

Design of Halal Assurance and Food Safety Tracking System on the Production of Palm Sugar

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Abstract

Indonesia Government is responsible for the assurance that every marketed product is guaranteed of its safety through BPOM certification and halal label in compliance with the law and regulation on halal assurance. Palm sugar is sugar in form of powder that is made of fresh sap juice and the production process is same as the production of palm sugar. The production process of this palm sugar is done manually, thus it is prone to chemical, physical, and biological contamination and is risky to its halal assurance system. This research aimed to identify contamination on safety and halal for every production process of palm sugar by performing approach to ISO 22000:2018 and HAS 23000, starting from the raw material provision to packaging. The method used was descriptive qualitative. This research proposed the design for food safety and halal assurance system in the production process of palm sugar, presented in control-flowchart, critical control point determination, and control flowchart verification the production process of palm sugar. The result of the research showed that there were 22 HICCP and HACCP critical control point components in the production process of palm sugar. The next research that can be done is to design food safety and halal assurance tracking system in the production process of palm sugar.

Keywords

Tracking System, Food Safety, Halal Assurance, Hazard Analysis Critical Control Point.

1. Introduction

Aren palm is a plant from the palm family, like coconut, nipa, sago, date, and etc. The sap produced by the aren tree has unique smell and taste, thus it is popular in the society. The sap that is obtained from aren palm comes from both male (Wibisono 2017) or female bunch of flowers (Surya et al. 2018), that is still in the form of clear-colored bunch, has sweet taste and unique smell of sap (Mulyani, *et al.*, 2018). The carbohydrate content of sap is 11,28%, making it tastes sweet (Wulantika 2020). Aren sap can be processed into many products, such as palm sugar, brown sugar, and liquid sugar.

Palm sugar is sugar in the form of powder that comes from fresh sap water, with a cooking process that is almost the same as palm sugar, but this palm sugar is cooked until dried up (Pratama et al. 2015). The advantages of palm sugar compared to brown sugar are that palm sugar has a long shelf life, is more soluble, has a more attractive shape, and has a distinctive aroma of aren (Febrianto 2011). This palm sugar production had not yet obtained a permit from BPOM (Food Drug Supervisory Agency) and was currently extending the halal certification. Thus, the researchers were interested in conducting research on the design of a food safety and a halal assurance tracking system. The standards used in this tracking design were food safety requirements standards that referred to ISO (International Organization for Standardization) 22000 and halal assurance (HAS 23000) which have been integrated using clause 9 (Nadjamoeddin 2011).

Previous research has been conducted by Fajri (2020) regarding the integration of Halal Critical Control Point (HCCP) and Hazard Analysis Critical Control Point (HACCP) systems. Arsyhan (2019) has designed the Halal Assurance System (SJH) for Roti Amira SME to meet the HAS documentation requirements. Harma (2017) has conducted research on the design of a halal assurance tracking system for halal meat logistics activities. Products which have halal certificate can make consumers, especially Muslims, to feel safe and satisfied in consuming it because it is safe from haram elements (Hamzah 2021). International halal standardization development can increase

product's selling value, facilitate business actor, build trust, product loyalty, and competitive value in the global market compared to products without halal certificate (Kohilavani 2021). The international trade system for halal products gained good attention in terms of protection towards Muslim consumers around the world.

1.1 Objectives

The purpose of this study was to identify contamination in the safety and halalness of each stage of the palm sugar production process, starting from the stage of sapping water sap, cooking process, milling process, sifting process and packaging process and designing a control flowchart to determine critical control points.

2. Literature Review

Food safety is a public need to be safe in food and beverages so that people can avoid disease or other health problems (Sartika 2020). The standard system used internationally is ISO (BSN 2018). ISO is an international standard that covers all industrial activities, from technology, food safety, agriculture to health. The ISO used is ISO 22000: 2018. HACCP is a food safety system in the food industry that has been applied and is known globally (Lin 2017). In the HACCP preparation stage, there is a principle of determining critical control points using three main sources of hazards, namely physical hazards, chemical hazards and biological hazards (Suroño et al. 2018).

The standards used before implementing HACCP are GMP (Good Manufacturing Practices) and SSOP (Sanitation Standard Operational Procedure). GMP is a guideline or procedure for product processing that is good and correct and meets food quality and safety (Kusuma 2017). SSOP is a procedure to protect the entire production facility or company area from sanitary conditions. SSOP will be implemented well if it uses a common foundation such as GMP (Kusuma 2017). The Halal Assurance System is a management system that is prepared, implemented and maintained by companies holding halal certificates to become a sustainable halal production process in accordance with the provisions of the LPPOM MUI (Institute for the Study of Food, Drugs, and Cosmetics of the Indonesian Ulama Council) (LPPOM MUI 2008).

