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Zwitterion Anti-Scaling Membrane Coatings

Background

Water reclamation for space flight applications (e.g., International Space Station (ISS)) requires complex engineering solutions to ensure maximum water recovery. Current vapor compression distillation (VCD) technologies are effective but produce highly concentrated brines and often cause scaling within a separation system. Scaling in water treatment systems causes inorganic species to deposit on to the surface of the equipment or membranes, which can cause systematic problems with performance.

Pervaporation is a membrane separation process that utilizes dense, non-porous membranes to perform separations driven by a chemical potential difference across the membrane created by either a sweep gas or a vacuum pull. Pervaporation membranes can be subject to scaling, as with most membrane processes.

Zwitterions are polymeric materials with covalently tethered positive and negative ions, but an overall neutral charge. Zwitterion coatings increase the hydrophilicity of membrane surfaces have been shown to reduce scaling on membrane surfaces.

Invention Description

Researchers at Arizona State University have developed a novel method for applying zwitterions to the surface of pervaporation membranes. In this method, zwitterions are coated onto sulfonated pentablock terpolymer block polymer pervaporation membrane surfaces. The extra thickness of the zwitterion coating adds increased transport resistance to the coated membranes which results in lower observed water passage, but also results in improved anti-scaling properties.

The zwitterion coatings enhanced the relative hydrophilicity of the membrane surface and significantly decreased the amount of surface scaling on the membranes. Initial tests showed that membranes with zwitterions had up to 53% reduction in permeance but reduced scaling.

Potential Applications

- Space flight water reclamation
- Municipal water reclamation & irrigation

Benefits & Advantages

- Improved anti-scaling properties
- Enhanced lifetime of membrane system
- Higher yield recoveries over time
- Excellent salt rejection
- Solvent-free method

