PROJECT REFERENCE

Metal Industry

Direct Filtration for Metal Recovery

Project Details

Location:	Michigan, USA
OEM Partner:	Belmar Technologies
Application:	DF - Metal Recovery
Product:	**B-SMART®** *Eco* System
Capacity:	456 - 528 m³/d
Membrane type:	8 mm PVDF, backwashable

Project Overview

A factory in mid-western United States specializes in the recovery of titanium from waste streams collected from other factories. The company then treats and processes the recovered titanium. Afterwards makes it available for reuse in other applications.

The Challenge

The nature of the metal recovery process involves many steps and typically includes multiple steps of pretreatment to separate particles ranging in sizes from 1 mm in diameter to as small as 150 microns in diameter. However, due to the high value of titanium, it is essential to employ additional technologies. Aside from the recovery of the valuable titanium, the process ensures that discharge limits are met.

Belmar Technologies needed to design a robust and adaptable ultrafiltration (UF) system that could keep up with the high-solid streams and conditions of this demanding process, while minimizing energy consumption, membrane fouling and clogging. The total suspended solids (TSS) of the feed stream was between 1,000 - 2,000mg/L, thus rendering hollow fiber membranes as incapable of handling the load and ceramic membranes as too expensive and energy demanding.

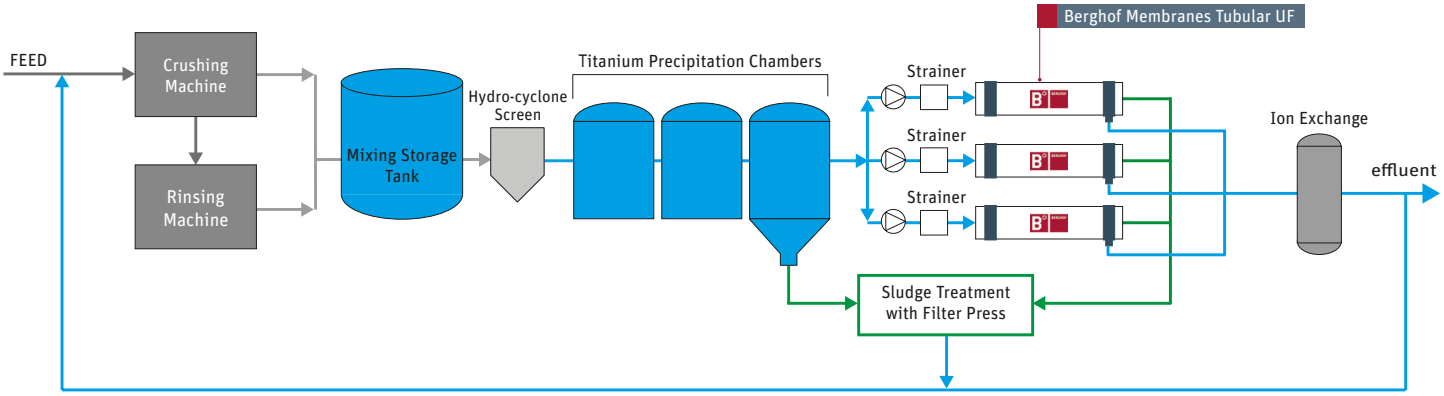
The Berghof Membranes Solution

The Berghof Membranes B-SMART® Eco system was the ideal solution for this application. The unit was designed as 3 single loop skids, each loop equipped with three tubular UF membrane modules plus one dummy module.

Because of the nature of the flow stream, the UF skid utilizes PVDF backwashable membranes in a feed-and-bleed configuration. The B-SMART® Eco feature automatically sets system parameters to run at the lowest possible crossflow velocity during normal operation, and then adjusts when it detects a higher fouling or plugging potential. This ensures that the system does not use additional energy beyond what is necessary for optimal performance.

Picture 1: Three tubular UF skids equipped with 8mm PVDF backwashable Berghof membranes

BERGHOF **Membranes**
Think outside the box



Picture 2: schematic diagram of titanium recovery process

Picture 2 is a representation of the recovery process which begins with the waste titanium entering the crushing machine to convert the metal pieces into smaller particles, using water to control the temperature within.

The particles are then sent to a rinsing machine. The titanium is then separated from the liquid stream which is sent to the same mixing storage tank as the wastewater from the crushing machine. Once the liquid waste passes through a series of strainers ranging from 150 - 200 micron, then stream is directed to thee titanium precipitation chambers. In each chamber, necessary adjustments are made to control the pH levels to within a range that optimizes titanium precipitation.

Picture 3: Titanium waste (top), crushing machine (bottom)

The sludge from the precipitation process is separated and it is then routed to a sludge treatment system and filter press. The wastewater with colloids, however, is sent to the tubular ultrafiltration system from Berghof Membranes. As shown in the schematic, the 3 single loop UF skids further recover material (concentrate) that is then directed for further treatment.

Picture 3 shows the initial titanium waste (top) that enters the process through the crushing machine (bottom) while table 1 shows the general operation parameters.

Berghof Membranes not only succeeded in increasing recovery of the titanium particles, but our tubular UF membrane modules provided quality effluent for the ion exchange process that then produced water suitable for reuse in the first stage of the process.

Table 1: General operation parameters

Flux	40 - 45 LMH
TSS	1,000 - 2,000 mg/L
Design crossflow velocity	2.0 - 4.0 m/s (3.0 m/s avg. during filtration process)
Membrane surface area	481 m² (641 m² with extension)

About Berghof Membranes

Berghof Membrane Technology GmbH, part of the Berghof Group, is the leading manufacturer of tubular UF membrane solutions for the filtration and separation of process streams and wastewater in a variety of industries including dairy, landfills, food & beverage, chemical, pharmaceutical and oil & gas.

We at Berghof Membranes continuously “think outside the box” by not only offering tubular UF membrane modules, but we also deliver engineered filtration systems and support services to our OEM partners. From lab-scale testing, to piloting, to engineering design, to commissioning, to remote monitoring and analysis, to replace parts - we’re more than just a membrane supplier.

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Membranes
Think outside the box
Agora 4
8934 CJ Leeuwarden
Niederlande
Telefon: +31 588 100 110
E-Mail: info@berghofmembranes.com
Web: www.berghofmembranes.com