Sun In . . .Water Out!: Light Absorbing Nanoparticles Dramatically Enhance Vaporization in Solar Desalination

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Population growth and climate change will increase global water demand while water supplies diminish. Creating a compact, inexpensive solar desalination device to salt water into drinking water can turn this crisis into an opportunity. This project explored the potential to create solar vaporization by exploiting the photothermal effects of nanoparticles in the desalination prototype. The concept is to create steam without boiling water using the sun and nanoparticles. Increased vaporization resulted in increased water production in the solar desalination device when the particle size was <100 nm. Evaluation of the potential to create a superhydrophobic condenser using hydrophobic polymers to speed condensation and produce more water did not produce the hypothesized results. The hydrophobic materials led to dense droplet formation, but the droplets did not release quickly and grew too large. Droplets must fall away quickly in order form new droplets to speed condensation. Seven different samples were tested, incorporating different particle size carbon black and hydrophobic coatings for the condenser, modifying last year’s best desalination device. Temperature measurements were taken over time and water was collected to determine rates of water production and temperature increases. The hypothesis was partially supported. Nanoparticles absorbed light, raising the surface temperature and causing vapor to be formed around the nanoparticle surface. This caused vaporization of the water that was close to the heated nanoparticle. With time, heat was exchanged with the water causing a rise in the bulk water temperature. The greater surface area of the nanoparticles improves reactivity and catalysis, driving improved efficiency of the desalination device.