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Removal of High Ammonia Levels from Municipal Wastewater Using Humic Acid and Selective Bio-Augmentation

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Objective:

The purpose of this project was to evaluate the feasibility of applying Bio-Regen Municipal (BRM), a blend of pharmaceutical grade Humic Acid (98.5%) and a blend of highly specific stabilized bacteria, to remove high concentrations of ammonia from a package wastewater treatment plant operating at a 270-site recreational campground. BRM was selected from a series of waste-specific Bio-Regen products (BRM-Animal, Paper, Food, Textile, etc.) that had shown similar reduction of various contaminants. Numerous discharge violations over several years of operation along with more stringent limits and monitoring requirements made it imperative that a solution be found. Without an "operational solution" the campground would likely have to upgrade the treatment plant at considerable expense.

Background:

During seasonal operation (May-November) the treatment plant receives high strength wastewater from recreational trailer black water tanks. This water is typically anaerobic and/or has been aseptically stabilized by the addition of a bacteriostatic tank additive. These additives often contain formaldehyde or glutaraldehyde based biocides to control the anaerobic activity in the waste tank until it can be discharged.

Flows to the treatment plant during the week days (M-F) were on the average of 500-600 gpd with Saturday and Sunday contributing 2500-3000 gpd. Flows in excess of 4000 gpd have occurred but are not common.

The treatment plant configuration consists of diffused aeration, surface skimmers, sludge recycle, a 4000 gal equalizations tank (EQ), 10,000 gal aeration, 1700 gal clarifier, 210 gal chlorine contact chamber and a 1500 gal waste sludge holding tank and is operated as an extended aeration facility. Influent carbonaceous 5-day biological oxygen demand $CBOD_5$ and Ammonia (as N) were typically 230-260 mg/l and 230-250 mg/l respectively. Plant operations were adjusted by periodic measurement of O_2 (maintained at 1.5 mg/l and above) and Imhoff cone settling tests for sludge volume, wasting requirements and effluent quality. Seasonal NPDES discharge limits for the treatment plant are shown in Table 1.

Table 1

Seasonal NPDES Discharge Limits (monthly average)

Sample Period	NH_3-N (mg/l)	$CBOD_5$ (mg/l)	TSS (mg/l)
5-1 to 10-31	2.80	25	30
11-1 to 4-30	8.40	25	30

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Bio-Regen Dosing Program

Based on the liquid holding volume of the EQ tank (4000 gal) a one-time inoculation dose was "shot fed" to the EQ tank at a concentration of 100 ppm-as product. The 100 ppm shot feed level was determined from other applications where it was shown to activate the stabilized bacteria and initiate a rapid reduction of nutrients, and BOD. A diaphragm chemical feed pump was then used to flow-proportionately feed a concentration of 40 ppm for the remainder of the campground season. Because of the late start and subsequent shorter duration of the campground season, it was not possible to fine tune or trim the Bio-Regen feed rate below 40 ppm.

Results and Discussion

Table 2 and **Figure 1** present plant influent and effluent ammonia levels for the period of May-Oct. Prior to the addition of BRM, influent ammonia levels ranged from 60 mg/l – 256 mg/l while pre-BRM effluent ammonia levels ranged from a low of 3.2 mg/l to a high of 55 mg/l. Prior to the addition of BRM, the lower effluent levels of ammonia (3.2 mg/l) were attributed to little or no activity/visitation at the campground. This correlates to the lower influent ammonia concentrations shown in late May. Further into the summer months, the activity of the park increased as did the effluent ammonia levels (see dates of 6-3 thru 6-29). BRM was introduced on July 6, 2004 and within 7-days the plant effluent ammonia levels plummeted to a high of 3 mg/l, a low of 0.5 mg/l, with a resultant average of 1.29 mg/l over a 106-day evaluation period. Influent ammonia levels remained at or above 200 mg/l during the same evaluation period.

Summary

At the end of the 15 week performance evaluation period, data shows that addition of Bio-Regen Municipal will significantly reduce high NH_3-N levels in extended aeration treatment plants. On-going application in other facilities (sequencing batch reactors - SBR, conventional activated sludge, etc.) has also shown a considerable reduction of ammonia. Identifiable benefits of using BRM were:

- ∞ Rapid Regulatory Compliance
- ∞ Low application cost
- ∞ Low cost of feed equipment requirement and/or design
- ∞ Significant reduction or elimination of capital expense for plant improvements and/or expansion
- ∞ Simplicity of application
- ∞ Environmentally safe and non-hazardous to facility personnel
- ∞ Product shelf life of 3-years

