FACULTY OF MECHANICAL ENGINEERING

MARA UNIVERSITY OF TECHNOLOGY

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FINAL YEAR PROJECT REPORT

NATURAL CONVECTION SOLAR DRYER WITH BIOMASS BACK UP HEATER

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ABSTRACT

A direct type natural convection solar dryer and a simple biomass burner have been combined to demonstrate a drying technology suitable for small-scale processors of dried fruits and vegetable in non-electrified areas of developing countries. From a series of evaluation trials of the system, the capacity of the dryer was found to be 2-3 kg of fresh pineapple arranged in a single layer of 0.01 m thick slices. During the same trail, the drying efficiency of the solar component alone was found to be 20.8%. Key features of the biomass burner were found to be the addition of thermal mass on the upper surface, an internal baffle plate to lengthen the exhaust gas exit path. Further modification to further improves the performance of both the solar and biomass components of the dryer are suggested.

INTRODUCTION

Compared to some other solar technologies, solar dryers continue to struggle to gain acceptance by commercial product of dried products. The reasons for this are complex and varied and depend on many factors. The Brace type solar dryer is one of the few designs that have achieved some level of acceptance. (Buatsi, 1998; Brett *el al.* 1996). The brace design is appealing, particularly to small-scale producers, because it is easy and inexpensive to construct, simple to use and can produce a good quality dried product under favorable climatic conditions. Another significant advantage of the design is that, the airflow through the dryer is normally induced by natural convection rather than by a fan. This means that the dryer can be used in areas where electricity is not available.

One significant disadvantage of the dryer is that it is normally not used with any form of back-up heating. For commercial producers, this factor limits their ability to process a crop when the weather is poor. It also extends the drying time because drying can only occur during the daytime when there is adequate solar radiation. This not only limits production but also can result in an inferior product. For commercial producers, the ability to process continuously with reliability is important to satisfy their markets. A review of the literature indicates that there have few attempts to overcome this limitation in simple natural convection solar dryers. One exception is the dryer report by Bassey (1987), which used a sawdust burner to provide heat during poor weather and at night. The sawdust burner was constructed as a separate component, rather than being integrated with the drying cabinet.

Biomass, particularly fuel wood, is the most common source of energy in rural areas of developing countries and provides unsustainable pressure is not placed on the