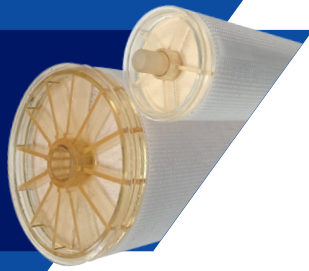


CASE STUDY

RO | NF | UF | MF

Whey Production
Germany



TORAY

Innovation by Chemistry

Toray Heat Sanitisable RO Membranes Demineralise NF Permeate for Diafiltration at a Whey Production Plant

CHALLENGE

In the food industry, heat sanitisation of membrane systems is a crucial aspect of preventing microbial growth. A leading producer of whey ingredients in Germany struggled with bacterial counts in the RO permeate. As a result, the whey producer began to pilot alternative membrane supplier models, including Toray's heat-sanitisation membranes.

HEAT SANITISATION

For the pilot, two pressure vessels were each set up to contain five RO elements: one pressure vessel loaded with Toray's heat-sanitisable membrane model TMRO8040HS, and the other pressure vessel with the existing RO membrane. The goal was to keep the germ content in the permeate as low as possible while maintaining a comparable performance through periodic sanitisation of the membrane elements.

The RO system has an average feed capacity of 35,000 litres per hour at 27 bar and 10 degrees Celsius. Since the pilot commenced, the test modules have been sanitised three times with hot water. Sanitisation conditions were 20 to 30 minutes at a maximum of 85°C, with a baseline of 1 bar and 0.1–0.2 bar of differential pressure.



Figure 1: Heat sanitisable RO system. Image source MMS AG Urdorf Switzerland

Table 1 – Comparative average performance

Parameter	Avg. flow (L/h)	COD (mg/L)
Heat sanitised TMRO8040HS	3,811	20–30
Existing RO	2,530	100–168

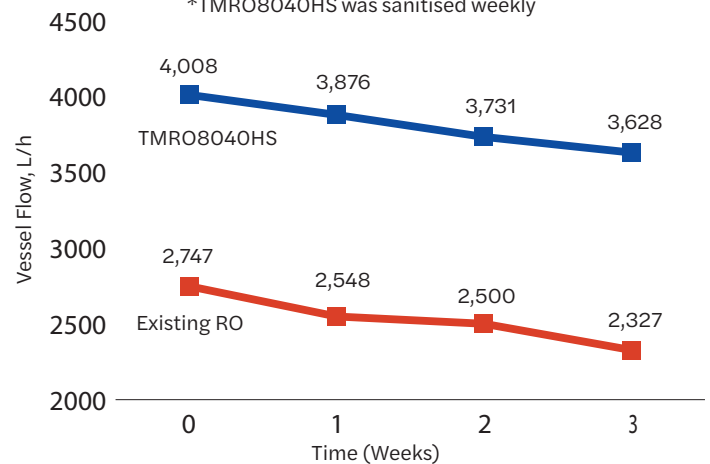
RESULTS

Toray modules consistently outperformed the competitor modules, measured by the permeate flow rate and COD (Chemical Oxygen Demand) levels (see Table 1). On average, the flux of the Toray elements was 50% higher, and the permeate COD levels were 82% lower than the competitor. Based on this performance, permeate flow, and the production time of 18 hours per day, the heat-sanitisable TMRO8040HS can reduce the COD content total by 176 kilograms per production day.

The results, with significant flow improvement and bacterial count reduction, are of great interest in other membrane systems within this plant.

