Review of thermal performance studies on solar hot box cookers with different coating materials

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Abstract

Solar cooking is a method of cooking foods using energy from the sun. A solar cooker collects sunlight and converts it into heat for cooking or heating food and water. It is an eco-friendly, low-cost, and fuel-saving technology that reduces the use of firewood, gas, and electricity. Solar cookers work based on the greenhouse effect, where heat is trapped inside the cooker to increase the cooking temperature. This study evaluates the performance of a dual-compartment solar box cooker using different additive-enhanced absorber tray coatings. Additives such as copper oxide (CuO), nano-TiO2, activated carbon, tungsten, and mica were mixed with black paint to improve heat absorption and retention. Experiments were conducted under no-load and water-heating conditions. The results show that all modified coatings performed better than normal black paint. Nano-TiO2 produced the highest absorber tray temperature, while Mica showed good water-heating performance. Temperature improvements of up to 14°C were observed during testing. The study concludes that additive-enhanced coatings are a simple and low-cost method to improve the efficiency of solar cookers and solar thermal systems.

Keywords: solar box cooker, absorber tray, thermal performance, Nano-TiO2, greenhouse effect, heat loss.

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