Contact:
Inrigo Water AS
LIV-bygget
7125 Vanvikan, Norway
Tel.: +47 916 61 252
Fax: +47 748 53 701
Email: gaute@inrigowater.no

Ceramic Microfiltration System for Drinking Water Treatment

Robust, Compact, High recovery

The Demands

Natural Organic Matter (NOM) in Norwegian surface water is a major concern and should be removed from drinking water.

Sand filtration and Nano filtration are the most common drinking water treatment technologies in Norway. Sand filtration requires much bigger footprint and infrastructure investment than Nano filtration. Nano filtration has advantages of small footprint and compact design, however, serious membrane fouling, resulting continual flux reduction and high frequency chemical cleaning is torturing the plant operators.

a b

Fig. 2 Color/NOM removal by ceramic microfiltration: a) raw water; b) treated by ceramic microfiltration

Solution

Ceramic microfiltration (combined with coagulation) is an efficient approach to achieve high level NOM removal, which is very compact and full automation. Ceramic microfiltration can be stable operated at high flux and minimize the chemical cleaning requirement.

Fig. 1 Typical Norwegian surface water with high NOM concentration

Fig. 3 First ceramic microfiltration drinking water plant in Norway: Vanvikan, 600 m^3/day, build by Inrigo Water AS

Inrigo Water AS Surpplies Ceramic Microfiltrtaion System in Norway

Ceramic Microfiltration System for Drinking Water Treatment