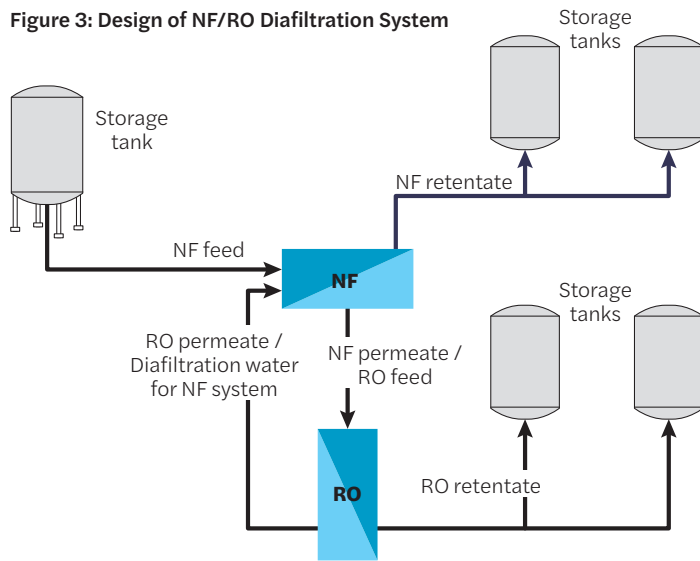
Figure 2: Comparative vessel flows

*TMRO8040HS was sanitised weekly



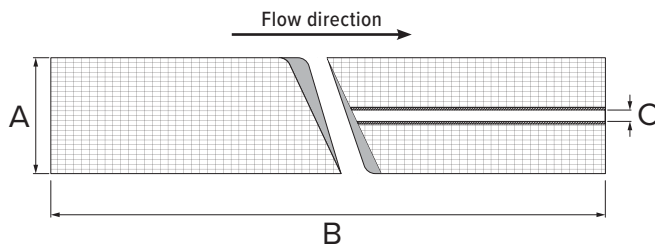
"With Toray's membrane, we save 138 mg/L csb [COD] compared to the competing product." —Whey producer

Figure 3: Design of NF/RO Diafiltration System



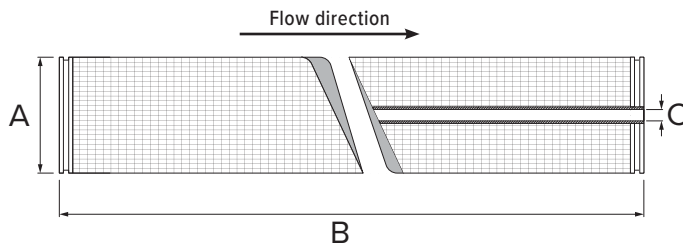
TRO8038HS in Sanitary Design (no ATD)

Components conform to FDA Regulation CFR Title 21 and USDA/3A Sanitary Standards



TMRO8040HS (w/ ATD)

Components conform to FDA Regulation CFR Title 21



TORAY HEAT SANITISABLE RO

Below are specifications for Toray's Heat Sanitisable RO elements. Toray HSRO elements are sanitised with hot water as the preferred method in food and pharmaceutical applications eliminating the need for chemicals and other disposals.

New Toray HSRO elements must be pre-conditioned before initial use by exposure to hot water. Conditioning water must be high-quality chlorine and oxidant free, non-scaling, non-fouling water. RO permeate is preferred, and from an RO that has been in operation for at least 24 hours.

Toray's manufacturing facility in San Diego, California that produces heat-sanitisable elements and other membranes in sanitary design, is registered under ISO 9001:2015 and 14001:2015 to ensure consistency in product and service quality and enhance environmental performance.

Specifications for TMRO8040HS & TRO8038HS

NaCl rejection %	Permeate flow rate GPD (m ³ /d)	Feed spacer thickness in. (mm)	Active area ft ² (m ²)
99.5%	9,000 (34.1)	0.028 (0.71)	400 (37.2)

Standard dimensions in. (mm)

Size	A Diameter	B Length	C Permeate tube ID
8040	7.9 (201)	40 (1,016)	1.125 (28.6)
8038	7.9 (201)	38 (965)	1.125 (28.6)

Test Conditions

Feed water pressure psi (bar)	150 (10.3)
Feed water temperature °F (°C)	77 (25)
Feed water concentration mg/l as NaCl	2,000
Recovery rate %	15
Feed water pH	7

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