

AERO & NUTREX Restores Tainan Canal (Taiwan)

June 1, 1999- June 18, 1999

BIOFEED SOLUTIONS, INC. FIELD STUDY # ENV-5 "The next generation of probiotic technology"

INTRODUCTION

Agents of BioFeed Solutions, Inc., and Environmental & Infrastructural Technologies, Inc. (EIT) demonstrated the dynamics of BioFeed products in the Tainan Canal for 17 days before and during the annual Dragon Boat Race. Approximately 35,000,000 gallons (132,475 m3) of untreated sewage is discharged on a daily basis into the Tainan Canal. This has decimated the ecological components of the canal by severely degrading the health of the flora and fauna within the canal. Extremely low dissolved oxygen (DO) levels combined with high BOD/COD and suspended solids levels enhance the anaerobic decomposition of organic matters, which produces putrid odors from the canal.

PROCEDURE

On June 1, 1999 one hundred and ten (110) gallons of AERO and NUTREX were sprayed from a boat along a 2,400 meter stretch of the canal. Additionally on the same day, 110 gallons of AERO and NUTREX were added into the city sewer system upstream of the canal discharge point which has a flow rate of 9,326,260 gpd (35,300 CMD). This protocol continued for 17 days with additional product dosing in areas where the odors were still objectionable or the daily discharge rate was higher than normal. A total of 4,024 gallons of AERO and NUTREX was added during the 17 days.

TESTING

Sampling Point	DO (mg/L)	BOD/COD (mg/L)	NH3-N (mg/L)	SS (mg/L)
Anyi Bridge	0.2.6	1.3-32.9	3.3-14.9	N/A
Loli Bridge	0	11.2-44.9	7.1-17.2	N/A
Linan Bridge	0	13.8-76.3	7.0-26.7	N/A
Anping Harbor	2.22	0.5-4.0	0.1-2.7	N/A
*Sampling by Daniel Chou(EIT) from Dec. 7, 1993 to April 8, 1994				
Chentien Bridge	1.22	15.17	2.20	35.7
Wanyue Bridge	0.88	14.33	2.78	28.3
Linan Bridge	0.40	17.00	3.36	40.8
Hsinnan Bridge	0.13	24.67	4.93	15.0
Chunghwa W.Rd. Bridge	0.00	22.83	4.71	17.0
*Data provided by Kaohsiung Harbor Bureau in 1990, 1992				
Chentien Bridge	N/A	105/144	N/A	48
China Town	N/A	99/208	N/A	40
South Exit	N/A	90/144	N/A	43

Sampling Point	DO (mg/L)	BOD/COD (mg/L)	NH3-N (mg/L)	SS (mg/L)
*Data provided by Tainan Environmental Protection Bureau				
Wanyue Bridge	4.8	20.4	1.7	12.8
Linan Bridge	5.2	26.9	2.0	18.2
China Town	6.2	24.3	0.6	14.6
*Sampling by EIT from June 10 - June 17, 1999				

RESULTS

Approximately 4 days after the addition of AERO and NUTREX into the Tainan Canal, some significant effects were already noticeable. The putrid odors emanating from the canal were eliminated and replaced by the smell of seawater and algae. Most of the volatile organic compounds (VOCs) that contribute to odor problems in wastewater are mercaptans, organic sulfides, polysulfides and thiophenes. Some other compounds that contributed to odor problems are organic acids, phenol and p-cresol. Because these unique products contain enzymes capable of splitting the water molecule, thereby releasing molecular oxygen and hydrogen, odor causing compounds are buffered and readily oxidized by spraying the combined products over the surface of the water. Hydrogen sulfide, methyl mercaptan and amines are oxidized to sulfur, methyl sulfonic acid and amine oxides respectively. Besides oxidation by chemical means, odorous gas oxidation by microbial action also occurs rapidly. Biofeed products stimulate the indigenous photosynthetic bacteria (chlorobium chromatiaeeae and chlorobiaceae) which use hydrogen sulfide (H₂S) as an electron donor in photosynthesis and oxidize it to elemental sulfur and sulfate.

Another significant effect was the presence of numerous fish in the area of sewage discharge where the largest volume of Biofeed products was added. Dissolved oxygen (DO) is a good indicator of the overall health of a river. Although other indicators also signify general health, an adequate supply of oxygen is essential for animal life. For many species of fish, DO levels below 6 mg/l for any length of time can be lethal. The most significant effect of Biofeed products is the stimulation and proliferation of beneficial aerobic bacteria. Some aerobic microorganisms have the ability to produce molecular oxygen via photosynthetic reactions. Due to the combined oxygen release by AERO and NUTREX and the photosynthetic increase of oxygen levels in the aquatic environment enhance the aerobic decomposition or bio-oxidation of organic matter and eliminate the production of ammonia, nitrite and hydrogen sulfide, all of which are toxic to fish. Along with an increase in the DO levels, the BOD/COD levels and suspended solids decreased significantly.

The water in the canal on Wednesday, June 9, 1999 appeared to be visibly more greenish instead of the brownish color in prior weeks.

The applied BioFeed products had a significant effect in aiding in the reestablishment of many of the former ecological components of the Tainan Canal in a very short time period. Reestablishing areas of habitat and river process integrity are important objectives if we are to maintain any semblance of a self-sustaining river ecosystem impacted by human mismanagement. The daily addition of a relatively small amount of AERO and NUTREX significantly improved the ecological health of the Tainan Canal and over a longer period of time could reestablish the health of the flora and fauna within the canal. It can also be noted that for the first time in many years, the citizens of Tainan enjoyed an odor free Dragon Boat Race day on June 18th, 1999.

Dedicated to preserving our environment by renewing the life in our soils and water.