Membrane device with integrated photoelectric system for producing drinking water and electricity

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ABSTRACT

This work is devoted to the design and testing of new type membrane devices, which are provided with photoelectric systems. The purpose is to design a system with the multiple recovery of solar energy, which can be used to produce drinking water, from seawater by the membrane distillation (MD) process, and electricity, using photoelectric elements. The schemes of the combined portable devices are presented. Photoelectric elements, which are integrated into the constructed modules, carry new functions, not limited to the production of electricity. The testing of the designed small pilot devices was conducted in field conditions, powered by solar energy, independent from electricity and other fuel sources. A hydrophobic, microporous, commercially available membranes from the Millipore Corporation (Billerica, MA) were used for the desalination of seawater. The dependence of the MD solar desalination device productivity on desalination stage number, the specific productivity of drinking water and electric power depending on different hours during the day, and the heat losses from the external surfaces of devices were investigated. Combined production of two products provides the opportunity to increase the efficiency of devices, to minimize the demand of ground area for the devices and to lower the cost of the products.

Keywords: Membrane distillation; Desalination of seawater; Combined solar device; PV

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