

MICROBE-LIFT® Removes Oil & Grease, and Hydrogen Sulfide in Pump Wells and Sewage Pipes

Location: Aarhus, Denmark

Background: Aarhus Vand is a local water company that treats more than 30 million cubic meters of wastewater annually, including the discharge of restaurants. The high flow of wastewater and the large amounts of fats, oil, and grease exceeded the capacity of the pumps. The problem drove extended hours of sludge removal and maintenance. Furthermore, pumps and wells became challenging to access. Cleaning became more frequent due to extensive oil and grease deposits, forming a tight hood around them.

Objectives: Over the past year, Aarhus Water A/S (<https://www.aarhusvand.dk/en/international/>) collaborated with [microbes.dk](https://www.microbes.dk), to test the effectiveness of adding a unique consortium of bacteria, MICROBE-LIFT® technology, in two pump wells and a wastewater pipeline to remove and prevent the accumulation of oil and grease and hydrogen sulfide. Aarhus Vand selected two sites that receive wastewater from two restaurants and have the most congested and problematic pump wells. The operations manager at Aarhus Water even stated before the treatment, "If your bacteria can cope with our problems in these two locations, then they can cope up with the similar problems elsewhere."

Before the treatment projects, a safety assessment was conducted to determine if there were any risks in applying the solution. The result validates that Microbe-Lift formulation falls under Biosafety level one (BS1), the lowest level, which indicates that the product can be used in a standard open facility or laboratory without special equipment. It does not pose potential diseases for workers and threats to the environment.

1st Site: Wastewater treatment plants that receive the effluent of two restaurants at Thors Mølle and Skovmøllen, Southern Aarhus.

Details of the wastewater treatment plant at Thors Mølle, Thorsmøllevej 15, 8000 Aarhus C:

- Wells: 250L well with a mini pump installed
- pressure line (40 mm in diameter, 500 m long, and 25 meters in height) – with oil and grease problems
- maintenance by manual removal of the build-ups on the pumps and cleaning through pressure flushing and sludge suction

Details of the wastewater treatment plant at Restaurant Skovmøllen, Skovmøllevej 51, 8270 Højbjerg:

- wells with a mini pump installed

- pressure line up to collection well at Moesgaard (40 mm pressure line, 900 m long) – with oil and grease problems
- maintenance by manual removal of the build-ups on the pumps and cleaning using pressure flushing and sludge suction

Dosing requirement at the two sites:

Date	Requirement
June 24, 2020 (inoculation)	40 L
June 25, 2020	20 L
June 29, 2020	20 L
January 1, 2021	20 L
Daily maintenance (dripping method)	2 L

The solution was consistently applied until the restaurants closed in October 2021.

Date	Activities and observations at Thors Mølle and Skovmøllen
8/6/2020	Inspection and observations in a collection well behind Moesgaard of a pressure line from Skovmøllen. Thick and extensive deposits of fat, etc. in sewage pipe and well
9/6/2020	Inspection of wells at Skovmøllen and Thorsmølle. Extensive deposits of oil and grease
12/6/2020	the decision to initiate tests
22/6/2020	Preparation of addition plan for the bacterial mixture
24/6/2020	Addition of 40L in the wells Thorsmølle and Skovmøllen
25/6/2020	Addition of 20L in the wells Thorsmølle and Skovmøllen
29/6/2020	Addition of 20L in the wells Thorsmølle and Skovmøllen
1/7/2020	Addition of 20L in the wells Thorsmølle and Skovmøllen
July to Oct 2020	Daily drip addition of 2L at both sites
6/8/2020	Midway check. Fat partially eliminated, residual fat under visible solution and with an aqueous and very loose consistency
3/9/2020	Measurement of pH: Thorsmølle 5.0 - Skovmølle: 5.0
7/9/2020	Measurement of pH: Thorsmølle: 5.6 - Skovmølle: 6.0
9/9/2020	Measurement of pH: Thorsmølle: 5,0 – Skovmølle: 5,1
14/9/2020	Measurement of pH: Thorsmølle: 5.4 - Skovmølle: 5.2
16/9/2020	Measurement of pH: Thorsmølle: 5.4 - Skovmølle: 5.3

22/9/2020	Measurement of pH: Thorsmølle: 4.7 - Skovmølle: 4.5
28/9/2020	Measurement of pH: Thorsmølle: 6.3 - Skovmølle: 6.2
8/10/2020	Measurement of pH: Thorsmølle: 5.5 - Skovmølle: 6.0
20/1/2021	<ul style="list-style-type: none"> • Uptake of pumps for control of fat dissolution and elimination • Thorsmølle pump: Grease almost gone. There is still some grease on the lower part of the pump. A relatively thin layer with a mushy and airy consistency. • Skovmølle pump: Virtually no grease deposits. The individuals left on the pump were so dissolved that they fell off like wet pieces of paper. • Well: "clear water" is seen. Quite a bit of fat - the thick deposits are gone.
20/1/2021	Inspection and observations in a collection well behind Moesgaard of a pressure line from Skovmøllen. Deposits in the sewage line are gone concerning the situation before the addition of bacteria

Results Achieved:



Photo 1. Pump at Skovmøllen before and after treatment (Credits: Aarhus Water)

The wastewater pipeline from the pump well at Skovmøllen and the collection well at Thaihuset near the old Moesgaard Museum shows significant improvement. Photo 1 shows that approximately 95% of the oil and grease on the pump was removed.

