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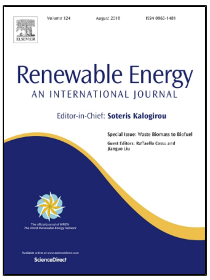

Evaluation of landscape fabric as a solar air heater

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Evaluation of landscape fabric as a solar air heater

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Abstract

Solar heating has great potential to displace fossil fuels in agricultural and industrial space heating. The conventional metal transpired solar collectors (mTSC) is highly-efficient but its high cost has impeded its adoption. While the plastic TSC (pTSC) would be less-expensive than the mTSC, it requires perforation. Since a high absorptance, non-woven landscape fabric is widely available and inexpensive, it could be cost-effective solar collector. The landscape fabric collector (fTSC) was compared with mTSC (anodized aluminum) and pTSC for temperature rise (ΔT) and efficiency (η) at two suction velocities (V_s). The mTSC and pTSC had porosity of 1.2% while the fTSC had a porosity of 80%. At 0.047 m/s, the fTSC produced higher average ΔT (by at least 2 °C) and average η (by at least 10%) than the mTSC and pTSC that were similar in performance. At the higher V_s of 0.060 m/s, the fTSC slightly outperformed the mTSC while the pTSC had the lowest ΔT and η. Superior performance of the fTSC was likely due to lower energy losses than the other two collectors as was indicated by its scanning electron microscope images. Modeling the fTSC as a simplified packed bed may be appropriate and challenges have been identified. Practical scale-up suggestions are provided. The fTSC is the least expensive solar air heater for space heating.

Keywords: Transpired solar collector, UTC, Landscape fabric, Temperature rise, Modeling