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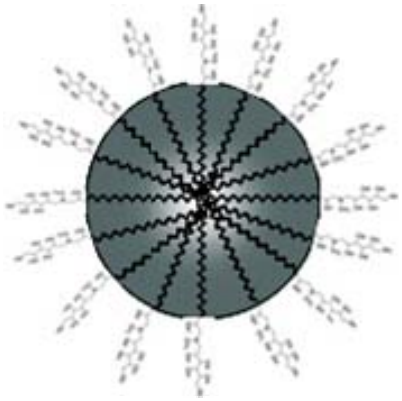
Desalting and Water Purification Research Program

Use of Dendrimers to Enhance Selective Separation of Nanofiltration and Reverse Osmosis Membranes

DWPR Report #140 – C. Bartels & I. Roh, Hydranautics

Background

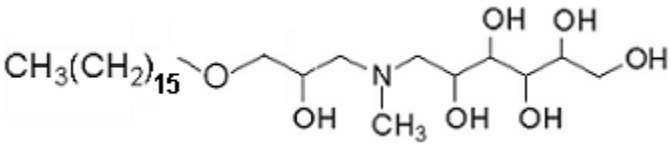


While boron was the component on which attention was focused, the purpose was to demonstrate the concept of selective separation of poorly rejected species.

- Boron is an essential micronutrient but is toxic to humans and plants at higher concentrations.
- Seawater contains 5 – 10 mg/L boron predominantly as boric acid which is uncharged.
- WHO guideline concentration for drinking water level is 0.5 mg/L.
- Softening membranes reject less than 10% of boron while seawater RO membrane can reject around 90%.
- Boron can be removed by raising pH to 8.5, using a second pass RO with pH at 10 – 10.5, or by using a boron selective ion exchange resin.

Objective

Develop a low cost, low pressure, sustainable method of sequestering and recovering boron.



Glycidyl hexadecyl ether (HGE) reacted with N-methyl-glucamine (MGA) to form a building block compound with hydrophobic core and hydrophilic functional end groups which in water to forms spherical micelles as illustrated above. When this compound is added to feedwater at 3000 mg/L, sufficient boron was sequestered in the micelle to enable rejection >96% using ultrafiltration membrane. Boron is released from the micelle by lowering the pH.

Three different processes for obtaining low boron concentration drinking water from seawater were compared. The method of treating a portion of RO permeate with the HGE-MGA micelles and separating with UF had the lowest cost.