Proceeding Book

GO GREEN2015
INTERNATIONAL POSTGRADUATE CONFERENCE ON GLOBAL GREEN ISSUES

"Incorporating Green Approaches for Resilient Future"

7 - 8 OCTOBER 2015 | Dewan Kuliah Al-Khawarizmi

Universiti Teknologi MARA, Cawangan Perak
Kampus Seri Iskandar
32610 Seri Iskandar
Perak, Darul Ridzuan, MALAYSIA
Website: www.perak.uitm.edu.my/gogreen2015/
Email: gogreen2015@perak.uitm.edu.my

UNIVERSITI TEKNOLOGI MARA

FSPU Fakulti Senibina Perancangan Dan Ukur
Faculty of Architecture, Planning And Surveying

9789675741357

INTERNATIONAL POSTGRADUATE CONFERENCE ON
GLOBAL GREEN ISSUES

GO GREEN2015

'Incorporating Green Approaches for Resilient Future"

7-8 OCTOBER 2015
Dewan Kuliah Al-Khawarizmi
Universiti Teknologi MARA Cawangan Perak

ISBN 978 – 967 -5741-35-7
eISBN 978 – 967 -5741-36-4

ORGANISED BY

Fakulti Senibina, Perancangan & Ukur
Universiti Teknologi MARA Cawangan Perak
Kampus Seri Iskandar
32610 Seri Iskandar,
Perak Darul Ridzuan, MALAYSIA
Tel: +605 374 2000
Fax: +605 374 2244

INDEX

SECTION II: GREEN TECHNOLOGY

SECTION III: GREEN MANAGEMENT

SECTION IV: GREEN CULTURE

SECTION V: GREEN ENVIRONMENT

Paper ID **Title of the Paper and Authors** **Page No.**

EDITORIAL BOARD

BOARD OF REVIEWER

Green Solar Dehydrator

A. N. Alias[1,2], M. H. Khalid[1,2], N. F. M. Sahapini[1,2], Z. Mahfodz[1,2], F. Abdullah[1,2], R. Julius[1,2], M. A. Yahya[1,2], F. Fariesha[1,2]
[1]Faculty of Applied Sciences,UniversitiTeknologi MARA(UiTM) Perak, Tapah Campus
[2]Faculty of Applied Sciences, UniversitiTeknologi MARA (UiTM) Shah Alam

Abstract

A solar drying system with portable design which consisting of different numbers of layer coated with aluminium foil was produced. This study was about using direct solar energy to dry food. From the information gathered from literature study, the prototype of several portable solar dehydrators with different number of layer coated with aluminium foil and the normal drying system was constructed and used in this experimental drying test. A portable solar dehydrator helps the food to dry faster and allow food to be better in quality. The earlier parameter for this solar dehydrator was the weight and followed with the percentage of the water loss. This portable solar dehydrator also can be used to dry the fruits. One major benefit of this dehydrator is its construction or design. It was simple constructed and was made with low cost materials. For all test conditions, the materials were dried with system efficiency of 60% to 78%.

