CASE STUDY – TREATABILITY STUDY FOR PEMEX OIL REFINERY SALAMANCA, MEXICO – MIXED USE INDUSTRIAL AND MUNICIPAL WASTE WATER TREATMENT PLANT FEASIBILITY

THE PROBLEM

Both PEMEX and the City of Salamanca were looking at constructing two sewage treatment plants to treat wastewater; one to treat the Ing. Antonio M Amor refinery's industrial waste and one to treat the City's municipal waste. Based on the successful performance of Nordevco's technology in remediating contaminated wash water at the decommissioning of the PEMEX La Nogalera petroleum storage facility in Guadalajara, Nordevco was commissioned to conduct a treatability study of its capability to treat both the refinery wastewater and the municipal waste water.

OUR APPROACH

Based on a review of the two waste streams, Nordevco's technical staff determined that the most effective solution would be to treat both waste streams in one facility. To demonstrate that capability, the Consorcio Quimico de Toluca in Toluca, Mexico, an independent laboratory, was commissioned to carry out treatability studies to evaluate the effectiveness of the Nordevco technology. To model a sewage treatment system, a three chamber system was constructed: a 12 liter waste storage tank, 9 liter aeration tank and a 4.5 liter sedimentation tank. Nordevco technical staff designed a series of three tests to assess the effectiveness of the BactiDomus® Technology to treat refinery waste, a mixed waste stream (57% refinery waste and 43% Salamanca municipal waste) and a final test to compare the BactiDomus® Technology's effectiveness to treat the mixed waste to a treatment with activated sludge from a wastewater treatment plant.

THE TECHNOLOGY

Nordevco's BactiDomus® Technology was developed by a diversified group of research scientists working together at Universities in Belgium and France. Their goal was to create a mechanism with the flexibility to delivery biological solutions to a range of environmental issues more effectively and efficiently

The foundation for the success of the BactiDomus® Technology was the development team's clear understands that for any carrier material to be successful it had to meet specific underlying needs of the organisms:

- Regardless of the organisms used, they would be cultured in a sterile laboratory and would require time to acclimate to the environment they were activated in.
- Microorganisms, like humans, do not exist or thrive in isolation of each other but rather rely on others for stimulation and competition;
- Organisms prefer to grow and live in colonies or flocs and prefer to attach to something to anchor these colonies;
- Individual species of microorganisms do not work in isolation to break down organic compounds. To successfully break down any organic completely to CO2 and H20, a variety of different organisms are required;

The result of that work is the BactiDomus® Technology which is based on the use of an inorganic limestone-like porous carrier material. The porosity of the material allows it to be bathed in a nutrient broth, absorbing key micro-nutrients that act as an initial food source when the product is activated. It is then impregnated with a range of different naturally occurring and non-pathogenic organisms, selected for their ability to breakdown specific organic contaminants.

The organisms selected for inclusion are selected based on the understanding that each contaminated environment can be aerobic, anaerobic or facultative anaerobic. Therefore, aerobic, anoxic and anaerobic organisms are selected and used in each product to ensure that they can function successfully in a broad range of environments.

The carrier material's large surface area to size ratio provides the organisms with both internal and external floc points where they grow and create large effective colonies of biodegraders working together to break down the organic contaminant into carbon dioxide and water.
The carrier material's hydrophilic nature allows it to absorb both the water and contamination. This provides a steady strong contact between the imbedded organisms and organic contaminant. This ensures that the organisms have a continuous food source as they grow and create flocs within the protective confines of the capillary network of the carrier material.

THE RESULTS

TEST 1: TREATMENT OF A MIXED WASTE WATER SAMPLE, USING BACTIDOMUS® TECHNOLOGY

	Retention Time: 6 hours			Retention Time: 8 hours			Retention Time: 12 hours			Standard	
Parameter	Influent (mg/l)	Effluent (mg/l)	Removal Efficiency (%)	Influent (mg/l)	Effluent (mg/l)	Removal Efficiency (%)	Influent (mg/l)	Effluent (mg/l)	Removal Efficiency (%)	SEDUE	EPA
BOD5	235	28	88	252	26	90	269	25	91	60	26
COD	484	76	81	456	66	85	508	55	89	100	100
SS	197	30	85	210	28	87	222	27	88	70	21
VSS	113	38	-	125	38	-	136	38	-	-	-
D.O.	-	-	-	-	-	-	-	-	-	-	-
pH	7.2	7.2	-	7.31	7.29	-	7.41	7.38	-	6-9	6 - 9
N	23	5	-	24	5.5	-	24	6	-	-	-
PO4	14.9	2.8	-	14.1	2.8	-	13.2	-	-	-	-
Phenoles	0.1	0.005	93	0.25	0.003	94	0.4	0.002	95	-	-
Grease and Oil	109.2	11.1	90	108.2	8.7	92	107.8	6.4	94	40	8

The Nordevco BactiDomus® Technology was able to treat the mixed waste (57% refinery waste and 43% municipal waste) and meet all SEDUE (Mexican Environmental Standards) standards within six hours and the EPA standards for BOD_5, COD and pH. Within twelve hours, the EPA standard for oil and grease was also met.

TEST 2: TREATMENT OF REFINERY WASTE WATER USING BACTIDOMUS® TECHNOLOGY

	Retention Time: 6 hours				
Parameter	Influent (mg/L)	Effluent (mg/L)	Removal Efficiency (%)	Standards SEDUE	Standards EPA
BOD5	243	47.9	80	60	26
COD	531	96.1	82	100	100
SS	98	25.6	74	70	21
VSS	90	-	-	-	-
D.O.	-	-	-	-	-
pH	8.71	7.61	-	6 - 9	6 - 9
N	20	-	-	-	-
PO4	0.2	-	-	-	-
Phenoles	3.91	1.36	65	-	-
Grease and Oil	138	18.31	87	40	8

The Nordevco BactiDomus® Technology was able to treat the refinery waste) and meet all SEDUE (Mexican Environmental Standards) standards within six hours and the EPA standards for BOD_5, COD and pH.

TEST 3: COMPARISON OF BACTIDOMUS® TECHNOLOGY TO NATURAL BACTERIAL FOR TREATMENT OF MIXED WASTE WATER

		Nordevco Technology		**Natural Bacteria**	
		Retention Time: 6 hours		Retention Time: 24 hours	
Parameter	Influent (mg/l)	Effluent (mg/l)	Removal Efficiency (%)	Effluent (mg/l)	Removal Efficiency (%)
BOD_5	235	28	88	66	72
COD	404	76	81	117	71
SS	197	30	85	-	-
VSS	113	38	-	-	-
D.O.	-	-	-	-	-
pH	7.2	7.2	-	7.41	-
N	23	5	-	-	-
PO4	14.9	2.8	-	-	-
Phenoles	0.1	0.005	93	-	-
Grease and Oil	109.2	11.1	90	20	82

The BactiDomus® Technology was more efficient in treating the mixed waste (57% refinery waste and 43% municipal waste) than the activated sludge. The BactiDomus® Technology was able to achieve an approximately 11% greater removal efficiency rate in six hours than the activate sludge was able to achieve in 24 hours.

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