study Period: August 2009 - January 2010
Treatment Technology: Tetra® Deepbed™ Denite® System with individual TETRAPace® Control System
Previous Carbon Source: Methanol
Carbon Source Trialed:

MicroCglycerin™

Background

Given the significant safety and price fluctuation issues associated with methanol usage, the Littleton-Englewood plant embarked on a test program to investigate the effect of using non-methanol carbon sources in the TETRA® Denite® system. A literature review indicated that many attempts to use non-methanol carbon sources in downflow denitrification filters ignored the fact that the filter operation itself may require modifications because of differences in yield and kinetic characteristics of alternative carbon sources relative to methanol. The trial was aimed at determining the effect of using alternative carbon sources on the operations of a tertiary effluent deep-bed biological denitrification process. We also aimed to determine the operational parameters that could be optimized to enhance the capacity of deep-bed filters to handle non-methanol carbon sources. MicroCglycerin™ was selected as the carbon source for the trial.

Flow was 21 MGD at the time of the study, with approximately 2.6 MGD flow through each of the eight filters. Six filters were operated in denitrification mode with carbon feed, while the other 2 filters are operated in filter-only mode. One of the six filters in denitrification mode was fed with MicroCglycerin™, while the other five methanol fed filters provided a comparative basis for evaluating the results. The backwash scheme to each filter could be individually controlled. Influent and effluent data can be found in the table below.

Table 1: Comparative Effluent Performance Post Optimization

	Influent	Effluent		
		Control Filter	MicoCglycerin™ Filter	Methanol Filter
Flow (MGD)	20.46	2.59	2.50	2.51
Ammonia (mg/L)	0.79	0.10	0.10	0.15
NOX-N (mg/L)	20.04	19.10	2.10	2.00
O-Phosphate (mg/L)	2.89	2.76	2.30	2.70
TOC (mg/L)	2.39	2.16	2.30	2.05
Total Nitrogen (mg/L)	20.83	19.2	2.20	2.15
TN % Removal		5.9%	89.2%	89.5%

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Challenge: Migration from methanol to MicroCglycerin™

Different carbon sources have correspondingly different yields associated with their usage. The most critical metric that determines how much carbon is used for denitrification is the COD:N ratio. The solids yield measures the quantities of solids (measured as VSS or COD) that are formed per unit of COD consumed for nitrate removal. The differences in COD:NO3-N and solid yields imply that for the removal of the same quantity of nitrates, different quantities of carbon (measured as COD) will be required and by extension, different quantities of new bacterial cells will be formed during the nitrate removal process. The figure below illustrates the factors to consider and process optimization steps action that may be required when using different carbon sources in downflow denitrification filters.

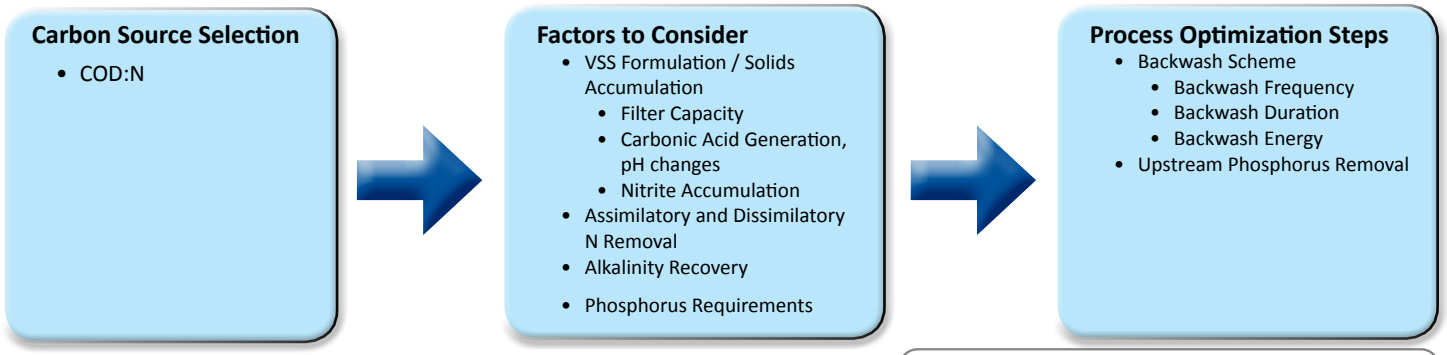


Figure 1

Results and Discussion

The accumulation of solids in the MicroCglycerin™ fed filter using the same backwash scheme as methanol was demonstrated (Figure 2).

Using the same backwash scheme as for a methanol fed system, Nitrite accumulation was observed in addition to the solids accumulation. The result was an overall NOx-N removal of about 60% compared to about 89.5% for the Methanol fed filters.

We investigated the effect of extending the backwash duration on solids accumulation and found that implementing a strict daily backwash regimen and extending the duration of the backwash by 5 minutes was sufficient to reach equilibrium with respect to solids removal in the MicroCglycerin™ fed filter versus the methanol fed filter. This was determined by measuring the VSS levels in the backwash liquid at given intervals (Figure 3).

Next, optimal filter bed solids control for the MicroCglycerin™ fed system was established and total Nitrogen removal in the MicroCglycerin™ and methanol fed filters was equal, demonstrating that alternative carbon sources can be applied as an effective replacement for methanol in biofilter operations (Figure 4).

This study showed that non-methanol carbon sources, such as MicroCglycerin™, can achieve equal TN reduction in tertiary deep bed denitrification filters such as the Tetra® Denite® Filter System. A second important finding is the importance of operational modifications to the solids removal mechanism (backwash scheme) to account for the higher yield of non-methanol carbon sources.

Figure 2: Backwash TSS Profile

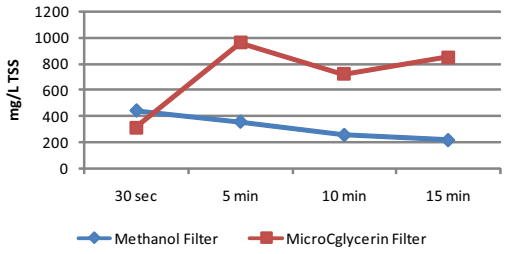


Figure 3: TSS Profile in Backwash Liquid

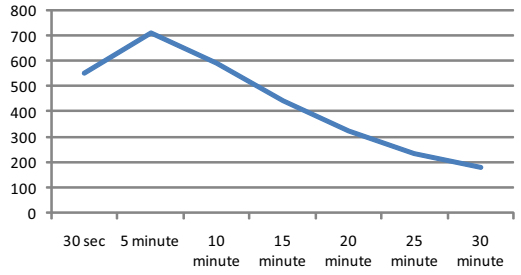
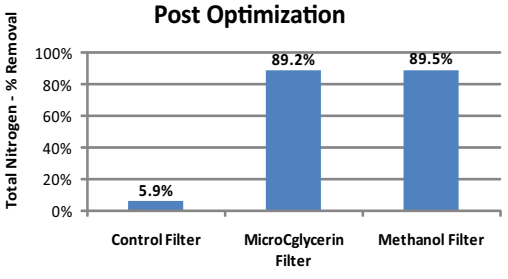


Figure 4: TN % Removal - Post Optimization



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