3. Methods

This study used a qualitative descriptive method, aimed to describe the variables related to the problem and the unit with the real phenomena being studied. The qualitative descriptive method used ISO 22000: 2018 as a food safety system and HAS 23000. LPPOM MUI was used as the guideline for halal criteria in the palm sugar factory. This research has limitations which include only discussing the process of producing palm sugar, starting from the stage of sapping the juice to the packaging process. The implementation of research is a structured plan made to obtain answers to questions or problems to obtain solutions (Razalli et al. 2011). Figure 1. describes the procedure for this research from survey to determination of critical control points of palm sugar production process.

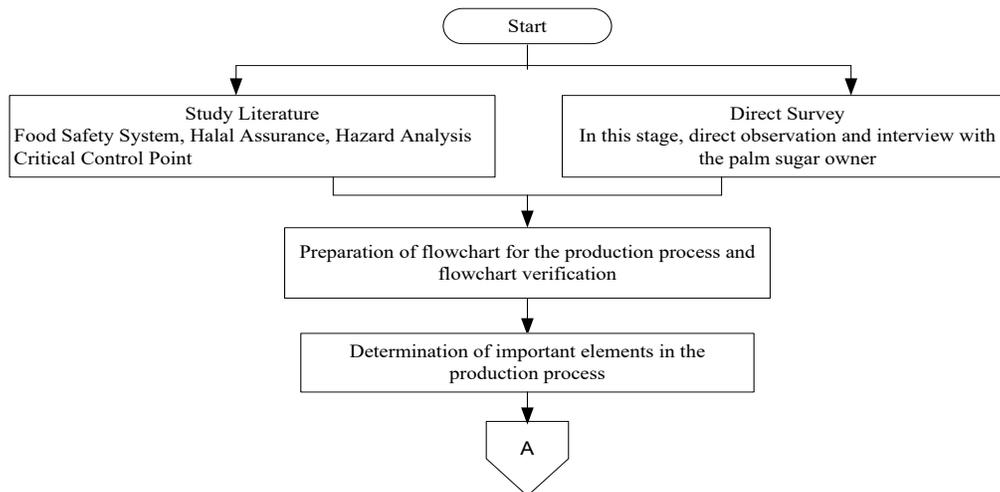


Figure 1. Research methodology

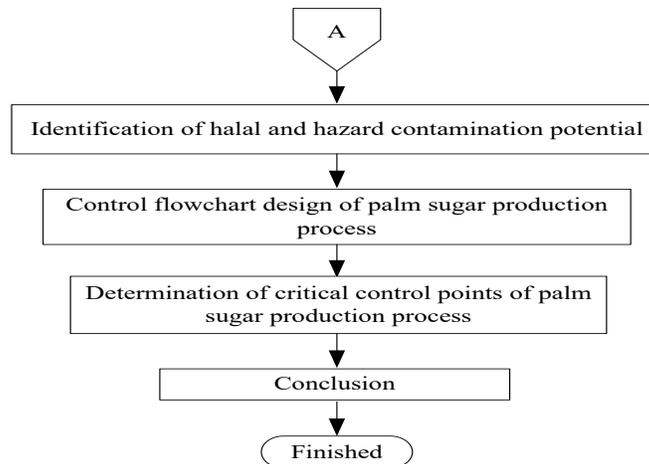


Figure 1. Research methodology

The flow chart above is a chart that illustrates how the process of designing a halal assurance system and food safety in palm sugar production. Starting from direct surveys, production flow diagrams, determining production stages, identifying potential halal and hazardous contamination, design flow control diagrams and determining critical control points for palm sugar.

4. Data Collection

This research was conducted in an SME in Limapuluh Kota Regency, West Sumatra. Data were collected by conducting direct observations in the field and conducting interviews with owners of small medium industries, conducting discussions with LPPOM MUI and BPOM experts. The basis used in the design of the control flowchart is the requirements of an integrated food safety and halal management system using clause 9 (Nadjamoeddin, 2011).

5. Result and Discussion

5.1 Palm sugar Production Process Activity Flowchart

The production process is adjusted to the sequence of the production process for making palm sugar in the field, starting from the taking of raw materials, which is the process of sapping sap water to the stage of packaging the finished product which is ready to be marketed. Figure 2. describes the flow of the palm sugar production process.

