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Selecting the best drinking water treatment for mineral-rich groundwater containing micropollutants

5. Water Quality Treatment and Supply System

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Key messages

HOFOR is challenged in finding the best treatment train for a new waterworks, designed to produce 11.5 million m³/year of soft water. The raw water is suburban groundwater with a total hardness of 22 °dH containing micropollutants including DMS and PFAS. HOFOR has preselected two different treatment trains: one with pellet softening and another one with LPRO membrane filtration. We present the advantages and drawbacks of both scenarios based on the results from membrane pilot tests and concentrate treatment studies. Finally, HOFOR's considerations of supply security, drinking water quality, and environmental sustainability used in the decision-making process are presented.

Abstract text

HOFOR's future Islev waterworks is designed to produce 11.5 million m³/year of softer water. The raw water resource is based on suburban groundwater with a total hardness of 22 °dH, containing pesticides and other micropollutants, such as DMS and PFAS.

HOFOR must select the best treatment for this new waterworks. Weighing factors include supply security, drinking water quality, and environmental sustainability. The choice stands between 1) the same treatment as the other newly built HOFOR waterworks with pellet softening, aeration, dual-media filtration and optional carbon filtration, or 2) an alternative treatment based on Low Pressure Reverse Osmosis (LPRO) membranes to remove undesired micropollutants and soften the water at the same time.

Membrane filtration is rarely needed in Denmark where 100% of the drinking water production is based on groundwater, and where simple and chemical-free treatment is often possible. There are concerns about the use of membrane technology, particularly the risk of contamination from antiscalants used to control fouling of the membranes. Moreover, membrane treatment will incur a minimum of 12% water loss (1.4 million m³/year for the future Islev waterworks), which impairs HOFORs' production capacity and importantly introduce challenges in disposing the concentrate from the membranes with increased concentrations of PFASs.

A 2-year pilot test is being carried out at Hvidovre waterworks, with focus on the removal of DMS and PFAS, the retention of antiscalants, and the amount and composition of the concentrate. The pilot tests are conducted by HOFOR with a membrane pilot plant from the Dutch company Logisticon, in collaboration with the Danish consortium Niras-Krüger and their Dutch partner Witteveen+Bos. Three LPRO membranes and three antiscalant types are being tested, including one antiscalant from each of the main antiscalant groups: phosphorous-based, organic-based and polyacrylics-based. Analyses include non-target screening and other novel methods based on mass spectrometry for identification of unknown compounds and byproducts. Additionally, different technologies for PFAS-removal from the concentrate have been investigated.

The results from the pilot tests and investigations with concentrate treatment will be presented and the considerations when selecting LPRO-membrane filtration for drinking water production will be discussed.

Figure1. Rendering of the future IslevWaterworks. PLH-Arkitekter



Figure1. Rendering of the future Islev Waterworks. PLH-Arkitekter