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# Development of the Solar Dryer for Drying Organic Fertilizer of Rubber Farmers

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***Abstract:*** *In this research, a solar dryer for drying Organic Fertilizer of Rubber Farmers made from Polymer, Metal Sheet and Ventilator. The dryer chamber has a volume of 2x2x2 $m^3$. Hot air supplied to the dryer chamber is obtained from clear-polymer roof. The total area of the roof is 7 $m^2$. The wall of chamber made from black-metal sheet for bottom-half and clear-polymer for top-half part. To investigate its performance, the dryer was use to dry two batches of organic fertilizer of rubber farms during June to July, 2015. For each drying test, 50 kg of fresh product was used in the experiment. It was found that this dryer can be used to dry 50 kg of Organic Fertilizer in 2 days. The product being dried in the dryer was completely protected from rains, insects, animals and win. The dried product is high quality. The outlet air temperature and the moisture removed from the product by ventilator on the top of the roof of chamber.*

***Keywords:*** *Dryer, Solar, Organic Fertilizer, Room.*

## 1. INTRODUCTION

Solar thermal energy can be useful for drying wood for construction and wood fuels such as wood chips for combustion. Solar is also used for food products such as fruits, grains, and fish. Crop drying by solar means is environmentally friendly as well as cost effective while improving the quality. The less money it takes to make a product, the less it can be sold for, pleasing both the buyers and the sellers. Technologies in solar drying include ultra-low cost pumped transpired plate air collectors based on black fabrics. Solar thermal energy is helpful in the process of drying products such as wood chips and other forms of biomass by raising the temperature while allowing air to pass through and get rid of the moisture.[1] Solar drying was controlled drying is required for various crops and products, such as grain, coffee, tobacco, fruits vegetables and fish. Their quality can be enhanced if the drying is properly carried out. Solar thermal technology can be used to assist with the drying of such products. The main principle of operation is to raise the heat of the product, which is usually held within a compartment or box, while at the same time passing air through the compartment to remove moisture. The flow of air is often promoted using the 'stack' effect which takes advantage of the fact that hot air rises and can therefore be drawn upwards through a chimney, while drawing in cooler air from below. Alternatively a fan can be used. The size and shape of the compartment varies depending on the product and the scale of the drying system. Large systems can use large barns while smaller systems may have a few trays in a small wooden housing. Solar crop drying technologies can help reduce environmental degradation caused by the use of fuel wood or fossil fuels for crop drying and can also help to reduce the costs associated with these fuels and hence the cost of the product. Helping to improve and protect crops also has beneficial effects on health and nutrition. Solar wood kiln have been developed to season timber. The Solar kiln is constructed using a wooden frame with a glass roof placed over the top. The principles are similar to that of a greenhouse design. The simplest have been modified greenhouses designed to take large pieces of wood for drying. Air is passed through the kiln to remove the moisture from the air and the cycle continues [2]. For this research was made the chamber for drying organic fertilizer of rubber farmer in Thailand.

## 2. MATERIALS AND EXPERIMENTAL

The process for all research from the start, beginning with a thorough study to design, build, solar rooms and dry organic fertilizer from solar panels poly carbonate and sheet metal. The operating methods will be made to get the treat and dry organic fertilizer from solar panels of poly carbonate and sheet metal complete. It is designed to be used in operations. The study and build a solar oven and dry organic fertilizer from poly carbonate sheets. Fertilizer is applied with a mixture ratio of underlying quail with growth catalyst. Baked and dry organic fertilizer from solar panels polycarbonate by exploiting solar energy through polycarbonate Connecticut entered the room and reflection on a metal plate. Below cause more heat and thermal conductivity equipment out on the ventilator and taking moisture out. The fertilizer is airing rack to save space on the second floor has been exposed.

Organic fertilizer of rubber farmers has 2 mixtures formulas depend on the age range of rubber tree in Kanchanaburi Province of Thailand.

**Fig. 1. Ventilator for drying organic fertilizer of rubber farmers**

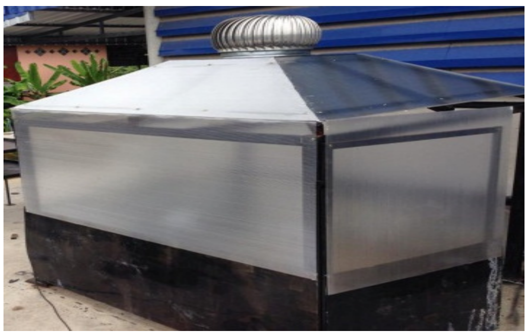

**Fig. 2. Solar chamber for drying organic fertilizer of rubber farmers**

**Fig. 3. Table 2 floors for drying organic fertilizer of rubber farmers has small pores for circulate the air**

**Fig. 4. Organic fertilizer of rubber farmers**

## 3. RESULTS AND DISCUSSION

From the data collection was determine the effective of the invention actual deployment. This research collected data on time, temperature, minimum and maximum temperature of the solar oven. Also look for efficiencies of dry fertilizer products for use in the molding process. The experiment for the moisture to the mix of fertilizer in the first set of formulas that one of the farmers, who had the following results, was shown in Table 1

