



Water & Waste Management

**BioRemove™ COD SP
and BioRemove™ HC**

Petrochemical & Refining

Case study: Improved stable operations

Rethink Tomorrow

novozymes® 

The application of BioRemove™ COD SP and BioRemove™ HC to a petrochemical wastewater treatment system lead to cleaner effluent and stable operations.

Benefits

- **Reduced the overall effluent COD indicator by 23%**
- **Decreased recovery time from shock loads by more than 30%**

Background

A large petrochemical company is located in an area facing severe water shortage.

Solving the water problem has become an important part in ensuring sustainable development of the company, and recycled water at the refinery has become the focus for water conservation.

The water recycling system at the refinery primarily involves flocculation, filtration, and biological activated carbon treatment processes designed to treat secondary oil refining discharge from COD of less than 120 mg/L to less than 60 mg/L, then returning it to the circulating water system. The main process flow is as follows:

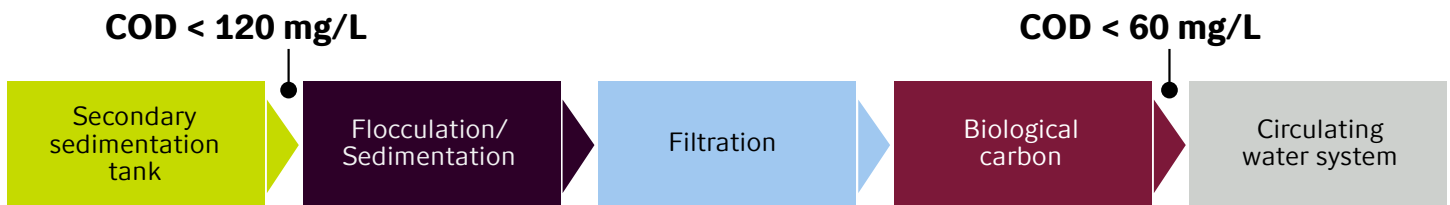


Figure 1. Diagram of the water recycling system.

The influent of the water recycling system is of poor quality due to the limited anti-shock load capacity in secondary treatment and unstable effluent from the secondary sedimentation tank. The lack of a homogenous conditioning system in the wastewater pretreatment system resulted in unstable effluent COD from the secondary sedimentation tank, reaching above 200 mg/L under shock loads and often requiring nearly a month

for system recovery. This resulted in the inability to use the water recycling system normally.

Furthermore, inadequate secondary treatment capacity resulted in its inability to meet the effluent requirements for the water recycling system stably. A regular activated sludge method is used for secondary biochemical treatment in the refining section, where the

average effluent from the secondary sedimentation tank can only reach about 150 mg/L due to high inflow loads, even when it is stable, and unable to meet the influent requirement of COD less than 120 mg/L for the water recycling system. This results in huge pressures on operation. Novozymes was contacted to assist.

Application

Novozymes technical experts visited the site and assessed the situation.

Since the plant was looking for a way to improve the effluent without incurring major capital costs, a bioaugmentation program using BioRemove™ COD SP and BioRemove™ HC was recommended to solve the plant's problem.

The secondary biochemical treatment process is traditional activated sludge process (Figure 2 shows the process diagram). BioRemove products were dosed into aeration tank #6, and the aeration tank #5 was the control line.