*Keywords:*Solar, Portable, Dehydrator, Food, Low cost

1.0 Introduction

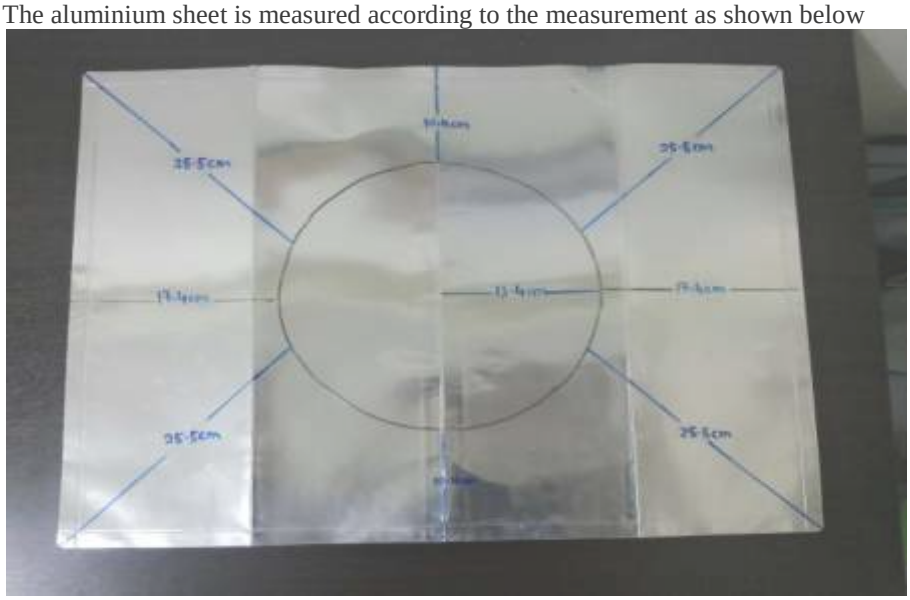
Solar energy is an abundant energy resource and has the radiant energy that is produced by the sun. Solar energy is referred to as the energy that comes from the sun's rays (Husted, 2007). The solar energy have many uses including heating a house, providing electricity and drying process. Drying by exposure to the sun is one of the oldest methods using solar energy for food preservation such as fruits and fish (Belessiotis, 2011).The solar energy is an important renewable energy that comes from the sun in abundance without paying for it like electricity. It is use for various purposes and one of the most essential uses of solar energy is in drying (Ltd., 2013). This drying concept is widely applied at sea sites. However, the normal drying system that was used does not give faster time for the food to be dry. By using a solar dryer, the drying time can be shortened by about 65% compared to sun drying(P.K.Wankhade, R.S.Sapkal, & V.S.Sapkal, 2012).

Hence, portable solar dehydrator is introduced to the solar drying system application. Portable solar dehydrator is the system that concentrated the sun light to give the best focus of the reflected light on the system and get the higher intensity of light than that of normal applications(P.K.Wankhade, et al., 2012). For the thousands of years, the solar energy is widely used to dry foods for short and long preservation(Sharma, Chen, & Lan, 2009). A direct exposure to the sun can also lead to over drying, insufficient drying and discolouring due to ultraviolet (UV) radiation(Böer, Holliday, & Kang, 2014). However, this method takes weeks for the foods to completely dry due to the temperature and humidity.This project is about to design the effective portable solar dehydrator by focusing on its design and the effect of the number of coated layer compared to normal drying system applications. This solar dehydrator is targeting to shorten the time taken for the food to dry. The reason of choosing this project is because the demand of green product is rising nowadays and to help people working with more efficient technique for food drying.

2.0 Methodology

The solar dehydrator was modeled as shown in Figure 3.1 below. The materials used in this project are aluminium sheet, velcrotape, aluminium foils, double tape and scissors.These are the step involved to produce the solar dehydrator model:

The aluminium sheet is measured according to the measurement as shown below



Then, the aluminium sheet is cut based on the line and measurement.

Stripe each of the cutted line of the aluminium sheet with velcrotape so that it will attached and become the shape as shown in figure 1.3 above.

There are 4 types of model were designed

- The aluminium sheet only
- The aluminium sheet coated with one layer of aluminium foil
- The aluminium sheet coated with five layers of aluminium foil
- Normal solar dehydrator which is by using net

The angle is adjusted to reflect the most sunlight is being analyzed by using the laser light. The laser light is turned and look straight down at the one farthest from the laser and see a shadow of the light.The laser lights are placed in each side of the polystyrene assuming that the position of sunlight is around the panel.

3.0 Result and discussion

Solar food drying system can be used in most areas but how fast the food dried was affected by many variables, especially the amount of sunlight and relative humidity. Typical drying times normally range from one to three days depending on the sun, air current, humidity and the type of food used to be dried. The concept lies behind the design of solar dehydrator.

