Application : water reuse
Technology : ceramic membrane filtration

➲ For more information, please visit: www.iwec-water-reuse.eu

✉ ❩ For enquiries, send an e-mail to info@rwbalmelo.nl or call RWB Almelo, The Netherlands (NL): +31 (0) 546 545 020

Optimal Use of Ground Water for Drinking Water Production by Implementation of Ceramic Membrane Filtration:

Filter Backwash Water Reuse

Increasing Our Water Source Efficiency

An optimal use of our fresh water resources for drinking water production is becoming increasingly important, also in the Netherlands.

Increasing our water source efficiency by water reuse will result in a more environmental friendly- and a more sustainable use of our fresh water resources.

Filter Backwash Water Reuse

The annual consumption of drinking water in Europe is around 37 billion m^3. The main water sources are groundwater (60 %) and surface water (40 %).

The most common filters used in the purification of fresh water to drinking water are sand filters, which need to be cleaned periodically. Cleaning of the sand filters is done by reversing the flow (backwashing), resulting in the production of spent filter backwash water (see **Figure 1)**.

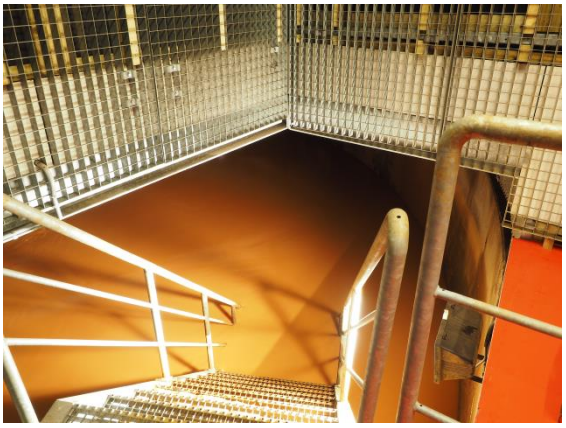

Figure 1. Spent filter backwash water. Vitens drinking water treatment site Wierden, the Netherlands (NL)

The amount of filter backwash water produced lies in the range of 5 – 10 % of the amount of source water.

For the European region this would mean that 1,85 – 3,70 billion m^3 of filter backwash water is produced each year. These numbers roughly equal twice the amount of drinking water consumed per year in the Netherlands!

Reuse of filter backwash water by ceramic membrane filtration will not only significantly increase the source water efficiency, but also reduces the environmental impact created by wastewater discharged to the surface water.

Chemical Reduction

Currently, it is common practice to treat the backwash water by gravitational sedimentation and sludge thickening. Supernatant water is discharged to the surface water. To enhance settlement/thickening, the backwash water is treated with chemicals like coagulants (FeCl3) and/or flocculants.

By implementation of ceramic membrane filtration the filter backwash water is almost completely reused (99 %), resulting in an almost 100 time reduction of the amount of wastewater discharged. As a result, also a drastic drop in coagulant usage (FeCl3) is realised, directly reducing the environmental impact.

IWEC water reuse 3.0

➲ For more information, please visit: www.iwec-water-reuse.eu

✉ ❩ For enquiries, send an e-mail to info@rwbalmelo.nl or call RWB Almelo, The Netherlands (NL): +31 (0) 546 545 020

Demonstration Plant

The first full-scale system for reuse of spent filter backwash water by ceramic membrane filtration was realised and commissioned in 2014 as a demonstration plant at the Vitens drinking water production site in Wierden, The Netherlands (NL).

Features

- Reduced ground water intake to produce the same amount of drinking water;
- Reduction of chemical consumption(s), lowering the environmental impact;
- Low energy input due to dead-end operation, low OPEX;
- Continuous 100 % integrity due to robust monolith ceramic membrane;
- Long membrane lifetime of up to 20 years due to use of durable ceramic material;
- Ceramic membranes reduce ecological footprint.

Plant Design

The demonstration plant was designed and constructed by RWB in close collaboration with Vitens and Eurosteel.

Figure 2. Picture of the ceramic membrane filtration demonstration plant at Vitens production location, Wierden, NL

Basic Properties	
Membrane pore	0,1 µm
Element membrane area	25 m^2
Installed element no	2x 12
Max. capacity	70 m^3/h

Key Performance Data

Treatment of the backwash water results in the production of a clear permeate with an average observed turbidity of **0,042 NTU.** This permeate is ready for direct reuse in the production plant to produce drinking water, see **Figure 3**.

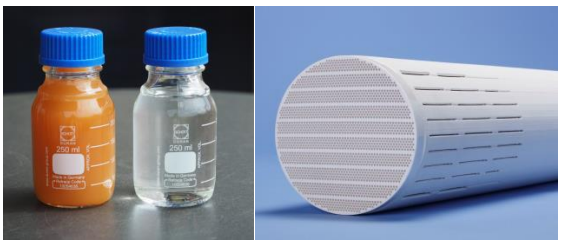

Figure 3. Left to right: spent filter backwash water, produced MF permeate (reused to produce drinking water), ceramic MF membrane (METAWATER Co., Ltd.)

Performance data per month	
Drinking water production	620.285 m^3
Sand filter backwash water	20.058 m^3
MF permeate	19.771 m^3
MF backwash water	287 m^3
MF recovery	99 %
MF energy consumption	3.024 kWh
MF specific energy consumption	0,15 kWh/m^3
Reduction coagulant consumption	>90 %

For the reported data, around **3,0 – 3,5 %** of the drinking water produced, is originating from treated backwash water. Observed E. coli reduction is **log 7-8.**

Outcome and Future Prospective

With its low specific energy consumption (**0,15 kWh/m^3**), minimum coagulant use, integer filtration properties and extremely high recovery, ceramic membrane filtration is a sustainable solution for spent filter backwash water treatment. The drinking water production price does not increase due to the treatment.

In addition, with its flexible design, small footprint and easy operating principles, the technology is also suitable for implementation in small scale drinking water treatment plants and for decentralized treatment and reuse.