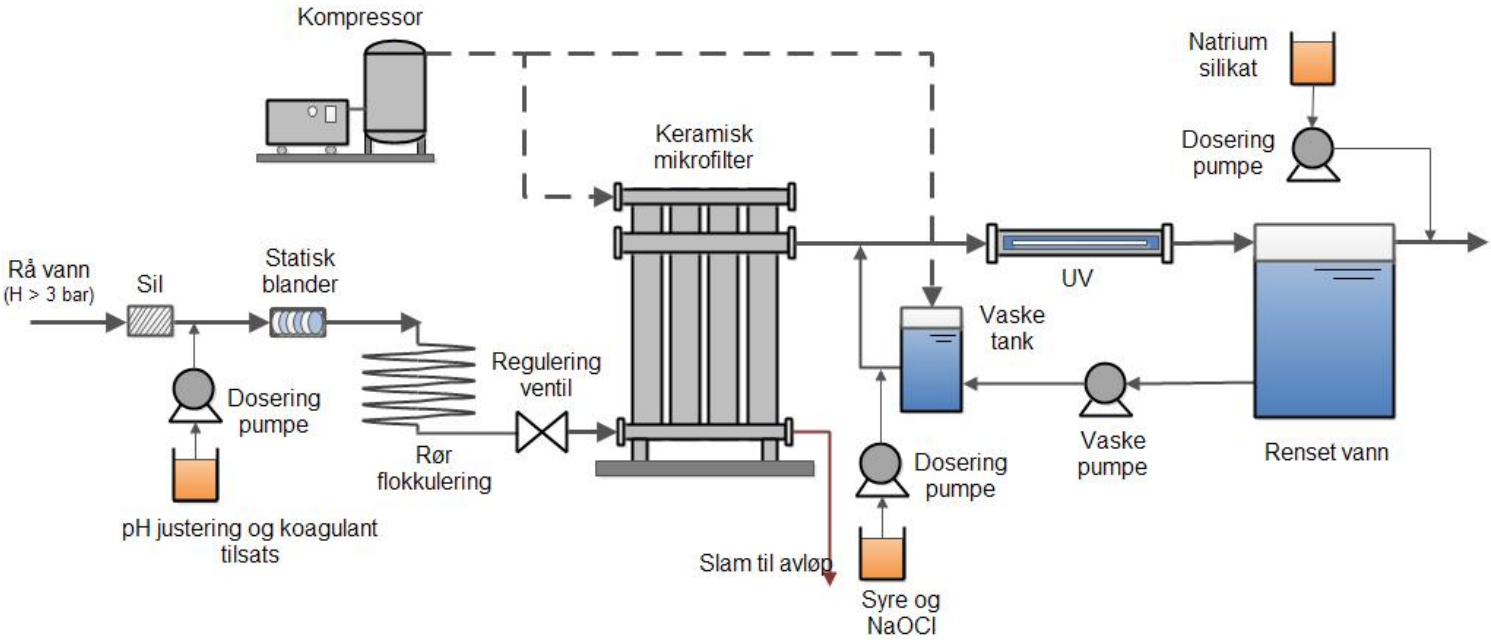

Fig. 4 Treatment scheme of ceramic microfiltration plant

Advantages:

The unique features of ceramic membrane element, such as high mechanical strength and resistance to chemicals, facilitate the ideal system design that meets the needs of every water treatment plant

- Safe and high quality water
- Stable operation
- High water recovery rate (98 %)
- Easy operation & maintenance
- Low operation cost

Fig. 6 Small ceramic microfiltration plant

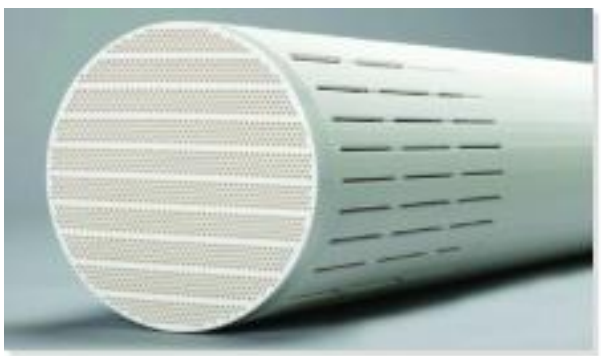

Fig. 5 Ceramice membrane module

Fig. 7 Ceramic microfiltration plant (inside)

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Technology discription:

Coagulation is the destabilization of colloidal/NOM particles. Before membrane filtration, coagulation and flocculation can increase the particle size, and then the flocs could be resisted and removed by ceramic microfiltration. Figure 8 shows the basic coagulation mechanisms.

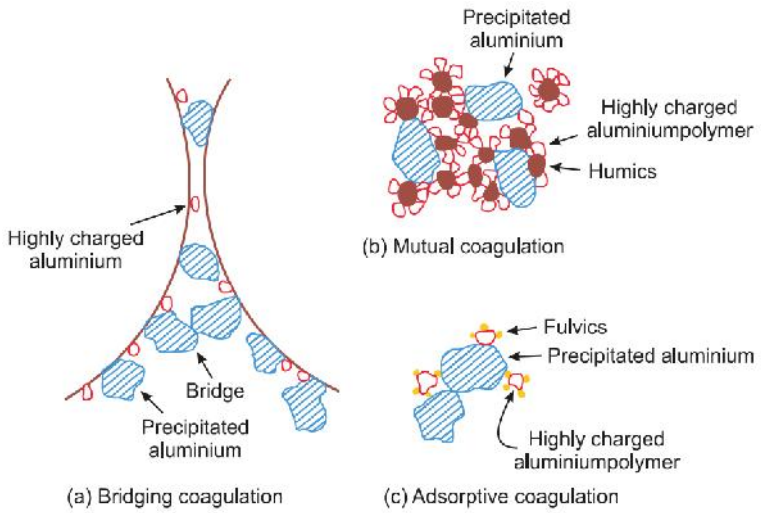

Fig. 8 Schematic of floc formation after coagulating NOM with aluminium salts

Ceramic microfiltration is a membrane separation process which has low filtration resistance, high permeate flux and minimum membrane fouling. Combining with coagulation, microfiltration with pore size 0.1 μ m could remove colloidal/NOM flocs, bacteria, and virus in the feed water. Coagulation and microfiltration processes provides the first hygiene barrier for the drinking water.