Table 1.0: Percentage (%) water loss of fishes

Fish	Types of Solar Dehydrator	Initial Mass, M_i(g)	Final Mass, M_f (g)	$M_f - M_i$ (g)	Percentage of Water Loss (%)
A	Aluminium sheet	12.59	2.79	9.80	77.84
B		12.55	2.91	9.64	76.81
C	Aluminium sheet coated with one	12.55	3.17	9.38	74.74
D	layer of aluminium foil	15.12	3.79	11.53	74.93
E	Aluminium sheet coated with five	13.87	4.20	9.67	69.72
F	layers of aluminium foil	15.83	4.76	11.07	69.93
G	Net	12.20	5.01	7.19	58.93
H		11.33	4.60	6.73	59.40

Table 4.0 shows the recorded initial and final mass of fishes and their percentage of water loss from 10.00 am to 3.00 pm (5 hours). During the day when the experiment was conducted, the surrounding temperature was 30˚C. The common name of the sample of fish used is *YellowstripeScad* or *SelaroidesLeptolepis* as listed in scientific name (Burke, (WRI), & Spalding, 2002). Based on the table, three types of portable solar dehydrator system were designed and one was from normal solar drying system. The first type was aluminium sheet, the second was aluminium sheet coated with one layer of aluminium foil, the third was aluminium sheet coated with five layers of aluminium foil and the fourth was the normal solar drying system which only used net. Two samples of fish were put on each of these types of solar dehydrator.

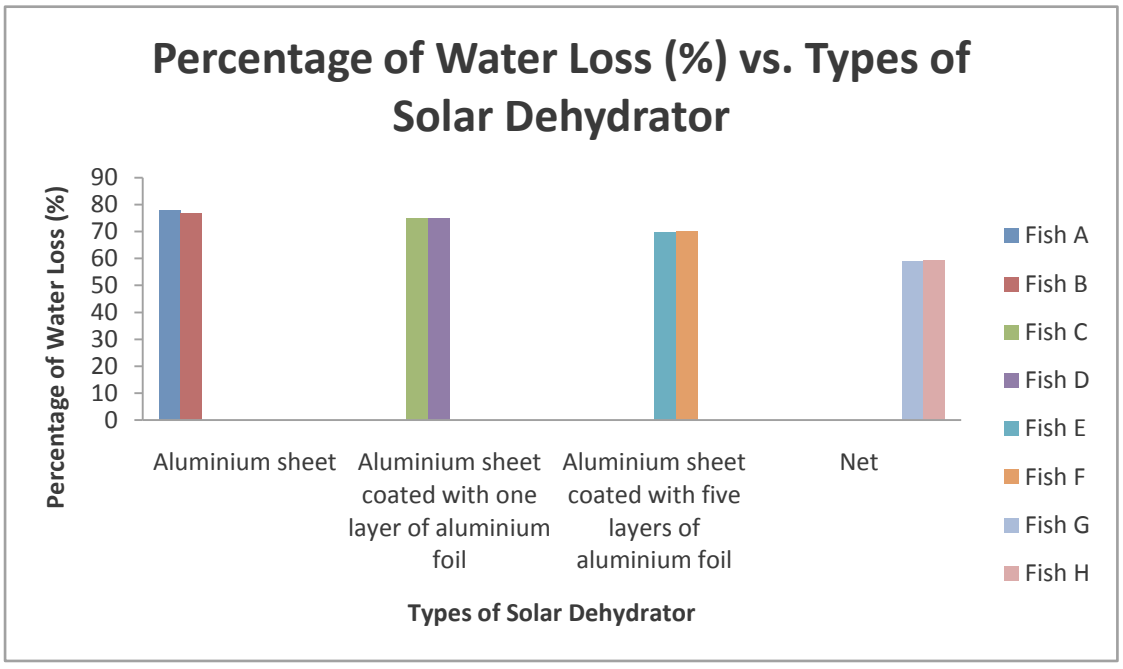


Figure 2.0:Graph of percentage water loss versus types of solar dehydrator

The percentage of water loss for each of the fish is calculated by using the formula as stated below:

$$\text{Percentage of water loss (\%)} = \frac{\text{Final Mass } (M_f) - \text{Initial Mass } (M_i)}{\text{Initial Mass } (M_i)} \times 100\% \quad (1)$$