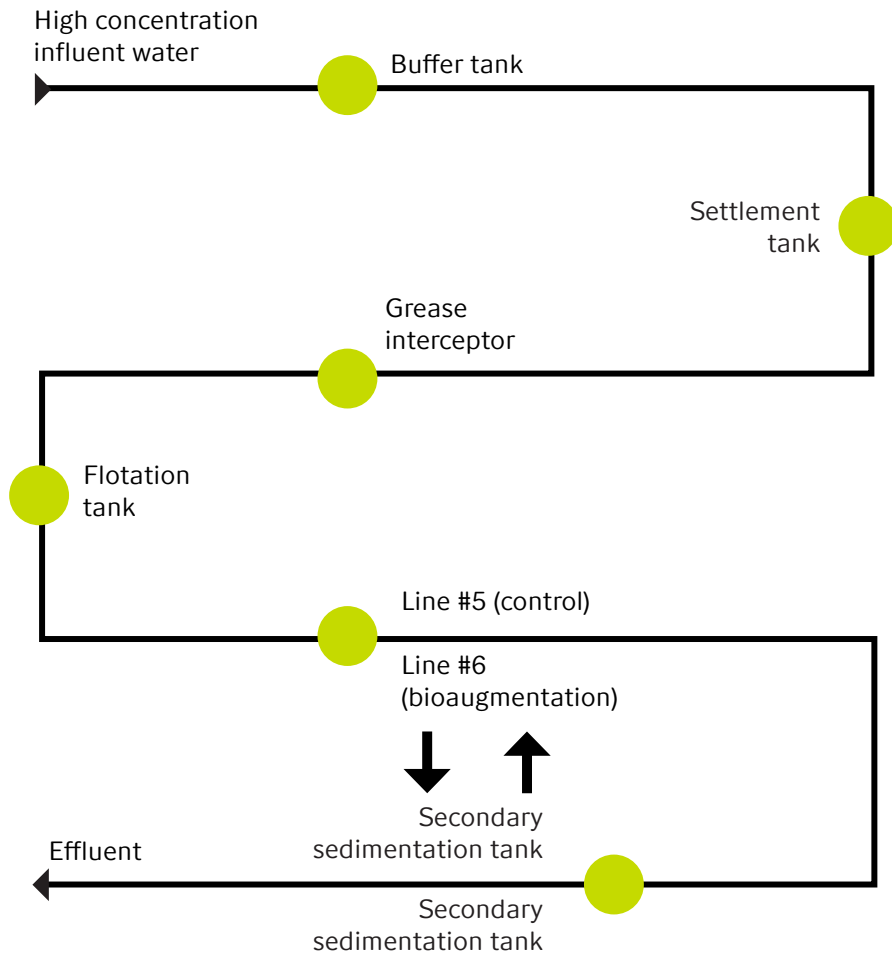


Figure 2. System diagram.

Results

The two aeration tanks were compared, and the tank dosed with Novozymes' solutions is generally superior to the control line. Even during three shock loads, which all occurred within the two months after dosing, the dosed line showed a 23% mean difference in overall COD when compared to the control line.

With the maximum difference during one shock load being nearly 200 ppm, the standard deviation reflects a 38% increase in stability with the use of bioaugmentation. Similarly, the mean COD of the control production line after the shock loads is 100 ppm, and the mean COD with bioaugmentation is only 80 ppm, a relative increase of 20%. These differences are shown in Figure 3.

COD removal

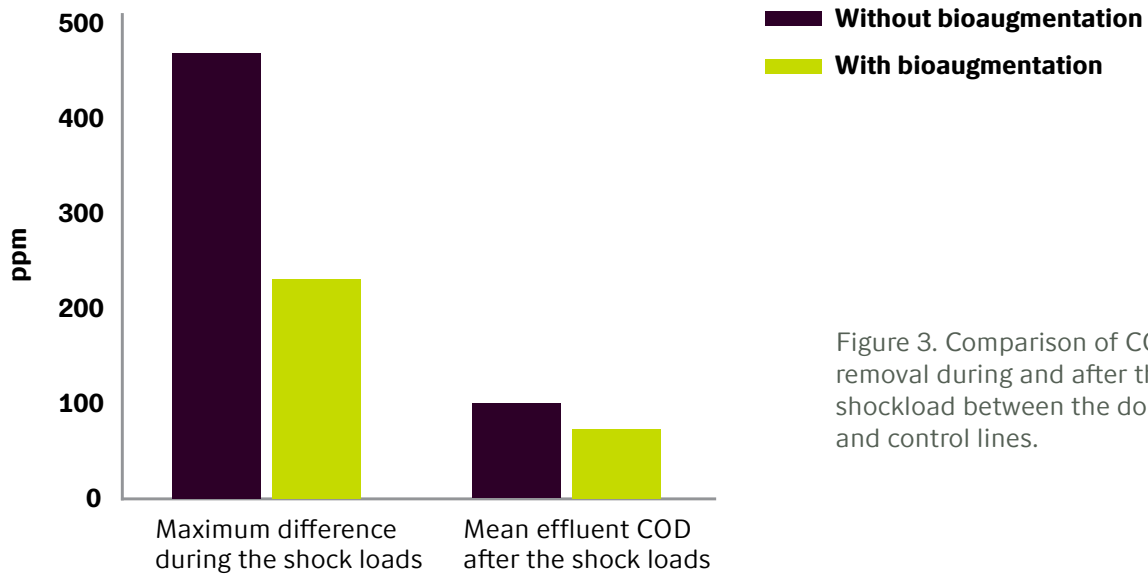


Figure 3. Comparison of COD removal during and after the shockload between the dosed and control lines.

