

**DAIRY**  
(dairy-based nutrition for young animals)

**MBR**  
Liprovit

## Project Details

<b>Location:</b>	Kampen (The Netherlands)
<b>OEM Partner:</b>	<b>SEPTO BIOTECHNIEK</b>
<b>Product:</b>	MBR
<b>Membrane material:</b>	PVDF
<b>Membrane diameter:</b>	8 mm
<b>Membrane type:</b>	Pilot evaluation RIDGE-M™ Membrane technology vs. standard Berghof HyperFlux™ membranes
<b>Ridge-M™ installed:</b>	2019

## Introduction

Along the way of continuous innovation, Berghof Membranes has recently developed the next generation tubular ultrafiltration membranes. The ground-breaking patented RIDGE-M™ membrane technology delivers enhanced performance thanks to its unique internal wall configuration: multiple longitudinal ridges generate uneven shear stress distribution inside the membrane tubes. As a result, the build-up of the fouling layer is prevented, and a higher stable permeate flow is produced. Consequently, the increased system productivity leads to lower investment, reduced energy costs and lower consumption of chemicals.

Berghof's invention was bio inspired. Nature shown us things as the groves of the blue whale, the ribbed shark skin and the increased flux effect of the king penguin. Based upon these ideas the first lab-scale tests were done. This to optimize the theoretical idea, validating it and making a preliminary quantification of its possible performance.

Once this was finished, a pilot-scale validation was addressed. In 2020, Berghof Membranes installed one of its containerized pilot plants at Liprovit, a leading Dutch company producing dairy-based nutrition products for young animals. Here, an external MBR based on Berghof membranes is in operation since 2018, so the containerized pilot was connected to the existing bioreactor. In this way, the RIDGE-M™ membrane technology could be tested

in long-term continuous operation and under real operational conditions.

## The demo site

The production of milk derivatives generates large quantities of wastewater with high concentrations of organic pollutants. Proper treatment and disposal are essential for several reasons including regulatory compliance, environmental stewardship, and brand reputation. Economic drivers are also important: discharge to the municipal sewer or external waste management involve considerable costs, that grow day after day. The most convenient alternative is the investment in an on-site wastewater treatment facility.

And this is precisely the case at Liprovit. When the new factory was put in operation in 2013, wastewater was discharged, at high costs, directly into the sewer. Moreover, one truck full of high-loaded wastewater left the facilities each day as well. Some years later, when the increase in production caused wastewater costs raising too high, Liprovit decided to invest in wastewater treatment technology. For this, they were searching for advanced treatment that could guarantee the effluent quality 100% of the time, regardless of the variability in influent quality.

The best solution was hence the tubular MBR as it provided the highest reliability and robustness against the highly variable organic load. Moreover, the use of external membranes allowed dealing with the high concentrations of FOG and hardness without implementing any pre-treatment step.

The ease of maintenance was one of the main concerns of the end-user. The fact that the UF modules, pumps and ancillary equipment are fully and quickly accessible was a determining factor for selecting the external membranes. Compactness was also important as they wanted to place the filtration skid inside an existing building with limited footprint available. Finally, the cleanliness and hygienic conditions were also essential requirements. The type of product manufactured demands high safety and hygiene standards and for this, the fully closed membrane system was indeed the best solution – contact with the biological sludge is avoided and no odour, VOCs or aerosols are released.



**Membranes**  
Think outside the box

## The MBR plant

The MBR was put in operation in 2018 for treating an average flow of 160 m<sup>3</sup> per day. The high variability in volumes and loading was the main challenge, with COD concentrations ranging between 2.000 and 20.000 mg/L. This variability arises from the batch nature of most of the processes and the different production lines that discharged independent waste streams. Moreover, the intermittent cleaning and sanitizing processes frequently causes pH shifts.

The 1.900 m<sup>3</sup> biological reactor consists of an anoxic selector and the aerobic tank, for removing both the organic matter and the nitrogen. The external UF system connected to the bioreactor was designed as a loop with three modules in series in simple circuit configuration, with 160 m<sup>2</sup> membrane area installed. It was placed inside a building nearby the biological reactor.

