MOLEAER
ADVANCING NANOBUBBLE TECHNOLOGY

NANOBUBBLES ELIMINATE ODORS, IMPROVE PROCESS EFFICIENCY AND ENERGY RECOVERY AT DANISH WWTP

Client Case Study: Stavnsholt WWTP (NOVAFOS), Denmark

Application:	Size:	Unit:	Installation:	Results:
Municipal Wastewater Treatment Plant, primary settling tank	**210 m^3/hr (1.1 MGD) or 40.000 Population Equivalent (PE)**	**Titan Nanobubble System**	**November 2022**	• **Eliminated odor issues** • **84% reduced ferric chloride usage** • **6.8% higher methane production** • **10.8% increased sludge dry matter**

Odors are inevitable while operating a wastewater treatment plant (WWTP), but when nearby community members are affected by noxious smells, WWTP's quickly receive complaints. Stavnsholt WWTP in Denmark experienced this challenge every year until the end of 2022.

Though there are many odor solutions on the market, none of them solved their odor problem well enough for the neighboring community. The use of ferric chloride ($FeCL_3$) had partially reduced some of the hydrogen sulfide (H_2S) smell but was not enough to stop the odor complaints. With the continued complaints, Stavnsholt WWTP's team had to find a new odor control solution fast. They considered completely covering the primary clarifier and treating extracted odors, though this solution was costly to implement and operate.

AN ALTERNATIVE SOLUTION: Nanobubble Technology to Control Odors

To solve their odor issues in the primary clarifier, Stavnsholt WWTP worked with TECHRAS Nano, Moleaer's channel partner in Denmark, to install a mobile nanobubble generation unit on the primary clarifier in November 2022. Moleaer's nanobubble generator's intake pulled wastewater from the primary clarifier's effluent channel and discharged it into the influent chamber. The nanobubble generator installed was designed to handle design loads of up to 5,000 kg COD/d (11,000 lbs/d) and only took half a day to incorporate into the plant's process.

Moleaer's nanobubble technology produces bubbles 70-120 nanometers in diameter - 10,000 times smaller than a 1 mm bubble. Due to their small size, they have unique chemical and physical properties, such as lacking the buoyancy to float to the surface and pop like larger bubbles, allowing them to stay suspended in liquid solutions and move in random motion. Nanobubbles also inhibit the anaerobic conditions that cause the formation of H_2S, a malodorous compound commonly found in wastewater treatment facilities.

THE RESULTS: How Nanobubbles Solved Their Odor Issues and More

After the installation of Moleaer's solution, odor complaints were significantly lower during the summer months, and even stopped completely during the rest of the year. Moreover, the average daily consumption of ferric during the nanobubble application period (November 25, 2022 to August 31, 2023) was 34 L/d, while for the previous same period (November 25, 2021 to August 31, 2022) was 212 L/d - almost 84% reduction in chemical usage. In addition to solving their odor issues with little to no chemicals, the WWTP's staff observed more treatment benefits downstream of the primary clarifiers.