**TABLE 1: Description of Experiment During 1st July – 5th July 2015**

| Date | Position | Time | Temp.(°C) | Time | Temp. (°C) | - (%) |
|---|---|---|---|---|---|---|
| 1st | Inside | 9a.m. | 38 | 3p.m. | 68 | 30 |
| | Outside | 9a.m. | 32 | 3p.m. | 34 | 14 |
| 2nd | Inside | 9a.m. | 37 | 3p.m. | 64 | 28 |
| | Outside | 9a.m. | 31 | 3p.m. | 34 | 13 |
| 3rd | Inside | 9a.m. | 36 | 3p.m. | 66 | 27 |
| | Outside | 9a.m. | 30 | 3p.m. | 35 | 14 |
| 4th | Inside | 9a.m. | 38 | 3p.m. | 67 | 29 |
| | Outside | 9a.m. | 31 | 3p.m. | 35 | 15 |
| 5th | Inside | 9a.m. | 37 | 3p.m. | 68 | 29 |
| | Outside | 9a.m. | 30 | 3p.m. | 35 | 12 |

The temperature inside the chamber start to collect the data from 9 a.m. and stop to collect is 3 p.m. The temperature was increase very high degree when compare with the temperature outside the chamber. The Moisture of organic fertilizer inside the chamber could remove faster than outside. Convert to show in diagram of Fig.5 and Fig.6

Temperature during 1st July till 5th July 2015 is summer season in Thailand. Temperature under sunshine without raining is suit for drying organic fertilizer. Conventional drying for farmer is put on the land under sunshine. Temperature was shown in the red symbol in Fig.5. Degree of heating from 9 a.m. to 3 p.m. is not big changed. But the degree of heating inside the chamber increased in the high rate was shown in the blue symbol. Refer to Moisture content in the organic fertilizer was shown in Fig.6

This diagram show the moisture content in the organic fertilizer. Compare between moisture inside and outside the chamber during 1st July – 5th July 2015. Blue symbol is the moisture decreasing of the organic fertilizer inside the chamber. Red symbol is the moisture decreasing of the organic fertilizer outside the drying chamber. The moisture could move out the organic fertilizer, inside the drying chamber faster than outside chamber about 2 times or 200% every day.

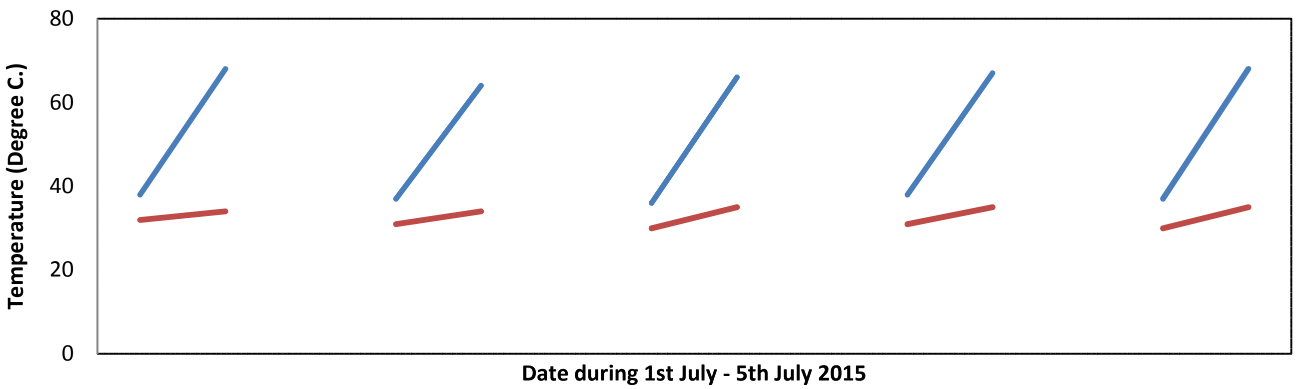


**Fig. 5. Temperature inside and outside of drying chamber**

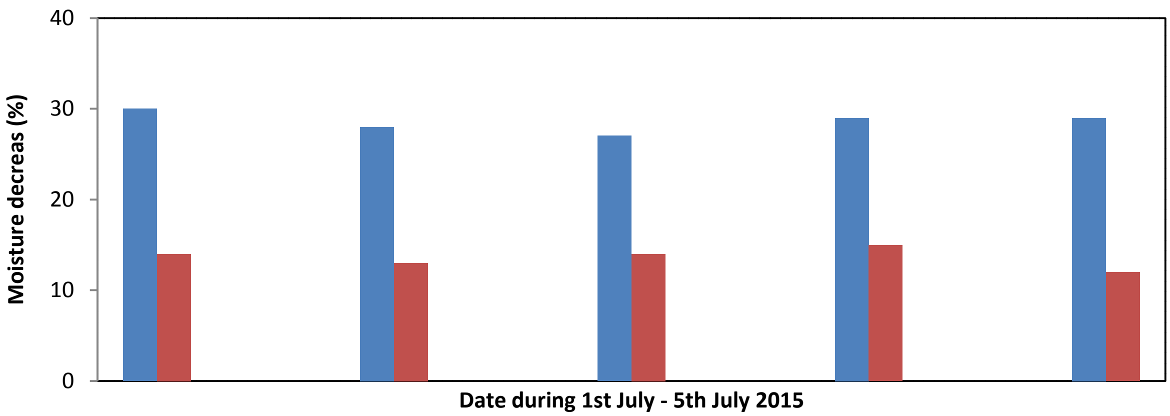


**Fig. 6. Moisture of organic fertilizer inside and outside of drying chamber**

## 4. CONCLUSIONS

The results of the experiment showed that the temperature in the solar oven. The temperature inside is warmer than the temperature outside in the sunshine at 9:00 a.m. about 5 degrees at 15:00. The temperature inside of the oven solar energy is hotter than a temperature of about 30 degrees outside in the sunshine.

The results showed that we mixed organic fertilizer it weighs 50 kilograms, in a solar oven for five days. When compared with the fertilizer under conventional sunshine. During the five days that the fertilizer will have moisture content lower than conventional sun about 200%.

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