Nanofiltration of highly colored raw water for drinking water production

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Abstract

Water purification with membrane technology was investigated as one of the alternatives for the future drinking water production (6,000 m³/d) in Nynäshamn community. The selected raw water source was surface water from Lake Muskan rather than brackish water from the Baltic Sea. The lake water, without need for desalination, has a high color number (up to 100 mg/l Pt) due to humic substances as well as taste and odor problems from time to time. This R&D project has been performed in two phases: Phase 1: Laboratory trials for membrane selection (NF/UF/MF) with and without activated carbon treatment compared with a conventional raw water treatment including flocculation, sedimentation, filtration and activated carbon treatment. Phase 2: Pilot plant operation with the selected nanofiltration (NF) method for design of a full scale plant. Phase 1 will be presented separately. The aim of the pilot plant operation has been to evaluate different design parameters, type of pretreatment, two tested NF-membranes, membrane cleaning procedure as well as to estimate the costs of a full-scale plant. The result of the pilot plant operation is satisfactory, implying removal of color and organic matter to undetectable levels and maintaining a higher membrane flux than expected throughout the trial period during 6 months. The membrane cleaning with a detergent (Ultrasil 10) has been repeated every second day. The disposal of the NF reject into the sewage net is not possible due to the increase of the hydraulic load. Purification of the NF-reject with ultrafiltration (UF) to a color level about the same as for the raw water from the lake has been suggested in combination with disposal of the UF reject by irrigation of a nearby golf course. The membrane alternative is according to the cost calculation competitive with other alternatives. The water price will be a little higher (about 0.17 USD/m³ higher) than conventional treatment including activated carbon, but the drinking water quality will be improved and more consistent. The membrane application above is unique in Sweden but at the same time in accordance with the present trend in several other countries to utilize membrane technology without chemicals instead of conventional raw water treatment for drinking water production.

Keywords: Humic substances; NF; Drinking water production; UF; Reject treatment and disposal

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