PROJECT REFERENCE

Food & Beverage

MBR EFFLUENT TREATMENT

Project Details

Location:	Eemshaven, The Netherlands
Product:	B-SMART™ MBR system
Produced permeate:	1,584 m^3/day
COD influent:	1,500 – 5,000 mg/L
MLSS:	12,000 - 18,000 mg/L
Membrane type:	8mm PVDF, backwashable

Project Overview

Holland Malt B.V., part of Bavaria Brewery, is a malt producer located on the northern coast of The Netherlands. Since 1938 the company has been **producing brewer's malt** for leading beer brands such as Bavaria, Heineken, Carlsberg and Budweiser.

Holland Malt is renowned worldwide for the quality of its malt production which involves three main processes: **(1) steeping, (2) germination, (3) kilning and roasting**. Steeping is a **highly water-intensive process** that increases the grain's moisture content up to 40%. For example, the production of **140,000 tons of malted barley requires 510,000 m^3 of water**, comparable in quality to drinking water so as to ensure product quality and meet strict European Union laws. Holland Malt aims to double its current capacity to 280,000 tons by 2019. Holland Malt has limited access to tap water, therefore the company is **forced to reuse their process water.**

The Challenge

As the world's population increases, so does the level of beer consumption. Studies suggest that by 2025, global beer consumption will grow by 15%. In order to meet the increasing demand, Holland Malt has decided to **double its malting capacity** in its Eemshaven plant. Unfortunately, doubling the production capacity means **doubling the water consumption**. Thus, Holland Malt needed a reliable and stable system that could provide **high-quality permeate** which can be reused for the production of malt while providing **significant cost savings**. After testing a few pilot systems from various manufacturers, Holland Malt chose the **B-SMART MBR filtration system** from Berghof Membranes for its reliability, high quality permeate production, ease of use and low maintenance.

Picture 1. Photo of the B-SMART System installed at Holland Malt

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The Berghof Membranes Solution

Berghof Membranes installed two feed-and-bleed systems at Holland Malt (double and single loop), which generates more than **1,584 m³/day of permeate** at an **average flux ranging between 65 - 75 l/m²/h (LMH)**, with a **crossflow velocity of 2.0 m/s** (see Figure 1).

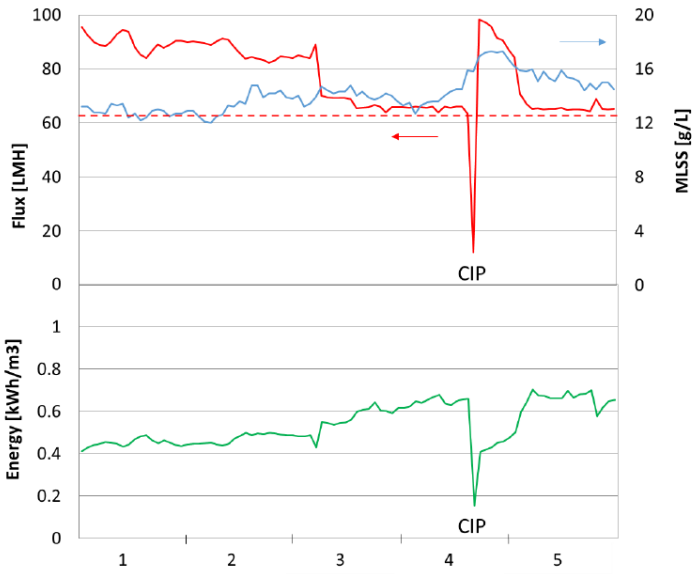

Figure 1. Operation results over a period of 5 months

Figure 1 demonstrates that the self-regulating external filtration system maintained a high permeate production (red line) regardless of Mixed Liquor Suspended Solids (MLSS) concentration (blue line) which varied from 12,000 to 18,000 mg/L in the waste stream. The flux was stable from early September through late November at 65-75 LMH. A visible peak in mid-October was related to a rapid increase of the MLSS concentration. In response the system performed an **automated "clean in place (CIP)"** to clean the membranes and restore the flux to its initial values. The **average energy consumption** during the whole period was approximately **0.6 kWh/m³ permeate**. The system was able to **control fouling** due to its **"smart monitoring"** of pressure drop and transmembrane pressure (TMP). As shown in Table 1, the Berghof Membrane modules produced the **high quality permeate** required by Holland Malt.

Parameter	Feed water [mg/L] range	Permeate [mg/L] average
COD	1,500 – 5,000	133
BOD	1,000 – 3,000	< 2
Total P	15 – 30	0,2
PO4-P	10 – 20	0,29
N-total	60 – 70	4,69
NH4-N	5 - 20	0,1
Plate count	> 1,000,000 CFU / 100 ml	< 500 CFU/100 ml

Table 1. Feed wastewater quality compared to permeate quality

Customer Benefits

For Holland Malt, the B-SMART™ self-regulating external MBR system from Berghof Membranes proved an innovative solution to reuse valuable water, produce high quality permeate, and lower overall operating costs.

- **Low energy consumption of 0.4 – 0.6 kWh/m³ permeate;**
- **High flux of 65 - 75 LMH;**
- **Ease of adaption to feed fluctuations;**
- **Self-regulating and fully automated operation;**
- **Treatment of fluids with medium and high fouling potential;**
- **Intelligent control of fouling;**
- **Small footprint: 37 m² for feed stations and membrane skids (single and double loop);**
- **18 modules (10" x 4,000 mm), 3 open slots for extended permeate capacity.**

The B-SMART System

Based on a side-stream ultrafiltration system located outside the bioreactor **(the external principle)**, the Berghof Membranes B-SMART self-regulating system uses high-quality tubular membrane modules. The system is self-regulating and therefore **consumes less energy**. The proprietary built-in software system **analyses data in real time** using advanced algorithms based on transmembrane pressure (TMP) to control pump speed, backwash and cleaning frequency. The filtration system automatically monitors the individual TMP and automatically initiates the cleaning procedure if it exceeds defined limits as a result of fouling. Depending on the need, the system selects one of the cleaning modes to eliminate fouling: **(1) increased cross-flow velocity**, **(2) backwash with- or without chemicals**, or **(3) flushing or cleaning-in-place (CIP)**. Once cleaning is completed, the **system automatically checks the TMP values** again and applies additional cleaning protocols if the set-point value is not reached. Additionally, the unit can continue to produce a fixed amount of permeate even during the backwash process. The Berghof Membranes B-SMART self-regulating external filtration sytem treats wastewater streams at a cross-flow velocity of 1.5 – 2.5 m/s and a flux range of 50 – 100 LMH. All this combined **ensures less energy, reduced maintenance time and improved OPEX**.

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