Improved Efficiency of Seawater Steam Generation Using Carbon Nanoparticles

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Water scarcity is a huge problem in our world today. Scientists at Rice University recently discovered that focused sunlight shone on nanoparticles in pure water generates steam without substantially raising the surrounding water temperature. My research last year was an extension of the studies performed at Rice. It compared the efficiency of nanoparticle steam generation with pure water and seawater, where “efficiency” was defined as the fraction of energy vaporizing water as compared to the total energy, including energy for heating the bulk fluid. My results confirmed that nanoparticles are required for efficient steam generation. Most surprisingly, I found that nanoparticle steam generation efficiency was statistically greater in seawater than pure water. A focus of this year’s research is identifying what factors resulted in the observed difference in steam generation efficiencies between the solutions. Experiments examined steam generation efficiency for solutions varying in properties such as percent salt, molarity, density, and viscosity. Absorption of IR light and a change in solution viscosity were not found to be important factors in steam generation efficiency; however, as percent mass, molarity, and density of a solution increased, so did steam generation efficiency. Results suggest that multiple factors may play a role in the increased efficiency of steam generation for water containing salts. A recent experiment points also to the potential role of salts in influencing agglomerated particle size and steam generation efficiency. This research is important because it can be applied to many applications including water purification in sun rich, water poor regions.

Awards Won:

National Aeronautics and Space Administration: Intel ISEF Best of Category Award of $5,000