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Homogenous Fish Cracker Dryer Using Hybrid Control System

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ABSTRACT

Currently in Malaysia, a conventional method used to dry a fish cracker is by drying it under the sun and it will took a lot of time for it to be fully dry. The problem by using this method is when there is a cloudy and rain, the fully drying cracker could not be produced. The research has been made and an automated hybrid fish cracker dryer is proposed to work under above condition. It been designed, constructed and tested under east coast of Malaysia climatic conditions. Dual heating method has been used solar and gas heating where the solar would be primary source of the drying method and latter as the backup. The power consumption of this machine is found to be 560 Watt and been supplied by 4 solar panels. The controller implemented for this machine is using PLC system which is for a better control and homogenous drying of fish cracker. The drying time was about 6 hours. The result after tested the machine shows that, it produces a better drying time compared to the conventional method.

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INTRODUCTION

Fish cracker also known as “keropok” in Malaysia is one of the Malaysian food / snack which is currently its manufacturing is most practiced in small scale. It is also called “krupuk”, “kerupuk” or “kroepoek” in Indonesia, “kaogrieb” in Thailand and “bánh phồng tôm” in Vietnam. There are more than 100 small scale producers of this product in the states of Kelantan, Terengganu and some parts of Pahang Malaysia. This indicates the importance of fish cracker to these communities. It also have the potential to grow in the market. However, the quality of fish cracker manufactured in small scale seems not to be consistent (Taewee, T. K., 2011). Also an engineering and scientific understanding of the raw material and processing options is required for the transition from small manufacturers to larger scale manufacturing (Kyaw, Z., Yu, S., Cheow, C. and Dzulki-fly, M., 1999). Starch gelatinized by steaming method. However, the temperature and steaming time will be a factor for complete gelatinization whether it is achieve or not (N Kyaw, Z.Y., Yu, S.Y., Cheow, C.S., Dzulki-fly, M.H. and Howell, N.K., 2001), as well as water and starch contents in dough (Yanchun W., Dequn L., Heng M. and Yan W., 2006) The effect of steaming time on starch gelatinization has been observed (Taewee, T. K., 2011).

A weather condition is also taken into account in fish cracker production. In Malaysia, there are always cloudy, rain and sometime sunny rotational basis during the year. Fish cracker should be dry under the sun and it will took a lot of time for it to be fully dry. After doing a research, an automated hybrid fish cracker dryer is proposed.

Mechanical Structure:

The proposed automated fish cracker dryer can bring the load of fish cracker until 15Kg to 20Kg. The time for drying a fish cracker can be reducing until $\frac{1}{4}$ times. For these machine, water's play an important role in the conduct heat to dry the fish cracker. Fig. 1 show the automated hybrid fish cracker dryer during test run.

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Fig. 1: An automated hybrid fish cracker dryer under running test

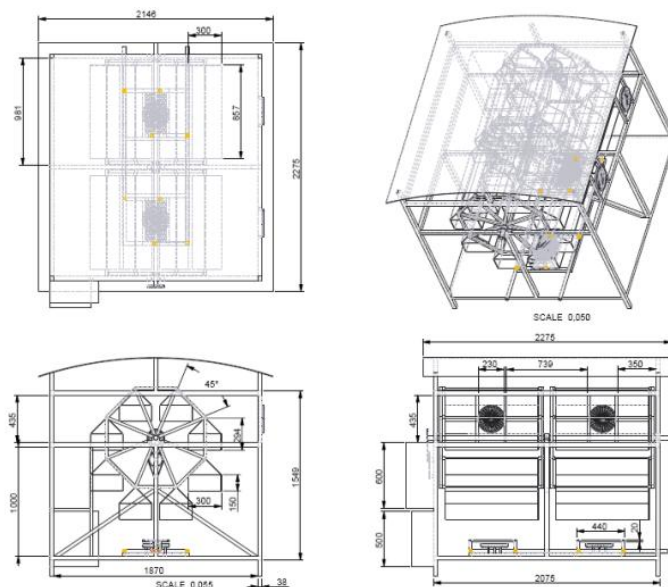


Fig. 2: Technical drawing of automated hybrid fish cracker

Fig. 2 show the drawing for the whole automated hybrid fish cracker dryer. The totally structure / bond are used the cast iron to support the weight of blades and wheels. The polycarbonates plate are used as a wall and roof to reduce the weight of an automated fish cracker dryer structure. The advantages of polycarbonates are it not brittle and can trap the heat in a certain time. Roof and wall is attached to prevent the rain from go inside the dryer. The reduction gear method was used to facilitate a small motor to move large loads. The size of automated fish cracker dryer are (2.5m x 2.5 m x 3m).

