syntekenvironmental
industrial wastewater treatment and reuse

TECHNICAL CASE STUDY

Ecosynergy® system application in treatment of wastewater from Pet Food Manufacturer

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Type of industry

The Ecosynergy® bio-engineering treatment process is being applied at a major manufacturer of pet foods. Both wet and dry pet foods are produced at this site. The main raw materials consist of byproducts of meat, poultry, and seafood, feed grains, and soybean meal. Wastewater is produced from cooking, blending and shaping, steam sterilization, cooling and cleaning operations. The wastewater contains high levels of protein, carbohydrates and fats, oil and grease.

Pre-existing treatment process

Before the introduction of the Ecosynergy® system the wastewater was treated by coarse screening, flow balance, coagulant and polymer dosing in a mixing tank followed by a DAF unit and a biological reactor operated by sequential decanting to reduce BOD and TSS.

Problems need to be solved

- Plant waste flow increased from 120KLD to 650KLD.
- The treatment facility was not sufficient to treat wastewater at high flow rates and solids loadings.
- Odor in the plant area.
- The sludge generated from DAF and bio reactor required pumping out frequently, at least once daily, and sometimes twice a day. Each pump out was 15 to 20 tonne.
- Increased chemical usage and costs.
- The treated water quality was deteriorating with BOD and TSS levels climbing up.

What is the 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 simulation of the natural bacterial ecosystems so that synergistic interactions are formed between the species in the population. 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 growth environment under aerobic and anaerobic conditions. Further enhancements to water quality are also achieved by the application of a natural coagulant and various novel membrane filtration systems.

How the Ecosynergy® process is applied

The Ecosynergy® system was first recommended for this site after its success in odor reduction and sludge reduction in other food processing industries. Syntek Environmental, the owner of the EcosynergyTM system, was engaged as a consulting company to implement the required process applications.

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

After the introduction of the Ecosynergy® system there was a significant reduction in odour and sludge. The system was much more able to cope with high flow rates and changing solids loadings due to the consideration given to retention times, multiple dosing points and dosing levels. The effluent had greater water quality, meeting all water board discharge limits to the sewer.

Odour Reduction

Odor generated by volatile organics has been controlled immediately after the application of synergistic bacteria. The existing odor control chemicals have been discontinued. Biological control of odor works by breaking down the foul smelling organics rather than suppressing the smell via chemical odour masking.

Sludge Reduction

At increased plant wastewater volume and solids loadings, the volume of sludge generated has been reduced from 200 tonnes per week to 33 tones per week. A novel technology for converting the sludge and other sources of solid waste from site to organic fertilizer is currently being assessed and trialed.

Improved water quality

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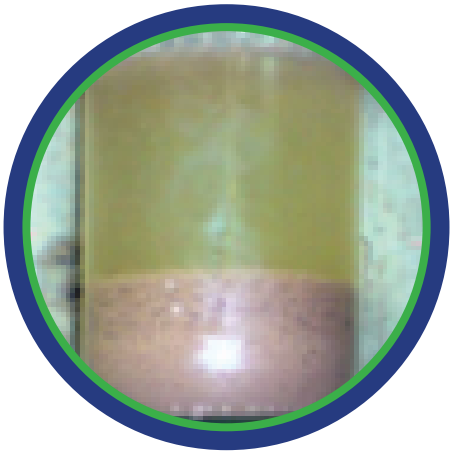
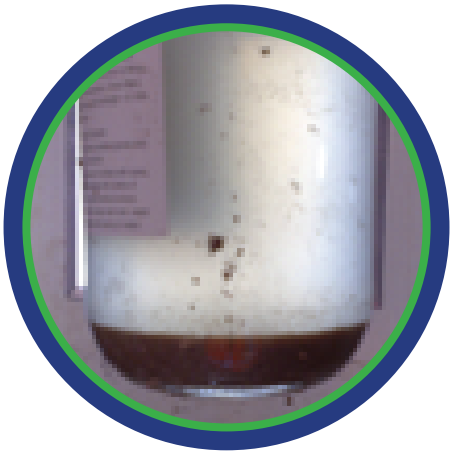
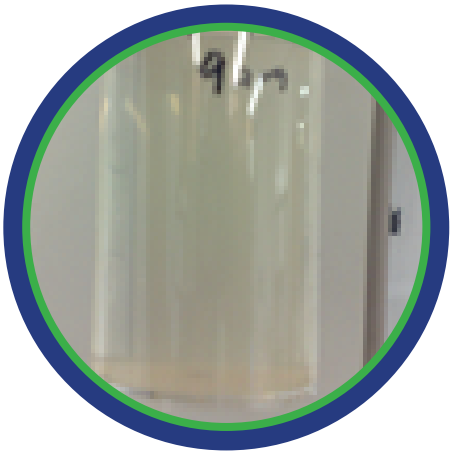


(a) Effluent in reactor before



(b) after 2 weeks



(c) discharged effluent

At a limited retention time of around 24 hours, the effluent quality has improved with concentrations of all parameters of concern consistently meeting the water board effluent discharge limits.

Chemical usage reduction

As the Synergy biological treatment acts as a natural coagulation process, the usage of normally applied metal based coagulant can be reduced 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, was used to replace the conventional coagulant and polymer mixture, and further reduced 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) Minimizing membrane fouling in downstream membrane plant for reuse.
4) Reduced hydrocarbon concentration in sludge.

Operating costs reduction

By implementing the synergistic bacteria control system, and using the naturally derived chemicals, the total operating cost for wastewater treatment has reduced by over 50% at this site.

Water Reuse

Further process modifications, including novel membrane filtration techniques, have been trialed in order to reuse the treated wastewater in the plant. High quality reuse water can be used for cooling towers, hot water plant, hose down facilities and cooking retorts. The plant trial proves that over 85 % of the wastewater currently being discharged to sewer could be reused.

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.

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