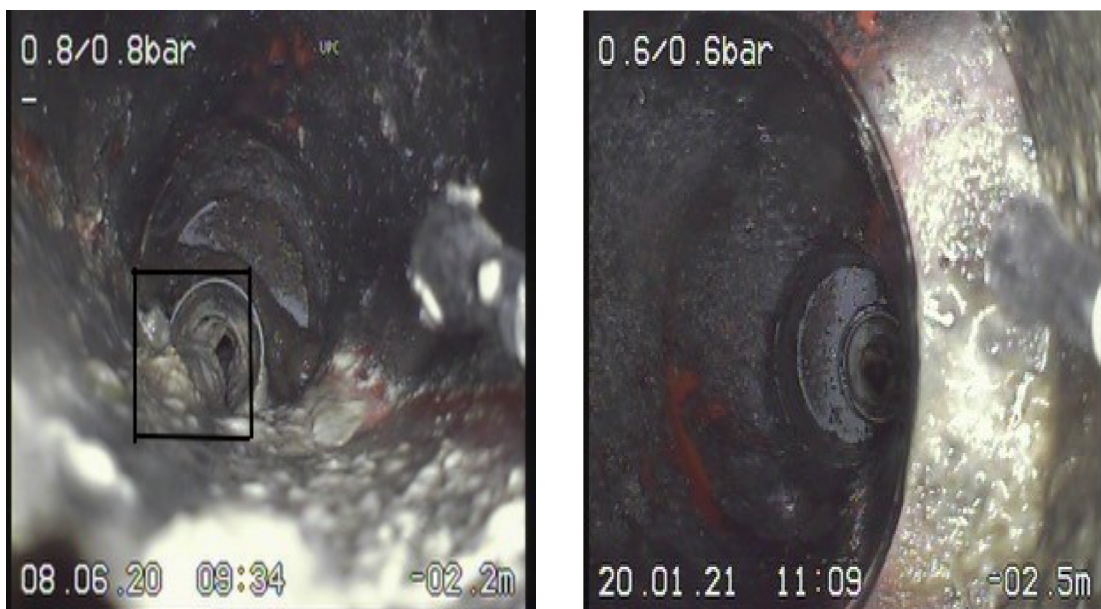


Photo 2. Collection well at Moesgaard before and after treatment
(Credits: Aarhus Water)

The pipeline survey camera photo of the sewage pipeline at the collection well before the treatment shows that a substantial part of the pipeline's cross-sectional area was blocked by grease and oil deposits. Aarhus Water stated that approximately half of the pipe's diameter of 40 mm was covered with grease before the treatment. It equates to 75% of the pipe's cross-sectional area. After the treatment, the pipeline is clean without oil and grease accumulation.

2nd Site:

Sewage pipeline in Jægergårdsgade in Aarhus C

In Jægergårdsgade in the central city of Aarhus, there were extensive odor problems for residents, businesses, shoppers, and café guests. Hydrogen sulfide can be dangerous to humans and shorten the life of the sewer network. In addition, the unpleasant smell. After trying different methods and without success, Aarhus Water decided in the autumn of 2019 to test whether adding a bacterial mixture could remove the hydrogen sulfide and thus the foul smell in Jægergårdsgade.

Description of the wastewater pipeline in Jægergårdsgade

The wastewater pipeline in Jægergårdsgade in central Aarhus is a 900 m long glass fiber gravity pipeline with $\varnothing 1600$ mm. The upper 400 m has a slope of between 0.3 and 1.0 o/oo. The lower portion is 500 m with a slope of between 44 o/oo. In dry weather, the daily flow of wastewater is 4,200 m³ and increases to 6,500 m³ in the lower part of the pipeline.

Dosing Requirement

Date	Requirement
October 7, 2019 (inoculation)	730 L
Daily Maintenance (Week 2 to 8)	12 L
Daily Maintenance (Week 9 onwards)	9 L

The dosing is divided into two parts: 2/3 for upper end of the line at Godthåbsgade and 1/3 for the lower portion. A dripping system was later on used for maintenance. The bacteria are continuously applied with a container, pump system, and suspension in the wells. This method led to a more practical solution by adding two dosing points in the street.

Results Achieved: Activities and observations at the wastewater pipeline in Jægergårdsgade

The observations of the operators on-site and their gas measuring device for safety indicate that the hydrogen sulfide was significantly reduced in just a few days of treatment. Aarhus Water's person-in-charge, Bjarne Dagø, stated that his gas measuring device is susceptible to the presence of hydrogen sulfide. From the end of 2018, he has used this device diligently in Jægergårdsgade for safety purposes.

According to him, from 2018 to 2019, the typical hydrogen sulfide levels above the well and water level are 5-10 ppm and 10-25 ppm, respectively. He added that after the application of the microbial solution in October 2019, the amount of hydrogen sulfide dramatically decreased. Hydrogen sulfide is no longer detected above the utility hole, and its concentration level at the water level no longer exceeded the 3ppm benchmark.

