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Water Treatment for Solar Panel Cleaning using Membrane Distillation

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Direct contact membrane distillation (DCMD) is an emerging treatment option for brackish waters and some industrial wastewaters. DCMD utilizes a microporous, hydrophobic membrane that allows the transport of water vapor while rejecting non-volatile contaminants such as salts and minerals. It is driven by the difference in partial vapor pressure across the membrane that is generated by the temperature difference between the hot, dirty feed water and the cool, distilled product water. Key advantages of DCMD are that it operates at low pressures, can use waste heat or solar heat sources, and can maintain efficacy at very high salt concentrations.

The NV Solar Nexus Water Team's objective is to develop sustainable and advanced water/wastewater approaches to support the water needs of solar energy development and to use solar energy to process water. As part of this, a small pilot-scale DCMD system is being designed and fabricated. The system has a novel, stacked flat-sheet design that provides greater flexibility than conventional hollow fiber configurations. The "Nevada Solar & Water Express", a mobile water treatment trailer, will house the DCMD system and a variety of state of the art and standard water technologies, and will be used on-site at solar energy facilities in Nevada. The trailer will also serve as an educational demonstration unit to raise STEM awareness.

To date, a bench-scale DCMD system has been used to test a large number of membranes for use in the pilot-scale system and the membranes have been characterized for hydrophobicity; this data will be used to validate a computational DCMD model being developed by other members of the NEXUS project. Synthetic panel rinse waters containing surfactants have been tested and were found to be detrimental to the DCMD membranes, verifying the need for non-surfactant based cleaning methods.

This material is based upon work supported by the National Science Foundation under Grant No. IIA-1301726. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.