



## RIDGE-M™ PROJECT REFERENCE

# Food and Beverage

## MBR Holland Malt

### Project Details

<b>Location:</b>	Eemshaven, The Netherlands
<b>Product:</b>	<b>MBR</b>
<b>Membrane material:</b>	PVDF
<b>Membrane diameter:</b>	8 mm
<b>Membrane Type:</b>	Evaluation Berghof Ridge-M™ Membranes vs currently installed modules
<b>Capacity:</b>	2.500 m <sup>3</sup> /day
<b>Ridge-M™ installed:</b>	2021

### Introduction

Along the way of continuous innovation, Berghof Membranes has recently developed the next generation tubular ultrafiltration membranes. The ground-breaking and 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.

It all started with a comprehensive lab-scale study for optimizing the product, validating it and making a preliminary quantification of its performance. In a second stage, the Ridge-M™ membranes were tested at pilot scale: here, they provided a clear higher performance when compared with the standard Hyperflux membranes. At this point, it was the time for demonstration in a real operational environment.

The MBR installation in Holland Malt's facility in Eemshaven was selected for the demonstration due to several reasons: the long-lasting partnership between the two companies and the

Holland Malt's deep knowledge of the MBR operation were of major relevance. Moreover, this MBR reference was the best candidate for the comparative study as it clearly exemplifies the Berghof Membranes project profile: dealing with the wastewater variability typically found in the food and beverage industry. The MBR is characterized by its reliability, ease of use, reduced maintenance and production of high quality permeate to be reused in the malting process.

### The demo site

Holland Malt B.V., part of Royal Swinkels Family Brewers, is a malt producer located on the northern coast of The Netherlands. Since 1939 the company has been producing malt to ensure the supply of their own brewery, and nowadays it is producing and exporting malt to breweries all over the world. Holland Malt is renowned worldwide for the quality of its malt production which involves three main processes: steeping, germination and kilning. Steeping is a highly water-intensive process that increases the barley's moisture up to 40%. As a reference, the production of 140.000 tons of malted barley requires 510.000 m<sup>3</sup> of water, comparable in quality to drinking water to ensure product quality and meet strict European Union laws.

When Holland Malt decided to double its malting capacity to 280.000 tons in 2017, the need for implementing water reuse strategies became evident: doubling the production capacity means doubling the water consumption and wastewater generation, and the access to tap water was limited and with high costs. They needed an efficient and reliable system that could provide high-quality treated water to be reused for the production of malt, while providing significant cost savings. After testing a few pilot systems from various manufacturers, Holland Malt chose Berghof Membranes for its reliability, high quality permeate production, ease of use and low maintenance.



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## The MBR plant

The MBR installation treats approximately 2.500 m<sup>3</sup> of wastewater per day. The wastewater is being collected in a buffer tank with a capacity of 3.600 m<sup>3</sup>. From the buffer, the waste water is diverted to 2 MBR systems each with 1.800 m<sup>3</sup> of sludge. The external tubular UF systems connected to the biological process allows the operation with MLSS concentrations between 12 and 18 g/L. The global performance of the MBR plant is fully satisfactory: as shown in Table 1, the MBR can remove the organic matter and nutrients very efficiently, even with significant variability in influent quality. A superior permeate quality is reached. It fulfils the requirements for being reused in the steeping process. By reusing the permeate, Holland Malt has been able to reduce the water consumption by almost 50%, with the consequent environmental, sustainability and cost-efficiency benefits.

Parameter	Wastewater (range)	Permeate (average)
COD (mg/L)	1.500 – 5.000	133
BOD5 (mg/L)	1.000 – 3.000	< 2
Total N (mg/L)	60 - 70	4.7
N-NH <sub>4</sub> (mg/L)	5 - 20	0.1
Total P (mg/L)	15 - 30	< 0.2
Plate count (CFU / 100 mL)	> 1.000.000	< 500*

\* Plate count directly after UF is much lower

## The Ridge-M™ success story

In August 2021, Berghof Membranes installed the new Ridge-M™ membrane technology in one of the existing crossflow UF systems to demonstrate the improved performance of the new product when compared with the currently installed membranes. By doing so, the Berghof Ridge-M™ membrane technology has been tested in a full-scale UF installation, under the real operational conditions and facing the common variabilities in the daily operation of the MBR process. The filtration system operates with a crossflow velocity of 4 m/s and average TMP of 2.4 bar. During the demonstration period, the MLSS concentration has varied between 12 and 19 g/L, with an average value of 15 g/L, and the temperature range has been 15 and 25°C, linked to the summer/winter periods. Figure 1 presents the evolution of the permeate flux – normalized at 20°C – of the Berghof Ridge-M™ membrane technology compared with the currently installed modules. During the whole experimental period, the flux was higher in the Berghof Ridge-M™ membrane technology. With relative increases of normalized flux ranging between 14% and 68%, an average of 48% gain has been measured during a 7-month testing period.



Figure 1: Evolution of normalized flux during the experimental period. Berghof R&D membrane technology vs. currently installed modules

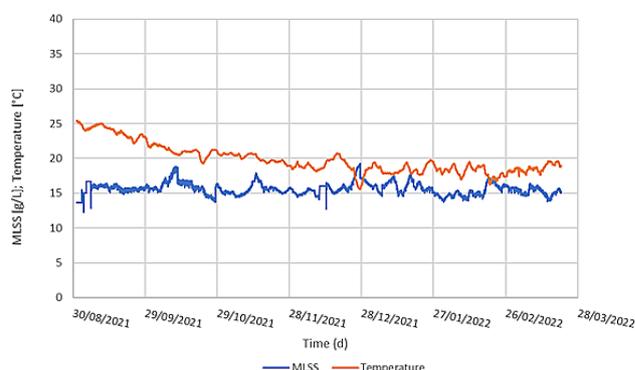


Figure 2: Evolution of MLSS concentration and temperature during the experimental period

## Conclusion

The demonstration of the Berghof Membranes at Holland Malt MBR plant has provided clear evidence of the unmatched performance of the Berghof Ridge-M™ membrane technology. The obtained results at Holland Malt, together with tests at previous pilot installations, show that the unique internal wall configuration boosts the performance of the Ridge-M™ 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™ membranes. Results obtained may vary by application or operating conditions