Electrical Wiring:

Relay, sensor and timer are important components and a major role to control the sequence of the container rotation in automated fish cracker dryer. The operation of automated fish cracker dryer can be select in two mode whether manual or automatic and the maximum power used is 180 Watt.

Four solar panel used on the automated fish cracker dryer. This will make the automated fish cracker dryer work in two condition which is by using wall socket + battery and the other condition is solar + battery. Solar can be used during sunny weather and back using wall socket when in rainy weather. Fig. 3 show the electrical wiring inside the control panel.



Fig. 3: Electrical wiring inside control panel

To ensure that the machine operates in accordance with the requirements of users, the 14 relay, 5 timer and 1 limit switch was used in automated fish cracker dryer. The type of motor used is DC power window motor.

Controller:

The controller used is PLC which is for a better control and homogenous drying of fish cracker. The automated fish cracker dryer process block diagram is shown in Fig. 4.

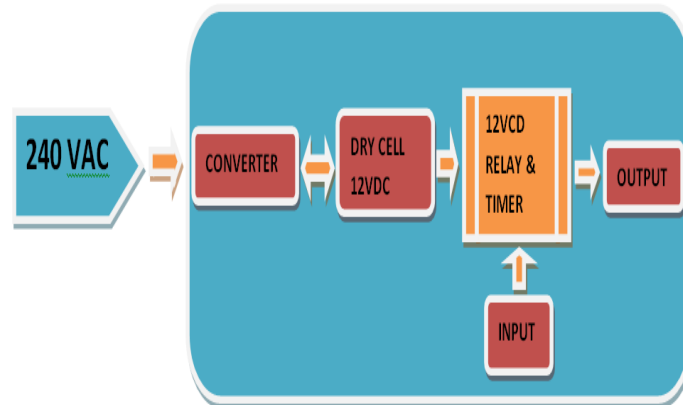


Fig. 4: Process block diagram

RESULT AND DISCUSSION

A data have been taken during the automated fish cracker dryer test run and the result is shown below.

Times versus Temperatures Analysis:

The 2 condition of data was taken. The first data is take without turning the timer for the release of steam fan outside and the second to turn the timer to release steam fan outside in a 5 minute intervals for 1 minute switched. The Fig. 5 and 6 will show the stability and saturation part for automated fish cracker dryer.

