Sustainable Energy for Sustainable Water: Solar Heat Driven Desalinating System for Providing Clean and Safe Water for Rural Areas

Sevostianov, Vladislav

This work presents the concept of solar heat driven membrane water desalinator and its experimental validation. In the present research, the desalinator is designed, built, and experimentally tested. The designed and constructed desalinating system consists of a desalinating reactor, water pump, ß-type Stirling cycle engine and parabolic solar heater. As a key element of the design, a desalinating reactor cell using the Direct Contact Membrane Distillation process is built. Three types of membrane materials are tested – M-C8520, M-8A2000, and M-A8515. The test results were negative, in contrast with the manufacturer's claims. To explain the problem, the microstructure of the membranes was studied using SEM and confocal microscopy and Image-J software, and the hydrophobicity of the membranes was estimated using an optical tensiometer. It is shown that the used membrane materials cannot work properly since pore size is too large and hydrophobicity is insufficient. At the same time, solar energy is sufficient to reach operating temperature of the Stirling engine- 1200 to 1500 F- which is sufficient for the mechanical part of the system to work properly. The proposed desalinating system is economically affordable, technologically simple, and leads to a new approach for water management in rural areas; however, the membrane material has to be changed.

Awards Won:

Third Award of $1,000