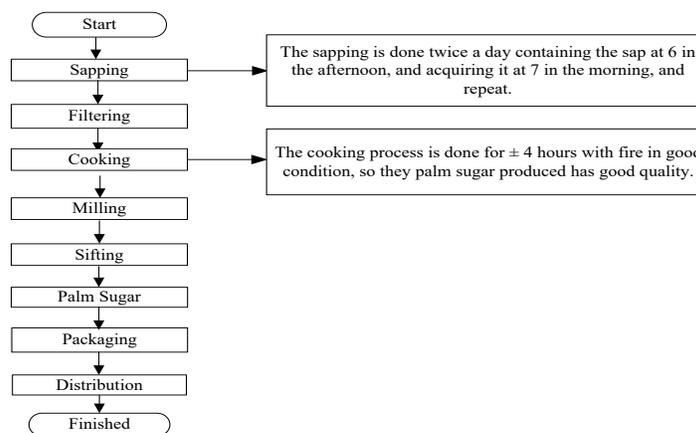


Figure 2. Palm Sugar Production Process Activity Diagram

The first stage is the preparation of a flow chart about the production process of palm sugar, which is shown in Figure 2, after that, verifying the flow chart carried out by palm sugar workers. The purpose of this verification is so that the design of palm sugar is in accordance with the conditions of the existing production process in the field that there are 5 production process activities, namely the tapping of juice, the cooking process, the milling process, the sieving process and the packaging process.

5.2 Determination of Important Elements in Palm Sugar Production Process Activities

Important elements in the production of palm sugar are the elements that became the main focus that must be considered in designing a tracking system for palm sugar production activities. The aim is to find out what elements are contained in the food safety and guarantee system. From table 1, it can be seen that there are 4 elements contained in food safety and halal assurance, namely equipment, production processes, workers and the environment. Table 1. describes the important elements in palm sugar production activities.

Table. 1. Important Elements in Palm Sugar Production Process Activities

No	Safety and Halal Element	Process				
		Sapping	Cooking	Milling	Sifting	Packaging
1	Equipment	Jerry cans, knives, axes and other tools used	Pots, strainers, spoons and other utensils	Grinder, skillet, palm sugar and other tools	Strainer, palm sugar, plastic and spoon	Polyethylene plastic, scales, spoons and other tools.
2	Process	Cutting, storing sap water, merging sap water, sap water is brought to the factory	Filtering sap water, removing foam, adding cooking oil, cooking \pm 4 hours	Cooling for 10 minutes, the process of grinding palm sugar in a cauldron	Sieve, Sieve holder, Coarse container	Palm sugar that is in compliance with SNI
3	Man	Wearing shoes, gloves, headgear.	Wearing headgear, gloves			
4	Environment	The palm trees are in residents' plantations	Close to local residents			

5.3 Identification of Food Safety and Halal Contamination Potentials in Palm Sugar Production Activities

Identification of food safety and halal contamination in palm sugar production process activities was carried out by determining the factors causing food safety and halal contamination at each stage of palm sugar production process activity. Table 2. This is an identification of potential contaminants in the palm sugar production process including physical contaminants such as dust, hair, gravel, soil, leaves. Chemical contaminants such as heavy metals, detergent residues while biological contaminants such as khamr, *Sacharomyces servecisiae* and *acetobacter* bacteria. In terms of the halal guarantee system, sap water contains alcohol which comes from the sap water fermentation process. Contamination can occur during the palm sugar production process, starting from the tapping process to packaging.

Table. 2. Identification of Contamination Potential in Palm Sugar Production Process Activities.

No.	Activity	Contamination Type	Cause of Contamination on Food Safety and Halalness
1	Sapping Process	Physical	Contamination from jerry cans, such as leaves, dust, soil and pieces of wood.
		Chemical	Pesticide

Table. 2. Identification of Contamination Potential in Palm Sugar Production Process Activities (advanced).

No.	Activity	Contamination Type	Cause of Contamination on Food Safety and Halalness
1	Sapping Process	Biological	The entry of bees and ants into the jerry cans when sapping
		Halalness	Used and unsterilized jerrycans will contain alcohol Jerry cans that are exposed to unclean/haram animals
2	Cooking Process	Physical	The entry of wood chips, dust, hair, gravel and soil in the cooking process Dirt from the leftovers from the previous cooking
		Chemical	Remaining laundry soap on cauldrons, spoons, and sieves that contain chemicals
		Biological	The entry of insects and ants into the cauldron containing sap water
		Halalness	Contamination from unclean/haram pets
3	Milling Process	Physical	The entry of hair, dust, soil, gravel into the cauldron
		Chemical	Remaining laundry soap on equipment
		Biological	The entry of insects and ants into the cauldron
		Halalness	Contamination from unclean/haram pets
4	Sifting Process	Physical	Contamination such as hair, soil, dust, and dirt from the rest of the previous production process on sieves, spoons, containers.
		Chemical	Remaining washing soap on containers and spoons
		Biological	The entry of insects and ants into the sugar
		Halalness	The entry of insects and ants into the sugar
5	Packaging Process	Physical	Contamination such as hair, soil and dust
		Biological	The entry of insects and ants into the sugar
		Halalness	Contamination from unclean/haram pets

