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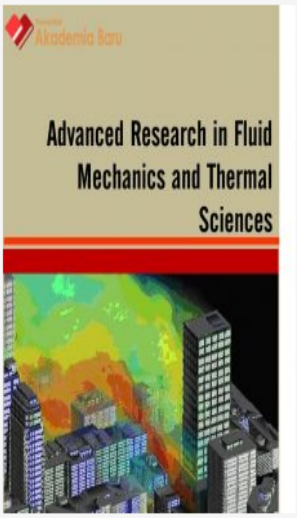

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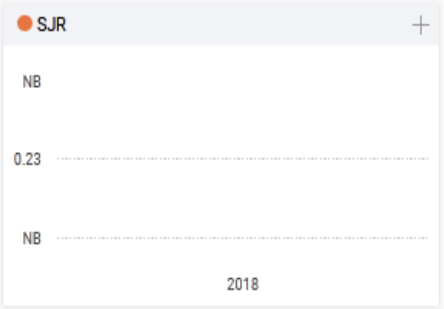
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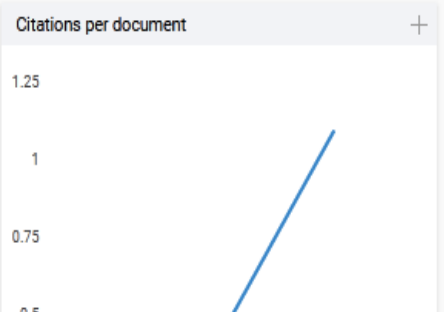
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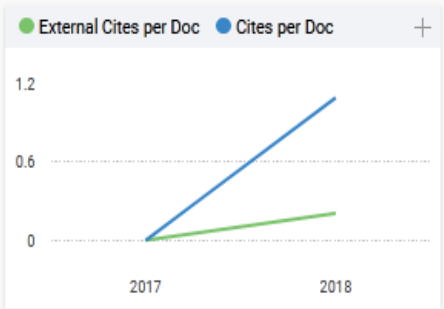
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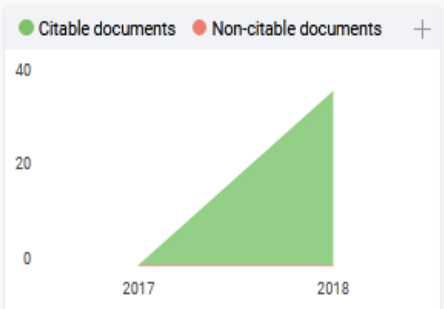
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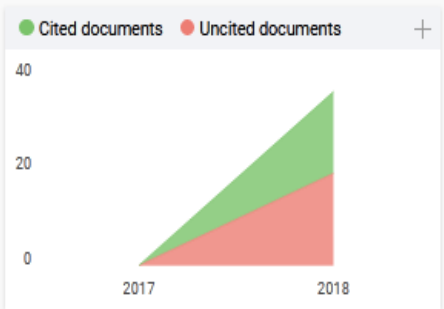
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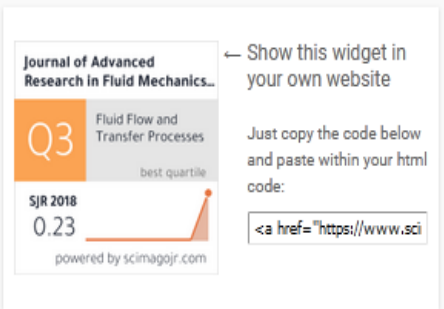
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Impacts of Fin Variation on the Performance of Shelf Type Solar Dryer

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Abstract – *This study is aimed to investigate the influence of using four types of fin (small wave, big wave, plate and zigzag) on the performance of shelf type solar dryer where the air flow applied in the study is the natural convection. Experiment method used in this study is by using four identical solar dryers in the same time. The different of these solar dryers is that each of them using different fin type. Research results show that waving fin yields the most optimum performance, followed by zigzag fin and fin plate. The lowest optimum performance is obtained from small wave fin.*

Keywords: Fin, Solar Dryer, Shelf Type, Natural Convection of Fin

1.0 INTRODUCTION

The quality of agricultural products can be enhanced by the drying process. The drying process is commonly performed by farmers in Indonesia are by direct drying using solar energy. In this drying occurs in direct contact with the outside air, until the material is dried to less clean and can be contaminated. To solve the problem, many models are developed solar dryer equipment, including the solar dryer rack type [1-5].

Exploiting solar energy for the drying process is very should be developed in Indonesia because of the potential for solar energy in Indonesia [6]. Indonesia is a country that only has 2 seasons and the sun shines for 12 hours a day.

Rack type solar dryers can increase the rate of drying and keeps material clean [1-5]. Research solar dryer rack type has been widely applied, such as by observing the effect of the use of gravel as heat storage of the solar dryer performance improvement rack type [1]. Improved performance of solar dryer rack type can also be done by providing forced convection flow [2], a hybrid with biomass [3], installing a heat sink plate [4], using wind ventilator [5].

