Metal Spacers Enhance Permeate Gap Membrane Distillation for Energy Efficient Desalination
Technology #16943

Applications

This invention uses high conductivity spacer materials on the condensate side of a permeate gap membrane distillation (PGMD) system to increase the effective conductivity of the gap and improve flux and energy efficiency. This can be used to increase the efficiency of membrane distillation processes for desalination, food processing and waste treatment applications.

Problem Addressed

Membrane distillation (MD) is used to separate the more volatile components of a mixture via phase change. MD is well-suited for harnessing solar and geothermal energy sources and is often used in off-grid desalination applications. Meanwhile, the overall market is dominated by large-scale, multi-stage distillation systems that produce millions of gallons of desalinated water per day with low energy consumption. The inventors have developed a permeate gap (PGMD) system that shows promise for higher efficiencies as these large-scale systems with lower capital investments.

Technology

Membrane distillation for desalination involves the passage of hot salt water over a microporous, hydrophobic membrane that allows pure water vapor through while retaining the dissolved salts in solution. In the PGMD design, the other side of this membrane contains a water column that fills the entire region between the membrane and the condensing surface. The gaps in the PGMD systems include a spacer material, often made of plastic, to hold the membrane in place.

This technology uses conductive metal spacers in an enhanced PGMD system. Detailed modeling of the heat and heat mass transfer processes shows the high conductivity spacer yielding positive effects, including a greatly reduced transport resistance across the gap and up to twice the energy efficiency of other membrane distillation configurations. The gap conductivity can be increased by using a metal mesh, metallic wool or any porous metal medium. The material used should be corrosion resistant as it is in continuous contact with liquid water.

Advantages

- Metal spacers improve flux and energy efficiency of PGMD system
- PGMD system has low capital investments compared to large scale distillation systems
- System doesn’t require complex parts such as vacuum pumps or pressure chambers
- Low construction costs

Categories For This Invention:
Water Treatment
Desalination

**Intellectual Property:**
Energy-efficient conductive-gap membrane distillation
Issued US Patent
9,956,528

**Inventors:**
John H. Lienhard V
David Warsinger
Jaichander Swaminathan
Hyung Won Chung

**External Links:**
Lienhard Research Group
http://lienhard.scripts.mit.edu/research/

**Image Gallery:**