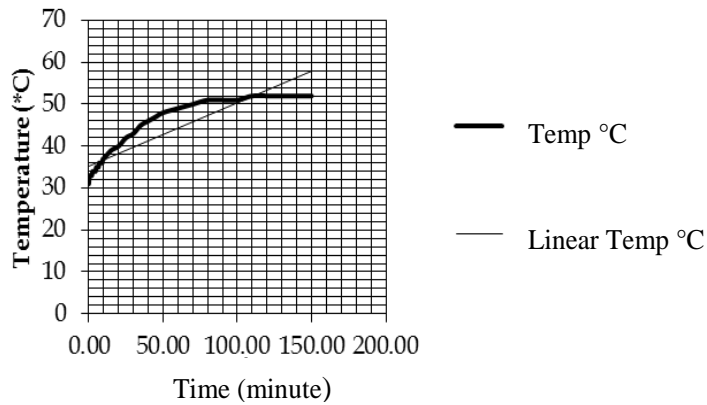


Fig. 5: The times vs. Temperature by disable the fan of steam released

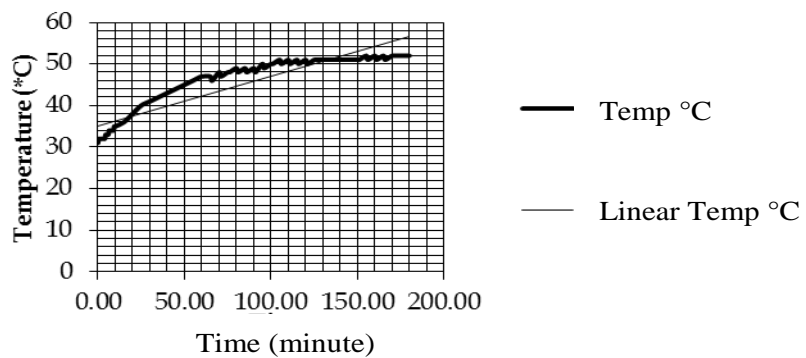


Fig. 6: The times vs. Temperature by enable the fan of steam released

Times Temperature Trap In Automated Fish Cracker Dryer Analysis:

Fig. 7 show the result for maximum temperature was trapped in the automated fish cracker dryer. In this part the system is totally disable. It is because to ensure that the data was taken totally from the temperature in surrounding.

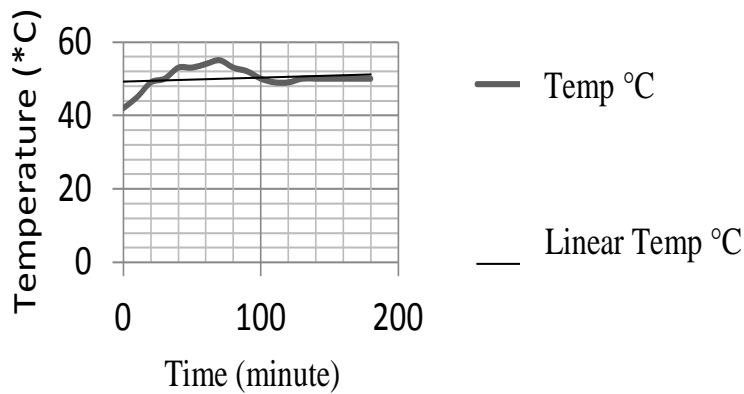


Fig. 7: Maximum temperature trapped in automated fish cracker dryer

Weight of LPG vs. Times Analysis:

To evaluate the efficiencies and the LPG cost was used. The weight of LPG is measured. The weight of LPG is taken before starting the process and after finishing the process. The process for drying the fish cracker only takes 6 hours. Fig. 8 show the constantly LPG was used.

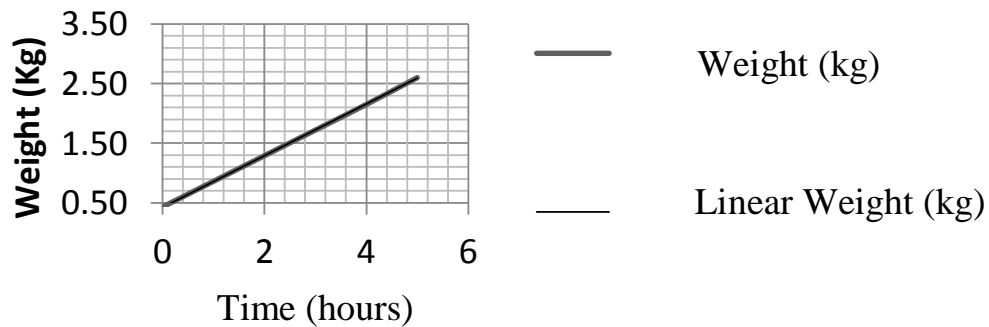


Fig. 8: LPG gas vs. Times was used in automated fish cracker dryer

Conclusion:

The closed drying systems guarantee the quality of food produced. This is because the contamination and the presence of insects or animals from outside can be avoided. Apart from this waste can be reduced use of the laundry area. Therefore monitoring of dried foods and the use of human energy can be saved and reduced the production process and guaranteed quality of crackers clean. By following the data above the increments of LPG gas used are constantly, there is 0.43Kg per hour. The constant temperature for the machine can be achieve until 53°C. That means the water difficult to vaporization at the level of temperature.

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