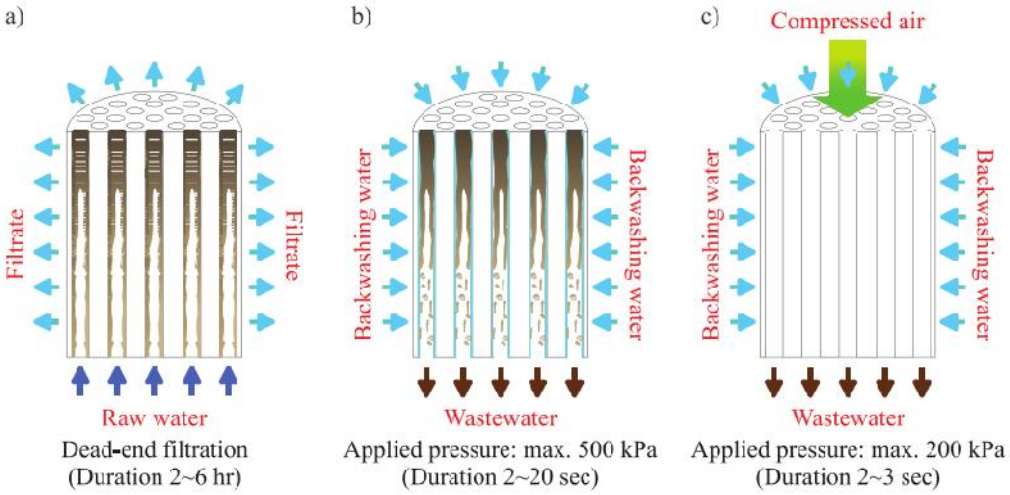

Fig. 9 Different stages of an operating cycle: a) filtration, b) backwash, c) air flush

The microfiltration membranes were operated in dead-end, inside out configuration. Once pressure was applied to the module, feed water was forced into the channels, through the membrane and into the porous support. Permeate left the membrane along the porous outer surface of the module as schematically shown in Figure 9 a. After 2 to 6 hours of operation a backwash was carried out. A backwash consisted of two stages. First, backwash water was forced into the module in opposite filtration flow direction, with pressures up to 5 bar and for a maximum period of 20 s (Figure 9 b). As a consequence, fouling attached to the membrane was detached from the surface. In the second stage, an air flush was performed, discharging the exfoliated material out of the module (Figure 9 c).

UV disinfection is electromagnetic radiation in the short wavelength range of the spectrum from 5 to 400 nm, causes dieoff of microorganisms and leaves no residual radiation in a water. UV disinfection provides the second hydiene barrier of the drinking water.

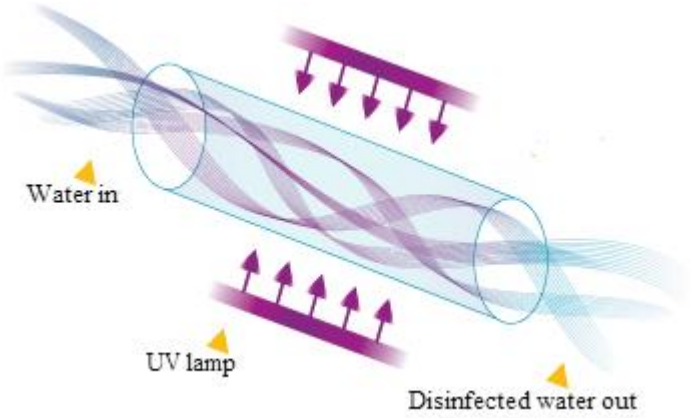

Fig. 10 UV disinfection

Corrosion control by adding water glass (sodium silicate) increases the water pH and creates protective coatings on pipes.

SMART WATER SOLOTIONS

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Email: gaute@inrigowater.no

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