Improved Efficiency of Steam Generation Using Carbon Nanoparticles

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Water scarcity is a huge problem in our world today. Although essential for life, almost one billion people lack access to safe drinking water. Scientists at Rice University recently discovered that when focused sun light is shone on nanoparticles in pure water, steam was generated without substantially raising the surrounding water temperature. My research aims to determine if nanoparticles can be used to generate steam, with similar efficiency, from seawater. Prior to testing, a high intensity, focused light source and testing apparatus were constructed, an artificial seawater solution was made, and carbon nanoparticles were dispersed. Many preliminary studies were performed to demonstrate nanoparticles were necessary for efficient steam generation and to improve steam generation efficiency. This study particularly focused on comparing the energy efficiency of steam generation for pure water, 3.5% NaCl, and 3.5% seawater, where “energy efficiency” is defined as the fraction of energy vaporizing water as compared to energy heating the bulk fluid. At 95% confidence, a two-tailed t-test demonstrated statistically greater steam generation efficiency for water containing either NaCl or seawater, as compared to pure water. The steam generation efficiencies for seawater as compared to salt water (NaCl) were not statistically different at 95% confidence. A later extension found that top surface illumination could achieve substantially (3X) greater steam generation efficiency than illumination of the bulk solution. This research can be applied to a variety of applications including water purification in sun rich, water poor regions.

Awards Won:

First Award of $5,000