Figure 2.0 illustrates that the type of solar dehydrator which is aluminium sheet has the highest percentage of water loss which is 77.84%. Whereas, the lower percentage of water loss by using normal drying system, the net which is 58.93%. This is because the surface of the solar dehydrator gives effect to the percentage of water loss . Based on the graph, the type of solar dehydrator that only used aluminium sheet give the higher percentage of water loss because of the properties that it have (Urray, 2000). Aluminium sheet properties are from UV to infrared and it is an excellent reflector of radiant energy. Visible light reflectivity of around 80% means that it is widely used in light fixtures (Minnaert, 2013). Besides, aluminium sheet has a smooth with shiny surface. In contrast, aluminium sheet that coated with layers of aluminium foil does not give the greater smooth and shiny surface. It was important to have the shiny surface in order to reflect sunlight thus the light will be focused on the centre of the sample. This is in line with when light waves are incident on a smooth, flat surface, they reflect away from the surface at the same angle as they arrive (Minnaert, 2013).

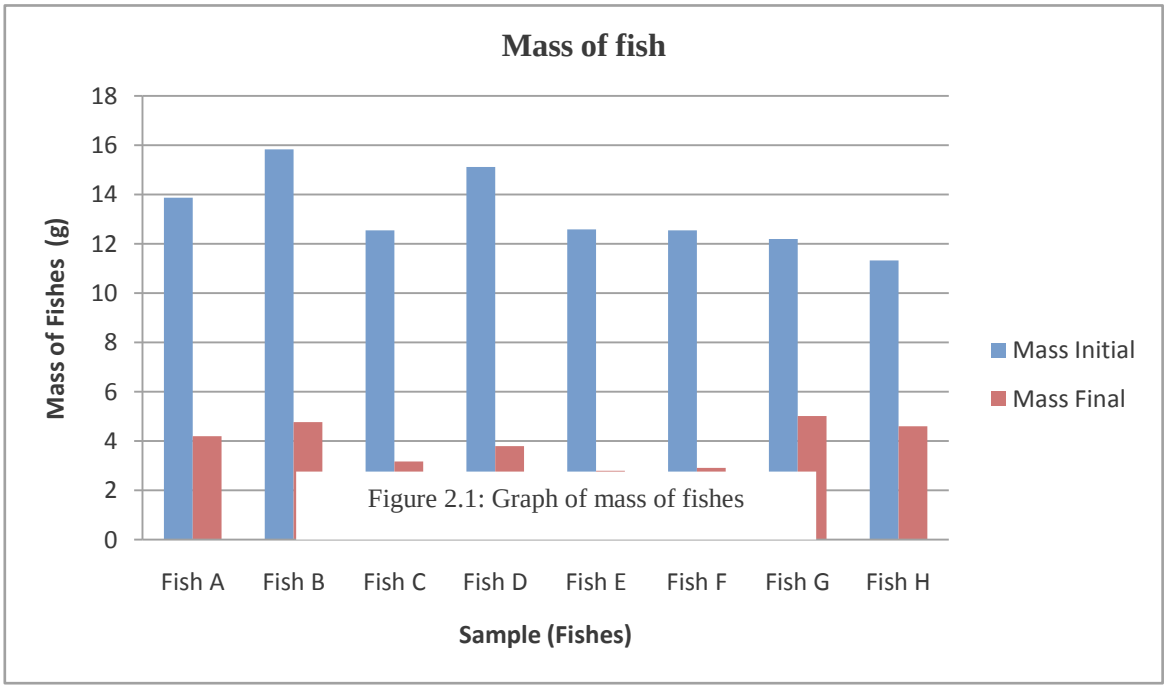


Figure 2.1: Graph of mass of fishes

Figure 2.1 showed the difference of initial mass and final mass of the fish. Based on the graph, it showed that there was bigger difference between initial and final mass for all sample of fish. Based on Figure 4.2, light from the sun is directed towards the net without any reflection occurs. In contrast, Figure 4.3 shows that how light from the sun is being reflected on the surface of the aluminium of the portable solar dehydrator. The reflected light on this solar dehydrator is the maximum, thus the sample fish on this model was dehydrated at a faster rate compared to normal dehydrator system.

Since this project undergoes the dehydration process, it brings some important changes in physical and chemical properties such as change in colour and changes in texture, flavour and smell. The smell of the sample fish before drying was fishyand after dehydration process occurs, the fishes smell salty. Based on the figure below, the colour of all sample fishes were white pale but after the fish was dehydrated, and the colour change from white pale to brownish orange. From the figure below, it clearly showed that all the sample of fish which were on the portable solar dehydrator was completely dry compared with the sample on the net. There was the present of a few ants and this explained that the fish was still not dry enough as shown in Figure 4.5. Figure below showed the physical or visual changes that happen to all the samples.

