



Case Study
TRISEP® SBNF
Elements
NOM Removal for
Drinking Water

Case Study: Municipal NOM Removal for Drinking Water

Removing natural organic matter (NOM) from surface water streams to produce drinking water.



PROBLEM

Surface water to drinking water must meet strict requirements



SITE

Municipal plant in Norway



OUTCOME

Successfully producing drinking water that exceeds requirements

OBJECTIVE

In Northern Europe, surface water is treated for natural organic matter (NOM) removal, including color removal and TOC reduction, to produce drinking water. The removal of NOM from source waters is very important in drinking water treatment because it affects the color, taste and odor properties of water. It also contributes to disinfection byproduct formation, increases chlorine or disinfectant demand and affects biological growth in distribution systems.

TRISEP® 8040-SBNF-TSA elements, featuring a cellulose acetate (CA) nanofiltration (NF) membrane with a nominal molecular weight cut-off (MWCO) of 2,000 Da, were developed specifically for customers treating surface waters in isolated locations throughout Northern

Europe, and are well-suited for removal of organics and color.

These NF membranes have been successfully used where surface waters contain high color content, low turbidity, and very low total dissolved solids (Table 1). Systems using these elements operate at very low pressures, typically less than 5 bar or 72.5 psi, and require very little maintenance. The low maintenance of these elements makes them very attractive for small and remote communities. They rely on simple and easy-to-maintain surface water treatment systems for their communities, which treat up to 16,000 m³/day (4.2 MGD) of surface water.

Spiral-wound NF systems using CA membrane elements are proving to meet the needs of these communities as they are



fairly automated, require little attention from system operators, are low-fouling, chlorine-resistant and operate at very low feed pressures.

MATERIALS & METHODS

TRISEP 8040-SBNF-TSA elements are in use at a surface water in Norway, which has a maximum color content of 100 Hazen (or 100 mg Pt/l), turbidity of 0.9 NTU and conductivity of 66.4 $\mu\text{S}/\text{cm}$ —ideal for a NF system using CA membranes. The elements demonstrate color removal and TOC reduction for drinking water.

The system uses a 50-micron automatic filter as pretreatment, so the NF membrane elements are arranged in a single stage. Post-treatment steps include UV and hypochlorite to avoid bacterial growth. Because NF membranes typically reduce the calcium and bicarbonate concentration by about 15-30%, using a sodium silicate-based product to increase the pH of the treated drinking water is a solid choice.

“We installed the elements and they exceeded all of our expectations, requiring little maintenance.”

- CEO of System Integrator

Table 1 Feed Properties

Parameter	Value
Color (mg Pt/l)	> 100
Turbidity (NTU)	< 1
Conductivity ($\mu\text{S}/\text{cm}$)	< 100

To prevent organic fouling, the membranes were exposed to a daily chemical rinse and maintained by annual cleaning.

RESULTS

The TRISEP® 8040-SBNF-TSA elements are successfully operating at exceptionally low pressure—despite cold feed water temperatures—while producing drinking water that surpass Norwegian drinking water requirements. Operation at low feed pressures significantly lowers operating costs.

The permeate quality requirements for this system were: color < 5 mg Pt/l, TOC < 2.0 mg/l and turbidity < 0.2 NTU. The SBNF membrane elements surpass these requirements and are expected to last five to ten years, offering stable performance. The results from the Norway surface water are extremely positive, with the SBNF membrane elements producing water with color consistently below 2 mg Pt/l, TOC below 1 mg/l and turbidity less than 0.13 NTU (Table 2) for two years after installation.

Table 2 NF System Influent & Effluent Water Characteristics

Parameter	4 months after install	1 year after install	2 years after install
Feed Color (mg Pt/l)	80	48	52
Permeate Color (mg Pt/l)	< 2	< 2	< 2
Color Removal (%)	> 97.5	> 95.8	> 96.2
Feed TOC (mg/l)	9.2	N/A	6.64
Permeate TOC (mg/l)	0.65	N/A	0.88
TOC Removal (%)	92.9	-	86.8
Feed Turbidity (NTU)	0.62	0.61	0.53
Permeate Turbidity (NTU)	< 0.1	< 0.1	0.13
Turbidity Removal (%)	> 83.9	> 83.6	75.5

Conclusion

In a small community in Norway, surface water is treated to remove natural organic matter (NOM), a complex mixture of organic compounds (i.e. decomposing vegetative materials and animal matter) and color, to produce safe drinking water. Since NOM in most surface waters consist mainly of humic substances (molecular weight of 1,000-10,000 Da), and Norwegian surface waters contain very little total dissolved solids (TDS), it is possible to treat these waters directly by an open cellulose acetate nanofiltration membrane to meet Norwegian drinking water quality standards.

8040-SBNF-TSA elements are installed and successfully producing drinking water that exceeds Norwegian drinking water quality requirements (color <2 mg Pt/l, TOC <1 mg/l and turbidity <0.13 NTU). They've been functioning at this level for over four years while simultaneously operating at very low feed pressures (an average of 2.2 bar or 32 psi).

The results of this system, as well as over two dozen other SBNF installations all over Northern Europe, are showcasing the ideal solution that these CA NF membrane elements provide for the removal of NOM to produce drinking water from surface waters.



Above Operator looking at HMI



Left Raw Water vs. Permeate

Tables & Data

Table 3 Feed

Parameter	Value
Feed Source	Surface Water
Feed Color	48-80 mg Pt/l
Feed TOC	6.6-9.2 mg/l
Feed Turbidity	< 0.9 NTU
Feed TDS	< 66.4 μ s/cm

Table 4 Parameters Measured

Parameter	Value
Operating Flux	7-10 l/mh (4-6 gfd)
Feed Pressure	2.2 bar (32 psi)
Color	< 2 Pt/l
TOC	< 1 mg/l
Turbidity	< 0.13 NTU