The use of solar dryers for drying rack type has been widely used because of the large amount of material to be dried in the drying process time. All materials can be dried using solar dryer rack types, in a variety of research products that have been dried using this type of dryer is chili [1], aubergine [2], herbal medicine [3], corn [4], banana [7].

One of the efforts to improve the performance of solar dryers is to use fins. The use of fins serve to increase the area of heat absorption [8] without increasing the dimensions of the solar dryers. Research is attempting study the effect of different types of fins to optimize the performance of solar dryer rack type.

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2.0 METHODOLOGY

Material that is used as object of the solar dryer experiment is maize, with initial mass of 2.7 kg for every solar dryer. The initial air content of the maize is 79.1%

There are four fin types used in this study; big wave fin, small wave fin, zigzag fin and plate fin. These four fin types if stretched will have the same dimension. The fins are made from iron sheeting with 1 mm thickness.

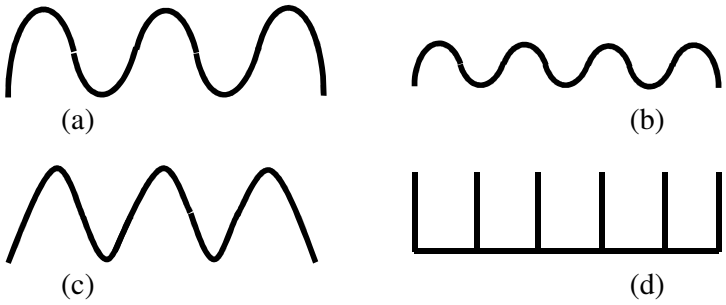

Figure 1: Various type of fin (a) big wave (b) small wave (c) zigzag and (d) plate

Figure 2: Shelf type of solar dryer with four fin types

For accuracy, the experiment is conducted simultaneously for every type of fins. It is required four identical shelf type solar dryers with various fins. The experiment is conducted in Makassar, South Sulawesi, Indonesia.

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3.0 RESULTS AND DISCUSSION

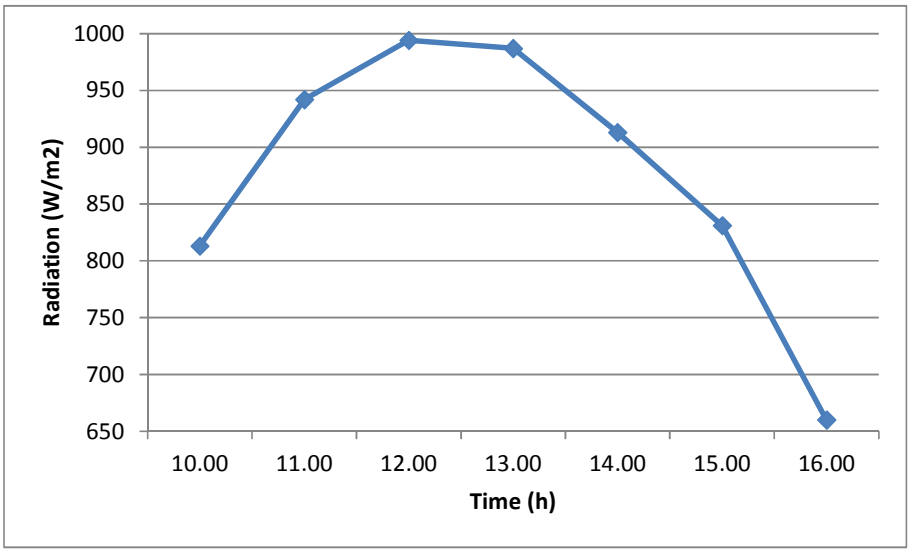

Figure 3: Solar radiation intensity

The Solar radiation intensity during the experiment is parabolic curve as shown in figure 3. The highest intensity is obtained at 12.00 by 994 W/m^2 and the lowest intensity is obtained at 16.00 by 660 W/m^2.