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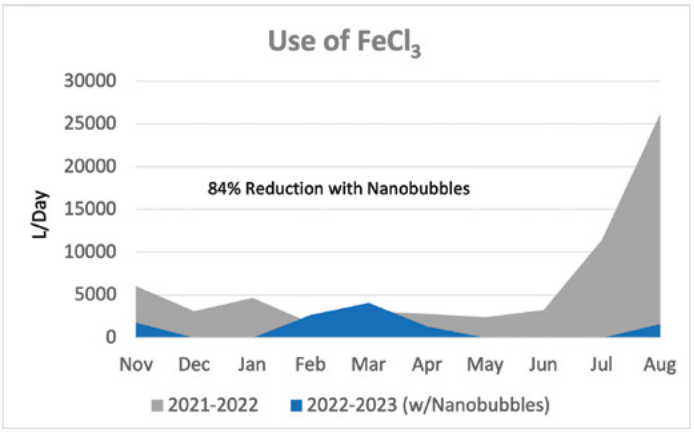
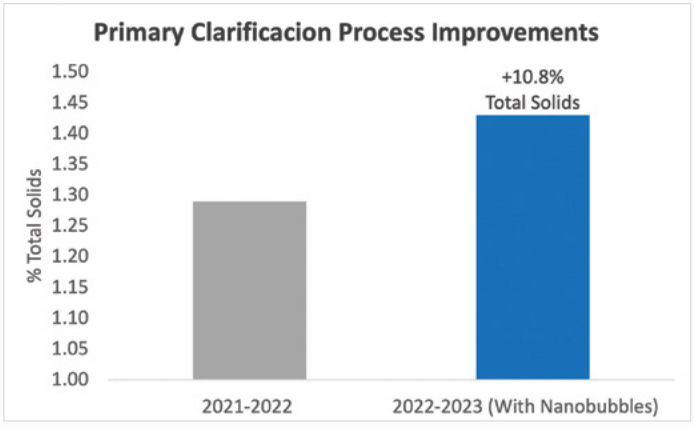
Odor Control

- Significantly reduced complaints from the neighborhood during summer months, reduced to zero during the rest of the year.
- Reduced use of ferric chloride to combat odor nuisances. The **consumption of ferric chloride used for H_2S control was reduced by 84%** compared to previous years until it was abandoned as it was no longer required.



Primary Clarifier Efficiency Improvements

Nanobubbles help the solid-liquid separation processes. For Stavnholt's WWTP this effect was evidenced by a significant reduction in the use of chemicals for enhancing primary settling and the **Increased sludge dry matter content by about 10%** compared to previous years.

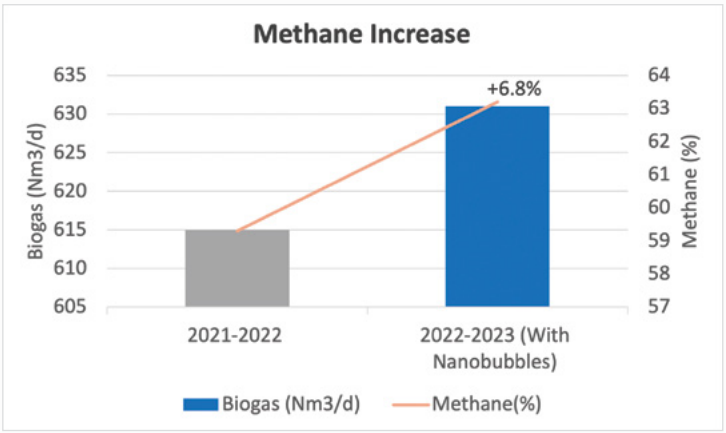


Aeration Energy Consumption Reduction

Prior to the Moleaer's Titan installation, Stavnsholt WWTP had installed energy-efficient oxygen diffusers to save energy. After the nanobubble generator installation, **electricity consumption fell an additional 5.3%** even though the plant was operating with a higher concentration of mixed liquor-suspended solids (MLSS).

Anaerobic Digester Improvements

Implementing nanobubble technology at Stavnsholt WWTP led to **enhanced biogas production and methane (CH_4) concentration**. Notably, CH_4 stability also increased considerably, as demonstrated by a 50% decrease in standard deviation. These achievements were remarkable given the suboptimal operating temperatures caused by modifications to the digester's heating system.



Conclusion

Stavnsholt saw significant benefits to using Moleaer's nanobubble pretreatment at their facility including:

- Eliminated odor issues
- Reduced ferric usage by 80+%
- Primary sludge dry matter content increased by 10+%
- Biogas volume and methane concentration increased.
- Digester resiliency improved

Having seen these results, Stavnsholt WWTP has opted for a permanent installation beginning spring of 2024.

Learn more about this chemical-free solution to common wastewater treatment problems by downloading the white paper.
www.moleaer.com/white-paper-surfactants-wastewater