Since the start-up, the MLSS concentration has varied widely, ranging between 6.5 and 20 g/L, with negligible effect on the performance of the tubular membranes. With average inlet COD of 10.400 mg/L, the MBR delivers a consistent and superior treated water quality, as shown in Table 1.

Parameter	COD	BOD	TSS	O&G	TN	Turbidity
Average	73 mg/L	< 5 mg/L	< 3 mg/L	< 5 mg/L	< 8 mg/L	< 0.5 NTU

Table 1. Permeate quality.

## Ridge-M™ membrane technology success story

Berghof Membranes carried out a comparative study at Liprovit to demonstrate the improved performance of the new membrane technology. The containerized pilot plant was connected to the full-scale bioreactor, in such a way that the test was performed with real biomass and under the ordinary operational conditions and variabilities. The pilot plant allows installing up to four modules of 3-inch diameter in series. In this case, two modules were assembled: position one contained the Berghof HyperFlux™ membranes and position two the Berghof RIDGE-M™ membranes.

As shown in Figure 1, the RIDGE-M™ membrane technology always delivered a higher performance, with increases in the normalized permeability ranging between 20 % and 80 %, the average being 50 %. During the experiments, the MLSS concentration varied between 8 and 16 g/L and the range of temperature was 26 – 36°C.

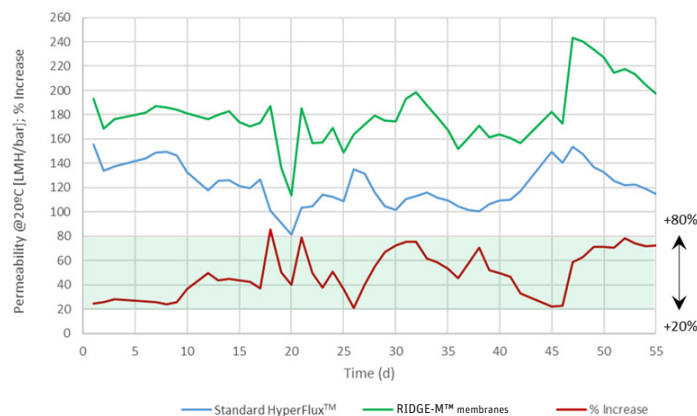


Figure 1. Daily average values of permeability (flux normalized for temperature and TMP). RIDGE-M™ membranes vs. standard Berghof HyperFlux™ membranes

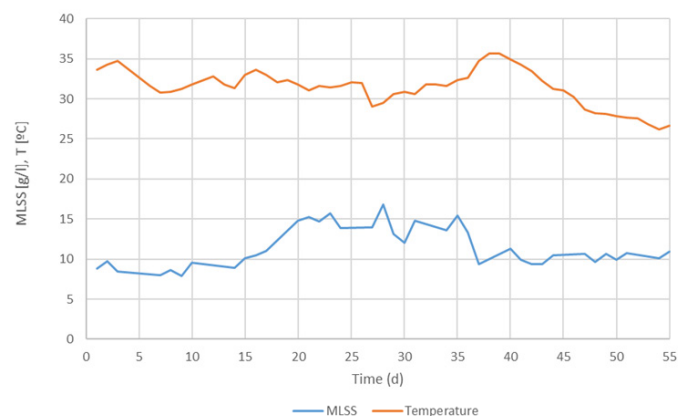


Figure 2. Evolution of MLSS concentration and temperature during the experimental period

## Conclusion

The pilot demonstration at the Liprovit plant provided clear evidence of the unmatched performance of the new Berghof RIDGE-M™ membrane technology. The results obtained at pilot-scale at Liprovit, together with subsequent tests at real-scale at other installations, show that the unique internal wall configuration of the Berghof RIDGE-M™ technology boosts the performance of the membranes up to 50 %\*.

The powerful self-cleaning effect allows our customers to develop both a lower CAPEX and OPEX at their projects, thus maximizing cost-efficiency and minimizing environmental impact.

\*Up to 50% flux increase compared to the standard Berghof HyperFlux™ membrane. Results obtained may vary by application or operating conditions