

Development of innovation in Malaysian traditional palm sugar cooking machine

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ABSTRACT – The research objective is to propose a new method of palm sugar cooking which is more efficient as compared to that of traditional method in Malaysia. Amongst activities in achieving the objective are data collections of traditional process, development of microcontroller and heating element, as well as design of cooking mechanism. In the new method, raw palm sugar is heated by using an electrical heater which is embedded around outer side of cooking pot and temperature is maintained by using a controller in order to produce a more uniform process. A stirrer is equipped in the pot in order to mix the ingredients uniformly. It is found that the new heating process can be used to cook the palm sugar without leaving crust at the bottom part of the pot. A controlled temperature is found beneficial for cooking time estimation.

1. INTRODUCTION

The traditional processing of palm sugar in Malaysia is highly labor intensive, thus producing limited outcome to fulfill consumer demand. Although there are many emerging food technologies, none of them are implemented in the processing of palm sugar [1]. Most of active palm sugar researches worldwide are dealing with the quality and properties of the sugar itself [2-3], and only little of them deals with the processing to enhance the production [4]. The one with the efforts to increase the production is also not specifically meant for the production of pure palm sugar as being consumed in Malaysia and South East Asia, but more towards the derivation of similar product from sugarcane which is called jaggery [4]. Moreover, only small part of the research dealt with modern technology, thus there are many aspects which can be improved especially in cooking process.

The lack of technology implementation in palm sugar production is due to unique characteristics of the cooked material and tedious procedure of the overall process. These factors have not been studied yet. Thus there is a need to do an intensive scientific study in addressing these factors in order to improve the productivity and sustainability of palm sugar production in this country. Study on new processing framework which utilizes potential of modern materials and technologies can be proposed. In initial research,

cooking process is studied and reported in this paper.

2. METHODOLOGY

The stages in this research are as follows:

- Data collection from traditional palm sugar industry
- Development of microcontroller and heating element for cooking process
- Design of cooking mechanism and analysis

In data collection, temperature throughout palm sugar cooking process is recorded using thermocouple, while viscosity of the cooked substance is recorded using viscometer. Figure 1(a) shows the traditional palm sugar cooking process while Figure 1(b) shows a data collection procedure of palm sugar sample.



Figure 1 (a) Traditional palm sugar cooking process; (b) Data collection of palm sugar sample

The collected data is used for selection of electrical heater. Ceramic band heater is selected in this study. The electrical heater is controlled by using an Arduino UNO microcontroller. Figure 2 shows the designed electrical circuit in this study.

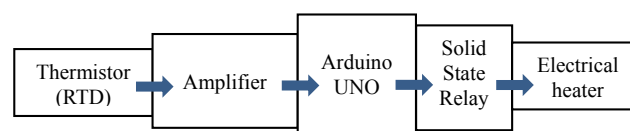


Figure 2 Electrical circuit in this study

A suitable cooking mechanism is designed to suit the proposed heating element. A standard design procedure is applied which consists of concept selection, house of quality, morphology chart, detailed solid modeling design as well as finite element analysis.

3. RESULTS AND DISCUSSION

Temperature and viscosity data for palm sugar cooking process is shown in Table 1.

Table 1 Data taken during palm sugar cooking

Time (minute)	Average temperature (°C)	Viscosity (Pa.s)
0	27	N/A
5	131	N/A
15	247	N/A
35	150	20
45	144	32
55	174	108
75	115	N/A
85	105	212

Controller system for this project is named R6 which consists of various microelectronic components that can save data for automatic control of the cooking process. The system is shown in Figure 3.



Figure 3 Automatic controller R6

Prototype of the innovation for palm sugar cooking mechanism according to the selected concept design is shown in Figure 4.



Figure 4 Prototype of an innovative cooking method for palm sugar

The prototype which is equipped with ceramic band heater and controlled by the automated system R6 shows that the maximum temperature of palm sugar cooking process is sufficient. This is shown in Figure 5. Meanwhile, Figure 6 shows comparison of temperature during both traditional and innovative automated palm sugar cooking processes done in this study.



Figure 5 (a) Temperature display in R6 system; (b) Cooking pot equipped with ceramic band heater

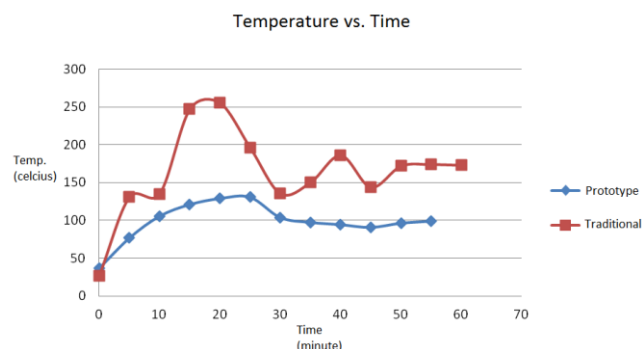


Figure 6 Comparison of temperature for palm sugar cooking processes

4. SUMMARY

From the research, it is found that the new heating process can be used to cook the palm sugar without leaving crust at the bottom part of the pot. A controlled temperature is beneficial for appropriate cooking time estimation. This early stage research concludes that the innovation is applicable in palm sugar industry in Malaysia, with future aim of introducing a more efficient industrial scale process.

5. ACKNOWLEDGEMENT

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