

Laboratory setup for water purification using household PV-driven reverse osmosis unit

Hazim Qiblawey^{a,b}, Fawzi Banat^{a*}, Qais Al-Nasser^a

^aDepartment of Chemical Engineering, Jordan University of Science and Technology, Irbid 22110, Jordan
Tel. +962 2 7201000; Fax +962 2 7201073; email: banatf@just.edu.jo

^bDepartment of Chemical Engineering, Qatar University, P.O. Box 2713, Doha, Qatar

Received 25 August 2008; accepted in revised form 22 February 2009

ABSTRACT

Water treatment using renewable energies as a power source is still not common due to the high initial investment cost. The possibility of using photovoltaics (PV) as a power source to run a household RO unit has been investigated. Experiments on the laboratory household unit were performed using water with two different total dissolved solid (TDS) concentrations (350 mg/L and 720 mg/L). During the period from February 28, 2007 to November 30, 2007 the unit was entirely powered by photovoltaic cells and operated with and without storage batteries. Without batteries the rate of production of fresh water varied throughout the day according to the available solar power, but was steady when operated with batteries. The specific energy consumption ranged from 1.1 kWh/m³ to 4.3 kWh/m³ for the battery system and ranged from 1.1 kWh/m³ to 1.5 kWh/m³ for the battery-less system. Two membranes (CSM and FILMTEC) were utilized. The CSM membrane was used from February 28, 2007 to June 18, 2007 (period of storage batteries), while the FILMTEC membrane was used during the battery-less period from October 1, 2007 to November 30, 2007. The FILMTEC membrane performed better than the CSM membrane, producing, on average, 8 L/h of drinking water (about 16 mg/L TDS) at specific energy consumption of 1.3 kWh/m³. Several effects on the performance of the RO unit were investigated, but the temperature effect was the most significant.

Keywords: Reverse osmosis; Water treatment; Photovoltaics; Energy consumption

* Corresponding author.