

Using Calcium Chloride to Source Drinking Water in Arid Climates: H₂O Absorption and CaCl₂ Regeneration Rates in Relation to Desiccant Surface Area

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Over 2 billion people lack access to clean drinking water, and 844 million lack basic water services. The United Nations estimates 80% of countries can't financially meet future water needs, and the UN's 2030 Agenda goal SDG6 — ensuring available and sustainable management of drinking water — isn't on track. Additionally, climate changes are increasing arid and semi-arid regions, causing greater water sourcing problems. Hygroscopic compounds, like CaCl₂, may be the key to a readily available and economically affordable solution to the crisis. In this experiment, it was hypothesized that increasing the surface area of 1000 grams of CaCl₂ would increase water vapor absorption and exothermic temperatures, causing greater amounts of H₂O condensation in a closed container collection device and increase water collection measurements. Over a 21-day test, three CaCl₂ surface areas — 489.44, 978.88, and 1468.32 sq. cm. — were exposed nightly to air to absorb H₂O vapor then sealed during the day, allowing solar heat to force H₂O condensation for collection. Data recorded included daily measurable H₂O collection totals, daily H₂O released from CaCl₂ trays during the condensation period, daily internal container temperatures, nightly H₂O increases per container, nightly humidity, and daily temperature highs. Results showed the greatest surface area containers produced 6.26 times more measurable water collected and higher internal temperatures (+20 to 25°F) than the smallest surface area containers. Recorded H₂O released (uncollected) from containers showed even greater gaps between surface areas sets. These measurable water losses were observed, recorded, and attributed to engineering flaws in seals and overall design.