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Heating Up: Using Phase Materials as a Thermal Battery

Phase change materials are a proposed large scale storage method for solar energy; mirrors melt a material - often salt - storing solar generated energy. As the sun sets, the salt resolidifies, releasing energy during peak usage times. This investigation examined whether materials which go through a phase change perform better in a small scale thermal battery than liquids. It was hypothesized paraffin wax would store more energy because it goes through a phase change and has a high specific heat. The experimental setup used peltier coolers to test four different readily available materials: paraffin wax, canola oil, Crisco, and water. The materials were heated for a set amount of time and energy recovered was measured. The average energy recovery over 29 minutes was 1.58 watts from paraffin wax, 1.32 watts from water, 1.26 watts from canola oil, and 1.06 watts from Crisco. The P value from one-way ANOVA test showed results to be significant with a P value of 0.0009. The Tukey HSD post-hoc test showed paraffin wax vs. canola oil and paraffin wax vs Crisco to be significant. Paraffin wax vs. water, canola oil vs. Crisco, canola oil vs. water, and Crisco vs. water did not show significance ($P < 0.05$). As hypothesized, wax recovered the most energy. Areas for further research include testing additional materials and finding a more efficient method for reclaiming energy. A viable small scale thermal battery has potential to be a cheaper and environmentally conscious alternative to lithium ion batteries.