

**DESIGN, FABRICATION AND PERFORMANCE EVALUATION OF A MIXED
SOLAR-CHARCOAL DRYER FOR BANANA**

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ABSTRACT

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Drying is essential in preserving and extending shelf life of agricultural products. It is performed either using mechanical dryers or laying commodities under open sun. The first method is costly, and the latter possess many issues like inefficiency and possible contamination. With this regard, a solar dryer that would fix both issues was designed. The study aimed to design and fabricate a mixed solar-charcoal dryer for bananas, evaluate its performance, and provide simple cost and return analysis of the machine. The mixed solar-charcoal dryer is composed of the solar collector assembly, combustion chamber and the drying chamber. The machine has a drying capacity of 15 kg of fresh banana sample and can facilitate airflow of 0.163 m/s to 0.2 m/s. The machine was tested operating under three conditions, the solar dryer, which uses sunlight as the heat source; the charcoal dryer, which uses coal as fuel; and the mixed dryer, which utilizes both heat sources simultaneously. The mixed dryer demonstrated greater results in moisture reduction rate and evaporation load than the solar and charcoal dryer while the charcoal dryer has the best heating system efficiency of 61%. Lastly, the cost and return analysis revealed that the machine is profitable with payback period of 3.5 months.

Keywords: mixed dryer; charcoal dryer: solar; moisture content; drying efficiency.

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