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Effects of a helical-grooved wick structure in a thermosyphon solar collector

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The heating of household water, which consists of nearly 20 to 30% of the average household's energy costs, has drastically increased in recent years. Solar water heaters have become popular to lower this cost, and one such system employs a thermosyphon system to collect solar energy and heat the water. Current market designs use a traditional thermosyphon with no wick structure inside. The purpose of this research project is to determine whether a thermosyphon with a helical-groove wick structure is better suited for a solar water heating system. Advantages for wick structures in thermosyphons include a decreased vapor-liquid interaction (preventing a condition called flooding), an aid to circumferential distribution of liquid in a tilted application, and to enhance condensation heat transfer in the condenser section. For this research, two thermosyphons are constructed; one with a smooth inner wall and one with a helical groove wick structure. Each thermosyphon is 10 mm in diameter, 1.83 meters long, and constructed of copper tubing. The temperature of the condenser, adiabatic, and evaporator sections are monitored as the thermosyphon is tested under increasing thermal loads. The data collected is used to determine whether the surface area of the thermosyphon is sufficient to collect enough solar energy or if a heat sink is needed to provide sufficient surface area. The overall goal is to determine whether the advantages of the grooved wick structure provide a significant increase in performance over a traditional smooth-wall thermosyphon.