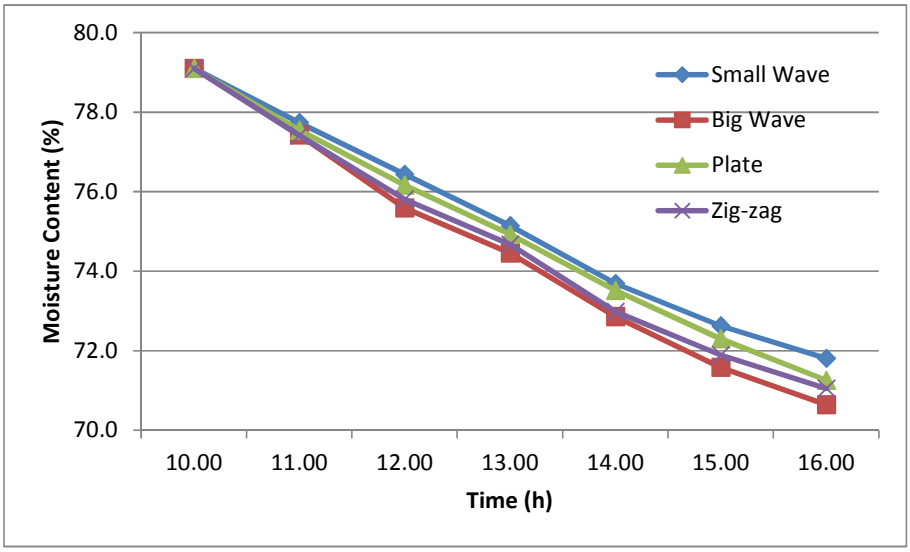

Figure 4: The influence of various fin types in reducing water content

Figure 4 shows that the experiment for 6 hours, the lowest water content is achieved from big wave fin, followed by zigzag fin and fin plate.

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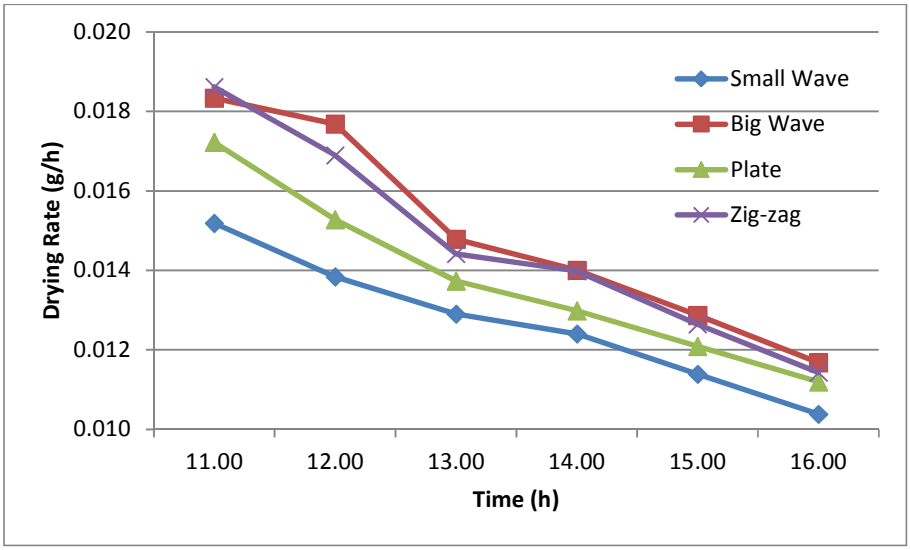

Figure 5: The influence of various fin types on drying rate

The highest drying rate is obtained from big wave fin, meanwhile the lowest is obtained from the small wave fin as shown in figure 5. However, from figure 5, zigzag fin yielding higher drying rate compared with plate fin.

Figure 6 shows that the highest and the lowest efficiency are obtained from big wave fin and small wave fin respectively. Zigzag fin obtains little bit smaller than big wave fin while plate fin obtains efficiency that lies between zigzag fin and small wave fins.

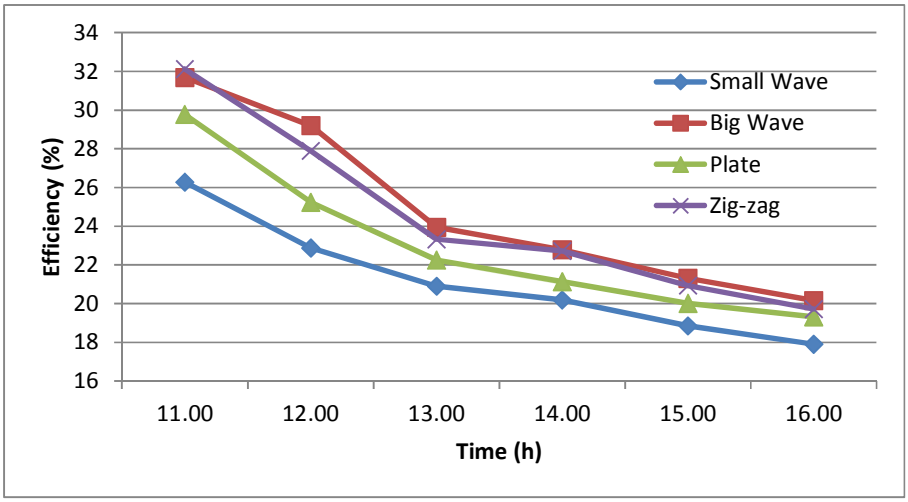

Figure 6: The influence of various fin types on solar dryer efficiency

4.0 CONCLUSSION

Based on water content reduction, the optimum drying rate and efficiency of solar dryer with natural convection is obtained with big wave fin type. Small wave fin obtaining the lowest

optimum level compared with other three fin types. Zigzag fin resulting better performance if compared with plate fin.

ACKNOWLEDGEMENT

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