3M | Liqui-Cel™ Membrane Contactors

Nanofiltration and Membrane Degassing Successfully Reduce Water Hardness and Excess CO_2 from Drinking Water

Municipal water services continually utilize improved technologies so that they can offer their customers higher water quality. Water can be improved by partially softening the water, which results in lower detergent consumption and lower scaling on kitchen utensils and water fittings.

Successful trials by the municipal water services in Bad Driburg, Germany supported planning and designing the new German water plant in Alhausen with membrane treatment to soften the water.

This system was designed with nanofiltration membranes which provide water treatment without the use of chemicals. This is a big improvement over other softener techniques which require chemical injection.

In this process CO_2 gas is added in front of NF to control scaling on the membrane. In the procedure, the NF permeate is blended with small amount of UF permeate to adjust the hardness level by 50%.

An added benefit of water softening with membrane systems is that the organic material such as bacteria and viruses are also retained or filtered out of the water and the content of pesticides and nitrates are significantly reduced.

This system design also utilizes another membrane technology, 3M™ Liqui-Cel™ Membrane Contactors. These membrane contactors remove the excess carbon dioxide from the NF filtrate to the $CaCO_3$ dissolving capacity limitation of 5mg/L. While nanofiltration and Liqui-Cel membrane degassing technologies have been utilized for over a decade, this technology combination is a new concept in a municipal water system that makes sense.

The water treatment system was completed through the cooperation of two German companies WAT-Membratec and ATEMIS.

www.wat-membratec.com
www.atemis.net

The following table shows the main parameters and outlet values of the system.

Parameter	Value
Inlet flow rate	Up to 5.7 m³/h (25 gpm)
Permeate yield	75 %
Hardness before treatment	20°dH
Hardness after treatment	10°dH
Operating pressure	5.5 – 6.0 bar (80-87 psi)
Membrane area NF / UF	126 m² (1356ft²)/16 m² (172ft²)
Flux	28 l/(m²*h)
CO_2-consumption	0.2 kg/m³ (0.01 lb/ft³)
Membrane area LMC	84 m² (904 ft²)
Cleaning chemicals	Not yet
Energy consumption	1 kWh/m³ Permeate
Investment costs	115,000 € (~$ 170,000)

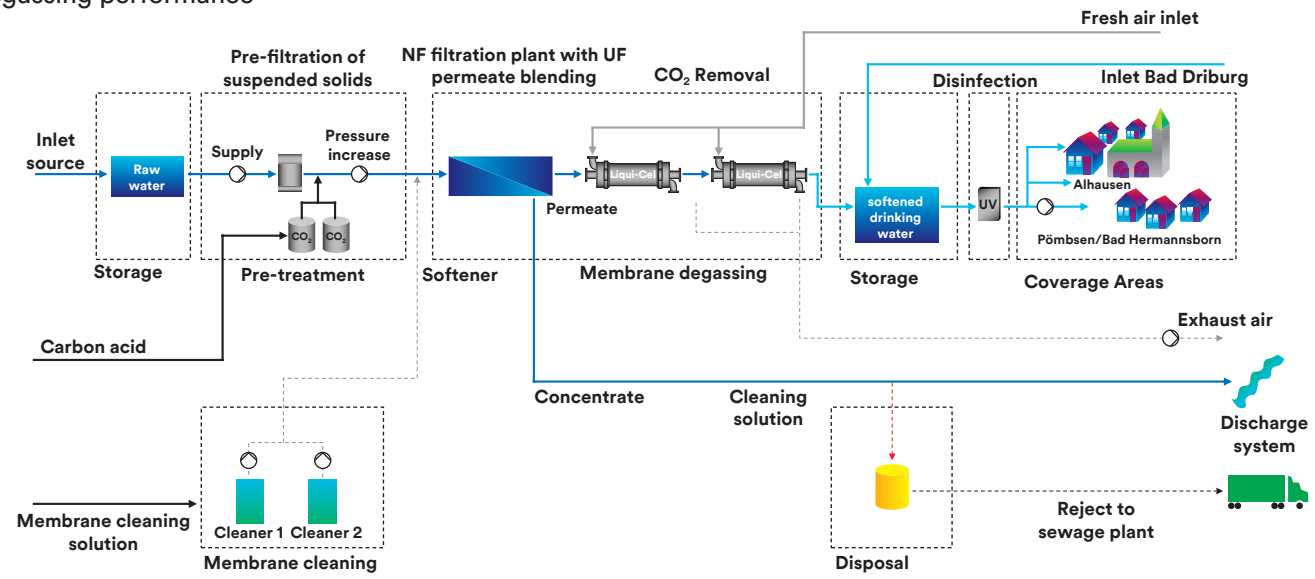
Plant design

- CO_2 dosage for stabilization of hardness at the NF stage
- Spiral wound nanofiltration modules with internal UF permeate blending
- Set equilibrium in filtered water by removing the excess carbon dioxide using membrane contactors
- Continuous control of the water flow, yield, mixing ratio and degassing performance

Advantages

- Continuous regulation of hardness reduction while maintaining sterile water quality
- Chemical-free drinking and waste water
- Fully automated settings for drinking water demand and source water supply

For additional information, please contact your 3M representative or visit 3M.com/Liqui-Cel.



Certified System™
ISO 9001

Separation and Purification Sciences Division
13840 South Lakes Drive
Charlotte, North Carolina
28273 USA
Phone: +1 980 859 5400

3M Deutschland GmbH
Separation and Purification Sciences Division
Öhder Straße 28
42289 Wuppertal Germany
Phone: +49 202 6099 - 0
Fax: +49 202 6099 - 241

LC-1061
Rev. 01/2017
3M.com/Liqui-Cel