4.0 Conclusion

The results from this study showed successful performance by using correct materials which is aluminium as reflectors that made the process of food drying becomes faster which takes only five hours compared to open drying which take more than five hours for the sample to be dry. Solar energy for technologies is currently playing

an important role in food processing. However, for promoting solar energy application on a large scale in the food processing industry, it is important to integrate and generate knowledge of food processing with capabilities of different solar gadgets. Solar dehydration is an effective as the mechanized equipment and offers an alternative at low or no cost. For example, with the life styles of people at the East Coast area and seaside of Malaysia, there is a great demand on this type of solar dehydrator because it will greatly help them to increase the production of food due to the faster and shorter time taken for the food or fishes to dry. Besides, for further improvement of this solar dehydrator, solar panel and capacity storage charge can be added. The solar panel will traps sunlight and save the energy for further use. For example, during windy day, the energy from this solar panel can be used for drying the food or fishes and it acts as the sunlight.

5.0 References

Belessiotis, V. (2011). *Solar drying*. Aghia Paraskevi, Greece: Demokritos.

Böer, P., Holliday, L., & Kang, T. H. K. (2014). Interaction of environmental factors on fiber-reinforced polymer composites and their inspection and maintenance: A review. *Construction and Building Materials, 50*(209-218).

Burke, L., (WRI), L. S., & Spalding, M. (2002). Biodiversity of Southeast AsianCoral Reefs in: Reefs at Risk in Southeast Asia. 13. Retrieved from

Husted, H. (2007). Solar Energy and Its use Today. Retrieved from

Ltd., H. M. (2013). The Financial ExpressSolar energy; Cooking; Alternative energy sources. *Food*. Retrieved from

Minnaert, M. (2013). The nature of light and colour in the open air. Retrieved from

P.K.Wankhade, R.S.Sapkal, & V.S.Sapkal. (2012). *Proceedings of the World Congress on Engineering an Drying Characteristics of Okra Slices using Different Drying Methods by Comparative Evaluation Computer Science* Paper presented at the WCECS 2012, San Francisco, USA.

Sharma, A., Chen, C. R., & Lan, N. V. (2009). Solar-energy drying systems: A review. . *Renewable and sustainable energy reviews, 13*(6), 1185-1210.

Urray, H. H. (2000). Traditional and new applications for kaolin, smectite, and palygorskite: a general overview. *Applied clay science, 17*(5), 207-221.