ENGINEERING A DESICCANT-DRIVEN ($CaCl_2$) SELF-CONTAINED SOLAR DISTILLATION SYSTEM TO COLLECT DRINKING WATER FROM THE ATMOSPHERE

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ABSTRACT

Freshwater accounts for 2.5% of the planet's water, and the UN's estimated 7.7 billion people on Earth are taxing that supply. With 3,100 cubic miles of freshwater vapor trapped in the atmosphere, a desiccant-driven solar distillation system may be a viable solution to a crisis in areas with no water sources. A diamond-shaped square pyramid solar distillation system was built using impact-resistant polycarbonate and stainless steel and tested in 45-100ºF temperatures under diverse weather conditions. Calcium chloride absorbed water vapor then the still utilized solar energy to help regenerate the $CaCl_2$, forcing it to release the H_2O through distillation. The design eliminated the traditional trough system and was managed by one person. While productivity was dependent on climatic conditions, the still could produce 6.5 ounces with external temperatures above 85ºF. External temperatures below 60ºF produced measurable water of 2.5+ oz. with full sun exposure. The predominant factor contributing to higher water collections was the amount of solar exposure on any given day. The insulated stainless-steel base and black cloth substrate increased internal temperatures by +/-15ºF, and the inverted stainless-steel base doubled as a solar concentrator by maintaining internal temperatures above 110ºF on mid-60ºF cold weather days.