The following is statistical data obtained over several months.

Effluent quality comparison

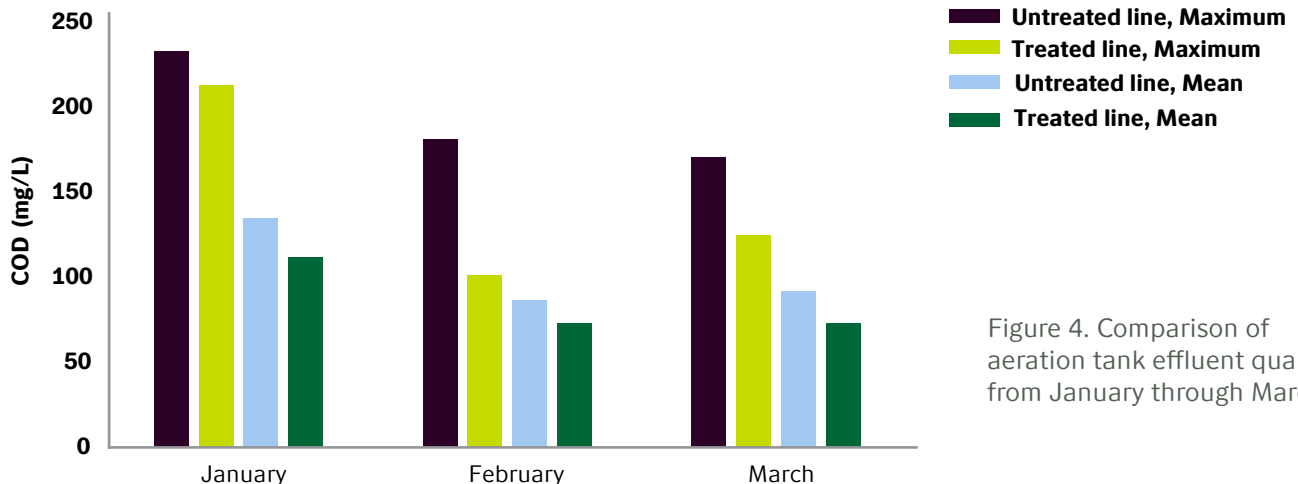


Figure 4. Comparison of aeration tank effluent quality from January through March.

It can be seen that from the data of January to March, that the effluent water quality of line #6 is much better than that of line #5 after bioaugmentation. The average COD concentration was 15%, 14% and 21% lower than the control line in the 3 months respectively. And, in February and March, the COD concentration of line #6 effluent never exceeded 120 mg/L, which is the desired water quality to feed into the recycling water system.

The trial result shows that the bioaugmentation program led to a huge improvement in effluent water quality, reducing the overall effluent COD concentration by 23% and reducing the effluent COD from 150 mg/l to less than 120 mg/l. This achieved a mean effluent COD of 80 mg/l in the stable phase, thus

meeting the influent requirements for the recycling water system in oil refining. This also reduced total COD discharge by 43.8 tons (five-month cumulative reduced by nearly 20%) and total oil discharge by 7.3 tons (five-month cumulative), greatly shortening the recovery period from shock loads by more than 30%, and stably improving the system's anti-shock load capacity.

Conclusion

Novozymes' biological program was easy to implement and provided significant benefits. The use of BioRemove™ COD SP and BioRemove™ HC resulted in:

- **Improved plant efficiency**
- **Simplified operations**
- **Lower operational costs**





About Novozymes

Novozymes is the world leader in biological solutions. Together with customers, partners and the global community, we improve industrial performance while preserving the planet's resources and helping to build better lives. As the world's largest provider of enzyme and microbial technologies, our bioinnovation enables higher agricultural yields, low-temperature washing, energy-efficient production, renewable fuel and many other benefits that we rely on today and in the future. We call it Rethink Tomorrow.

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