Simply Stir: A Novel Approach of Harvesting Low-Grade Thermal Energy Using the Seebeck Effect to Power an Automatic Stirrer

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This work highlights the use of thermoelectric generators (TEGs) to harvest thermal energy inherently available in cooking, to power an automatic stirrer. The tedious task of manual continuous stirring can be replaced with a more efficient automatic stirrer - vastly superior to the current bulky alternatives. While battery-powered stirrers could address the bulkiness issues, they are impractical for a high-heat environment dealing with edibles. Through the Seebeck Effect, TEGs can harvest low-grade thermal energy from the stove's heat, converting it into electrical energy to power a small DC motor. The project involves building a prototype with a 40 mm x 40 mm low-cost TEG along with a 1 W DC motor. A sealed enclosure built with a 0.8 mm thick aluminum sheet housed the TEG on the bottom and a motor with a stir bar on the top. This prototype was tested for various parameters, such as impact on heat transfer, power delivery efficiency, and practical ability to stir various fluids. Results from a T-Test showed that the prototype statistically affected the time it took water to boil; however, this is acceptable for this application. A second test measured the dependency of the TEG's power output on the temperature gradient across the TEG. This specific TEG generated 31.27 mW of peak power at 6O load resistance (about 10% of an AA battery), making it suitable to drive a small DC motor. The practical fluid stirring test showed that the prototype easily stirred water, milk, and canola oil, but it could not stir honey as its high viscosity stalled the motor. With an improved gear ratio, this problem can be addressed. This project proved that the prototype is successful as a stirrer. Furthermore, TEGs are valuable energy harvesters that can improve energy efficiency.

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