Photo 3 shows the trend of hydrogen sulfide concentration levels before, during, and immediately after the addition of bacteria on October 7, 2019. The insignificant amount of hydrogen sulfide was maintained throughout 2020. Bjarne Dagø believes that bacteria effectively reduced the amount of hydrogen sulfide in pipes and wells. The results show that a minimal maintenance dosing rate is sufficient to maintain the low concentration level after the inoculation. Aarhus Water did not observe any unfortunate side effects - not even at the Marselisborg Wastewater Treatment Plant.

Aarhus Water's interviews with residents and businesses show that the previous complaints about pungent odor ceased in just a few days of treatment. The typical comment is, "There is no longer a trace of sewage odor."

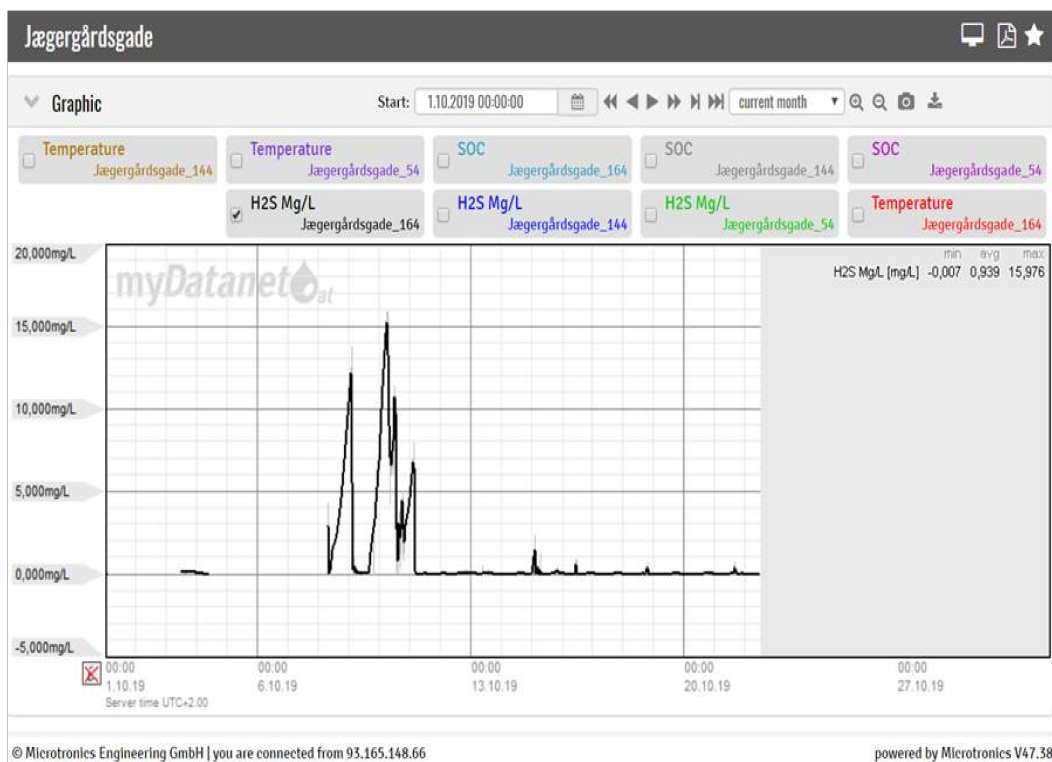


Photo 3: Monitoring of the lower section of Jægergårdsgade during the first 14 days of the treatment



Photo 4: The dripping method used to introduce the solution well in the wastewater pipeline in Jægergårdsgade (Credits: Aarhus Water, December 2019)



Photo 5: After the application of Microbe-Lift. The wastewater pipeline in Jægergårdsgade is solid build-up-free. (Credits: Aarhus Water, December 2019)

The pilot projects in the Aarhus Water plant for over 16 months show that the method of adding MICROBE-LIFT® technology works and has the following benefits:

- pumps, wells, and pipes are kept substantially free of oil & grease deposits on an ongoing basis, improving pumping efficiency and reducing energy consumption and its potential climate impact;
- prevents costly maintenance such as frequent repair or replacement of pumps and high-pressure flushing;
- the bacteria also metabolize hydrogen sulfide, control foul odors, prevent corrosion of piping systems;
- the technology applies naturally occurring bacteria, which is safe for the environment and humans and;
- the technique provides work environment benefits – no required chemical and heavy lifting

The results from the projects were published in with quotes from the employees of Aarhus Water:

- *"Bacteria create balance in sewers and lakes"* (DANSKVAND-DANVA magazine, October 5, 2020)
- *"Odor problems in Jægergårdsgade must be removed with a miracle cure."* (Aarhus Stiftstidende, June 5, 2020).
- *"Bacteria prolong the life of the sewer network"* (DANSKVAND-DANVA magazine, April 2, 2020).
- *"Bacteria can fight hydrogen sulfide in sewers"*— (Engineer's Supplement WATERTECH, March 5, 2020).