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Table 2

Influent and Effluent Analytical Data			
Date (2004)	**Effluent NH_3-N (mg/l)**	**Influent NH_3-N (mg/l)**	**Effluent $CBOD_5$ (mg/l)**
5-12	4.8	60	5
5-26	3.2		6
6-3	28	266	5
6-8	30		--
6-23	14	256	9
6-29	36		--
7-6*	55	220	6
7-13	3		--
7-21	1.2		9
8-4	1.3	210	3
8-18	1.2		3
8-24	0.5		--
9-1	1.2	260	4
9-14	1.3		4
10-7	0.8	200	4
10-20	1.1		6

*BRM addition started on 7-6-2004

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Figure 1

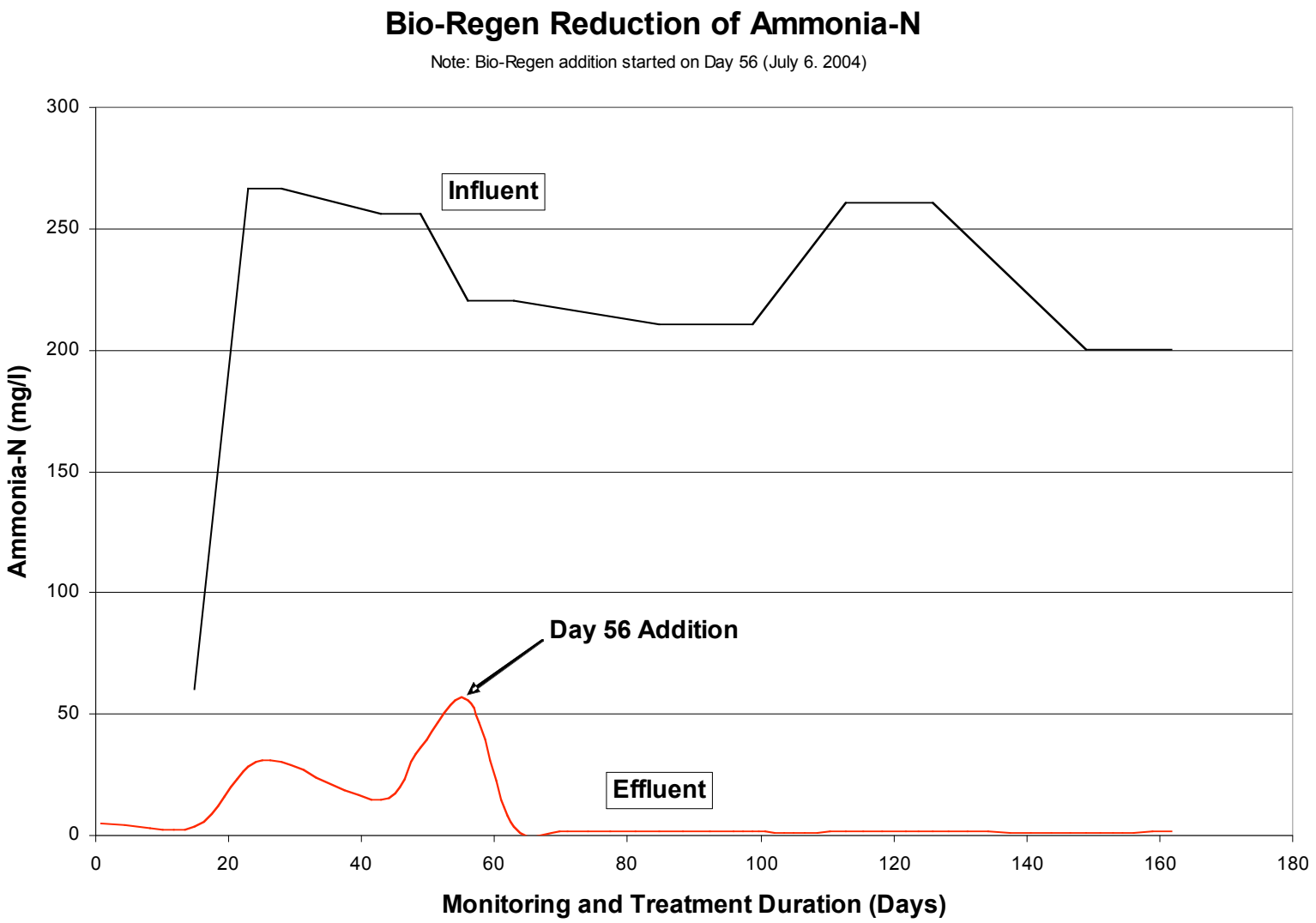

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Figure 2