Multi-functional 3D honeycomb ceramic plate for clean water production by heterogeneous photo-Fenton reaction and solar-driven water evaporation

Le Shi, Yusuf Shi, Sifei Zhuo, Chenlin Zhang, Yara Aldrees, Sara Aleid, and Peng Wang*
Water Desalination and Reuse Center, King Abdullah University of Science and Technology, Thuwal 23955-6900, Saudi Arabia

Introduction
Given the inexhaustibility, largely geographical indiscrimination, and wide availability of solar irradiation on the Earth's surface, effective utilization of solar energy toward societal benefits has highly been being sought after in human's history.

Solar-driven water treatment is a technique used to remove salts and other impurities from water via a specially designed solar still, that uses solar energy to evaporate water and capture the resulting steam, which is in turn cooled and condensed into clean water. Salts and other impurities are left behind.

Problem statement
Fig. 1. Scheme for solar still to produce clean distillate water and treat contaminated water simultaneously by multifunctional photothermal material driven by solar energy.

Results
• Solar-driven water desalination has a high energy efficiency ~80% (Fig.3A).
• Solar-driven water evaporation process can be used for a variety of water sources (Fig.3A).
• The VOCs can be removed efficiently from distillate water (Fig.3B).
• Solar desalination is confirmed by ion concentration of distillate water, which is much lower than WHO drinkable standard limit (Fig.3C).

Conclusion
The solar-driven water evaporation efficiency can be improved significantly by using this 3D multifunctional photothermal material, which can produce clean water from contaminated seawater through water evaporation and photo-Fenton reaction simultaneously.

Author email le.shi@kaust.edu.sa