

ANALYSIS OF DIFFERENT TECHNIQUES FOR IMPROVING PERFORMANCE OF FLAT PLATE SOLAR COLLECTORS FOR FRUITS DRYING

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ABSTRACT

Fruits drying had become a broader technology in fruits and vegetables value addition. The technology is reported to be a promising way of drying without incurring higher cost but its adaptation has not been feasible in rural areas. Solar dryers have been developed but its poor performance limits its applicability. In this study, several techniques for modifications of traditional solar collector were addressed. It was observed that, varying collector designs in different techniques, a range of collector performances can be archived. The research shows that, collector efficiency can be improved by 9.6% when employing double duct counter flow compared to conventional collectors. Likewise, performance difference between conventional collectors and studied models were found to be 8%, 7.2%, 6.1% and 5.2% for model parked with charcoal, 5 mm wire mesh, 4 mm glass thickness and 8 baffles respectively. This study shows that, double duct counter flow system is the best option for improving the performance of the collectors, followed by charcoal and wire mesh. On the hand, using 4 mm glass thickness gave improved performance, however, it is recommended for collector size not exceeding 2 m in length.

Key words: Flat Plate Solar Collector; Collector Performance; Temperature Profile; Glass thickness; Baffles.

1. INTRODUCTION

Tanzania is one of the countries that faces profound challenges in ensuring its food security (Rinehart *et al.*, 2011). Food problem in Tanzania and most other developing countries is largely due to the inability to preserve food surpluses rather than to low production (Banout *et al.*, 2011; Jairaj *et al.*, 2009; TaTEDO, 2010). Good examples are seasonal fruits and vegetables which are to be consumed in the short time span of the season. It is estimated that, more than 80% of fruits and vegetables production in developing countries are produced by small-scale farmers in rural areas far away from food-processors (Banout *et al.*, 2011). It is also reported that 80-90% of the working populations are employed in agricultural sector, however, the availability of fruit and vegetables during the off-season is still a problem. Lack of appropriate

preservation and storage systems has been reported as one of the causes of considerable losses of produce. Fruit and vegetables prices are very low during the pick of the season due to their bulkiness and rapid spoilage. It was reported that, 30-40% of total fruit production in sub-Saharan countries gets spoiled before reaching the market (Gbaha *et al.*, 2007; Karim, 2004). Philemon (2010) reported post-harvest losses in Tanzania to be 40-60%. It was also reported that only 10% of fruits produced in Tabora region were consumed due to lack of appropriate technology for processing and preserving (MATF, 2011). In addition, Lynch (1999) stated that, even though Tanga region produces more than 100,000 tonnes of pears each year, only 20% were consumed and the rest were left rotting under trees. Fruit's production in Tanzania has reported to increase from year to year,

