Democratizing Desalination: Study of Materials and Methods To Make Desalination Less Energy Intensive and Affordable

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Many in my grandfather's village are engaged in manual salt-farming, spending long hours by the sea under the blazing sun with little access to potable water. I researched suitable materials and methods to build a low-cost mechanism that can produce freshwater. Conventional desalination methods, known for their high energy demands and relatively low efficiency, remain inaccessible to many who reside in close proximity to coastal regions. A primary impediment to solar desalination is the dissipation of solar heat within the body of water, instead of effectively using it to provide heat for vaporization. I devised a mechanism aimed at insulating the water below while at the same time channeling a consistent water supply to a chemically modified evaporation layer possessing large surface area microscopically and focused on evaporation. This configuration maximizes the capture and utilization of solar energy exclusively for the evaporation of water. I evaluated numerous materials to discern candidates for the insulation and evaporation layers. These included local, natural alternatives that were investigated for their suitability in replacing the layers economically and effectively in response to salt fouling. Processes and protocols for chemically or physically modifying the specimens also were explored to enhance evaporation rate and desalination efficiency. Based on the findings, a small-scale pilot plant was constructed using hemp, coconut coir, and intercalated activated carbon, capable of desalinating 7L of water to yield 4.3L of potential drinking water per day using solar energy for desalination, which could provide 2-3 villagers drinking water during their workday.