syntekenvironmental
industrial wastewater treatment and reuse

TECHNICAL CASE STUDY

Ecosynergy® system application in treatment of wastewater from Beverage Can Manufacturer

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Type of industry

The Ecosynergy® bio-engineering treatment process has been applied at a beverage can manufacturer wastewater treatment plant. The beverage can wash process generates wastewater containing lubricant oil, solvent, aluminium, sulphate, ink, oil and grease. During maintenance period, concentrated waste may enter the treatment system, causing problems such as poor water quality, large amount of chemical use and excessive fresh water use.

Existing treatment process

Before the introduction of the Ecosynergy® system the wastewater was typically treated by flow balance, pH correction, coagulant and polymer dosing and settlement. The chemical sludge is dewatered by a filter press or vacuum paper filter. The oily waste is treated by using sulphuric acid to break the emulsion and free oil and sludge are disposed at expense.

Problems need to be solved

High sludge volume and disposal cost.

Chemical usage and high cost.

Membrane fouling problem caused by FOG content.

What is Ecosynergy® process

The Ecosynergy® system has been developed with the aim of reducing capital costs and space restraints when a biological treatment application is required in treatment of industrial wastewater. It is based on the concept of simulating of the natural ecosystems where syntrophic interactions are formed between the interspecies. The degradation of organic and some inorganic compounds can be enhanced where selected specialized bacteria or bacteria as plasmid donors for degradative pathways are added. The system is designed to provide a combined growth environment under aerobic

How Ecosynergy® process is applied

Initial investigation to solve the plant problems required laboratory scale bench trials of the various synergistic bacteria combinations in aerated samples of plant wastewater. From the lab trials appropriate bacterial consortia were chosen for plant trials. Process analysis was then carried out to determine the best points to add the bacteria into the system. This analysis consisted mainly of determining retention times in various stages of the process and determination of effective aeration, mixing and temperature regimes. No major modifications were made to the existing layout except for the introduction of aeration discs in the balance tank and biological reactor and the discontinuation of unnecessary chemical dosing.

Achieved outcomes

The Ecosynergy® system has been implemented for treating the “dirty stream” where oily waste is degraded by specifically formulated bacteria targeting oil and grease, solvent, and metals. The treated effluent is then blended into the main stream waste, and treated by naturally derived non metal based low molecular weight chemical products. The sludge volume has been reduced by 70%.

By separating and treating the concentrated “dirty stream”, the main stream wastewater treatment system is much more able to cope with the changing loadings due to plant operation and maintenance works. The effluent had greater water quality meeting all water board discharge limits to the sewer.

Odour Reduction

Odor generated by storage of waste oil has been eliminated after the concentrated “dirty stream” being treated biologically.

Sludge Reduction

Sludge reduction is achieved by using specifically formulated synergistic bacteria rapidly digesting the oily waste in the wastewater.

Treated water quality: chemical treatment vs. biological treatment

Historical discharged water analysis results and after biological treatment without using chemicals:

parameter	Concentration in composite sample 10-Jan-08	Concentration in composite sample 18-March-08
Suspended solids (mg/L)	21	18.3
Sulphate (mg/L)	1630	176
Aluminium (mg/L)	2.48	0.90
Oil and grease (mg/L)	14	1.41
BOD (mg/L)	47	7.97
pH (start)	8.2	8.0
pH finish	8.6	8.2

Chemical usage reduction

As biological treatment acts as naturally occurred coagulation process, the usage of normally applied metal based coagulant can be reduced by 40% after 1-2 weeks of application of synergistic bacteria.

“Natural floc,” developed using gel type material derived from natural products blending with synthetic organic product, replaces the conventional coagulant and polymer mixture, and further reduces the sludge volume by 30-40%.

The use of “Natural floc” in lieu of metal based coagulant and polymer (usually cationic based) has the following benefits;

1) Cost reduction.
2) Sludge volume reduction by 30%.
3) Minimising membrane fouling in downstream membrane plant for reuse.

Operating costs reduction

By implementing the synergistic bacteria control system, using the naturally derived chemicals the total operating cost for wastewater treatment has reduced by over 30% at this site.

Water Reuse

It has been found that chemically treated wastewater normally contains residual long chain polymeric material may bind the membrane surface during operation of reuse plant. Frequent membrane cleaning is required and this results in high operating costs. The feasibility of sustainable operation of reuse plant is largely dependent on the pre treatment process, where chemical usage is minimised.

Over 7 months trials of biological treatment of the beverage can wastewater and downstream micro-filtration and reverse osmosis reuse have been carried out prior to installation of the complete reuse plant. The membrane plant operation involves minimal chemical usage. The VPMF (variable pore micro filter) operates as pretreatment for reverse osmosis membrane or nano membrane system and does not require chemical cleaning. The recovery rate of VPMF system is 100% as its reject contains a high level of biomass which is returned back to the biological process. The reverse osmosis or nano system is operated at 85% recovery. The cleaning regimes involve auto flush with permeate, and soak chemical cleaning after every 2-3 months of continuous operation. The estimated reuse water cost is $0.7-0.8/kL.

Reuse plant trail results:

parameter	Pre VPMF 11.7.08	Post VPMF 11.7.08	Nano concentrate 11.7.08	Nano permeate 11.7.08
BOD (mg/L)	44	33	63	<5
COD (mg/L)	640	272	670	<50
Suspended solids (mg/L)	132	23	13	<5
Oil and grease (mg/L)	21	6.0	28	<2
Aluminium (mg/L)	13	2.5	2.0	<0.1
Sulphate (mg/L)	540	355	665	<10
TDS (mg/L)	1070	787	1220	121
Chloride (mg/L)	<40	<40	<40	26

Standard plate count for post VMPF/post UV is ~22 cfu/ml

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