



Water & Waste Management

BioRemove™ Phenol and BioRemove™ COD

Petrochemical & Refining

Case study: Phenol control and filament
reduction saves USD 5,000 per day

Rethink Tomorrow

novozymes® 

A Novozymes program was developed to meet plant goals by significantly enhancing the microbial community: Strengthening it against adverse effects of chlorination, improving its phenol degradation capabilities, and lowering its filamentous abundance.

Benefits

- **Phenol reduced by more than 90%**
- **Reduced chlorine dioxide use for phenol destruction, saving USD 5,000 per day during excursions**
- **Reduced filamentous abundance without interrupting treatment**

Background

A 24.6k m³/day (6.5 mgd) refinery was having trouble maintaining phenol concentrations in its effluent. When effluent phenol concentrations exceeded 0.3 mg/L, the plant was spending up to USD 5,000 per day on chlorine dioxide to oxidize the phenol and worried that these harsh chemicals were having a negative effect on the biomass. The plant was also experiencing high TSS in the effluent.

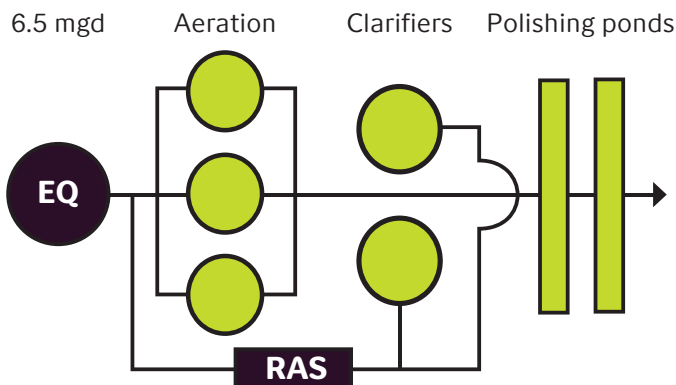


Fig. 1. System diagram.

The plant was looking for a way to cut operating costs and improve plant efficiency. The plant contacted Novozymes to see if a biological solution could provide an effective alternative to the traditional chemical solutions.

Application

Novozymes visited the site and did a comprehensive site evaluation, discovering that the existing microbial community could not consistently degrade phenol to levels below 0.3 mg/L. Furthermore, Novozymes found that there was a high abundance of filaments, which were causing poor settling and compaction in the secondary clarifiers. Plant data and microexams were used to determine that Thiothrix I, a filamentous bacterium, was proliferating as a result of rising sulfide concentrations.

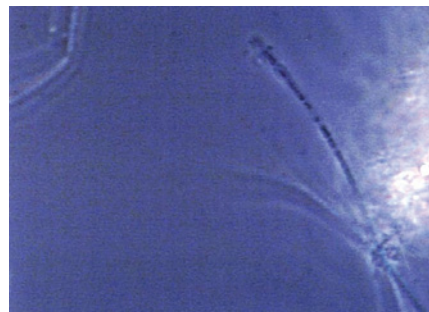
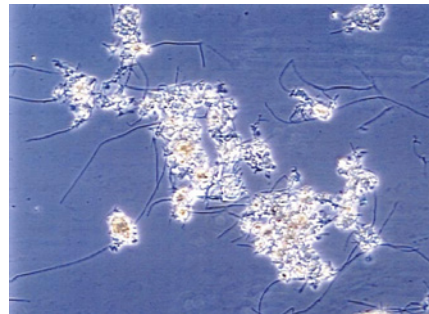


Fig. 2. Microexam results. Abundance of Thiothrix I was rated as 4 (5-20 filaments per floc particle) and floc particles were bridging together. Thiothrix I appeared healthy and contained white sulfure granules, indicating high sulfides in the wastewater

The typical treatment for reducing filamentous abundance is chlorination; however, the plant was concerned that chlorination could adversely affect the microbial community, negatively affecting phenol degradation to an even greater extent. To address both the poor phenol degradation and the proliferation of filaments, Novozymes recommended a chlorination program with bioaugmentation to maintain stable treatment. Specifically, Novozymes recommended using BioRemove™ Phenol to enhance phenol degradation capabilities and BioRemove™ COD to help strengthen the biomass during the filament chlorination program and ensure COD reduction is maintained.

Results

Soon after Novozymes' program was implemented, phenol levels were immediately reduced to below 0.3 mg/L. After the microbial community had been stabilized, effluent phenol levels were consistently maintained below 0.3 mg/L, which reduced the need for chlorine dioxide treatment altogether.

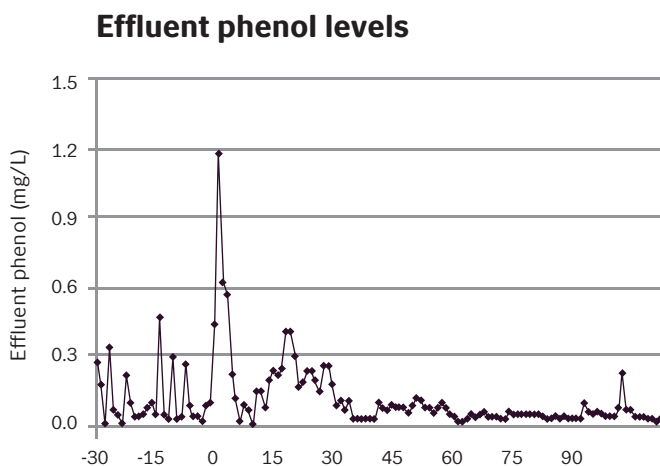


Fig. 3. Effluent phenol was quickly stabilized and remained below permit levels.

The program also resulted in substantial improvements in settling and compaction in the secondary clarifier, without negatively impacting effluent quality.

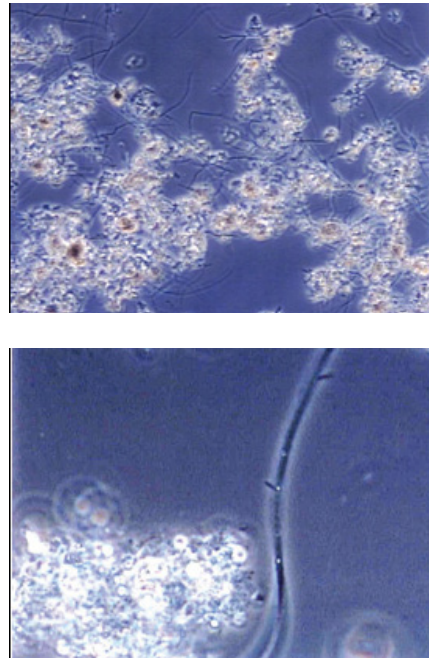


Fig. 4. Microexam results showed signs of successful chlorination. Filaments were less abundant and shorter.

Conclusion

Novozymes' biological program produced significant benefits over a strictly chemical alternative. By using BioRemove™ Phenol and BioRemove™ COD, the plant was able to reduce operating costs significantly and, at the same time, maintain effluent quality. Operation of the treatment plant was simplified by improved settling, reducing the need for chemical additions. Novozymes' program resulted in:

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



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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