5.4 Control Flowchart Design for Palm Sugar Production Process Activities

The stages of control flowchart design on palm sugar production process activities carried out in each production process activity include: the sapping process, the cooking process, the milling process, the sieving process and the packaging process. In this control flowchart, there are questions that function as control elements in ensuring the safety and halalness of palm sugar products. A hazard to food safety is called HACCP. HICCP (Halal Critical Control Point) basically follows the principles applied to HACCP (Kohilavani, et al., 2013). The basis used to design a food safety system control flowchart that is guided by HACCP and a halal assurance system that is guided by the requirements of the 2008 LPPOM MUI. Figure 3. to Figure 7. below is an initial design of the control flowchart at all stages of palm sugar production activities, starting from the tapping of sap water, the cooking process, the milling process, the sifting process and the packaging process.

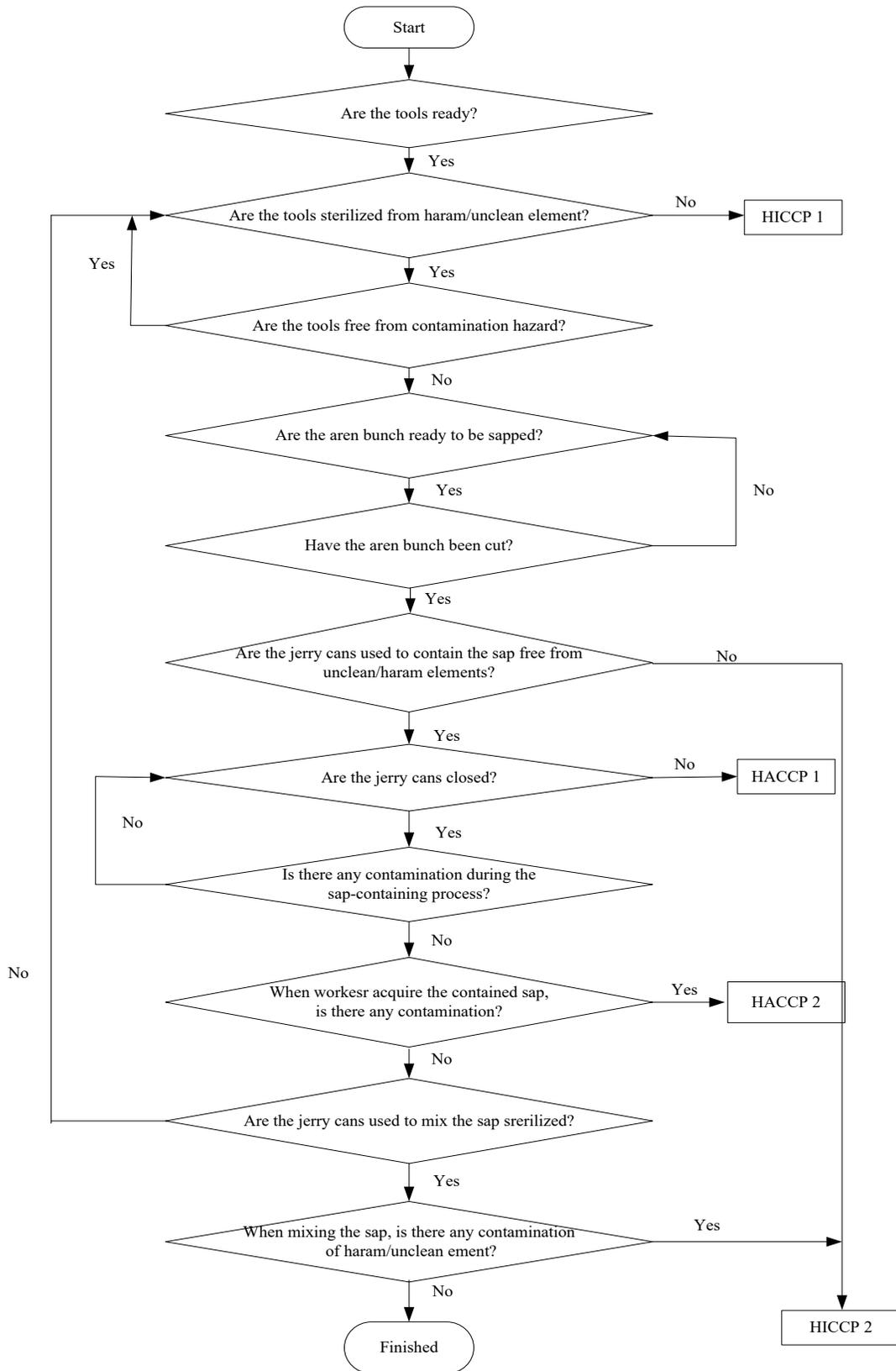


Figure 3. Sapping Process Control Flowchart Design

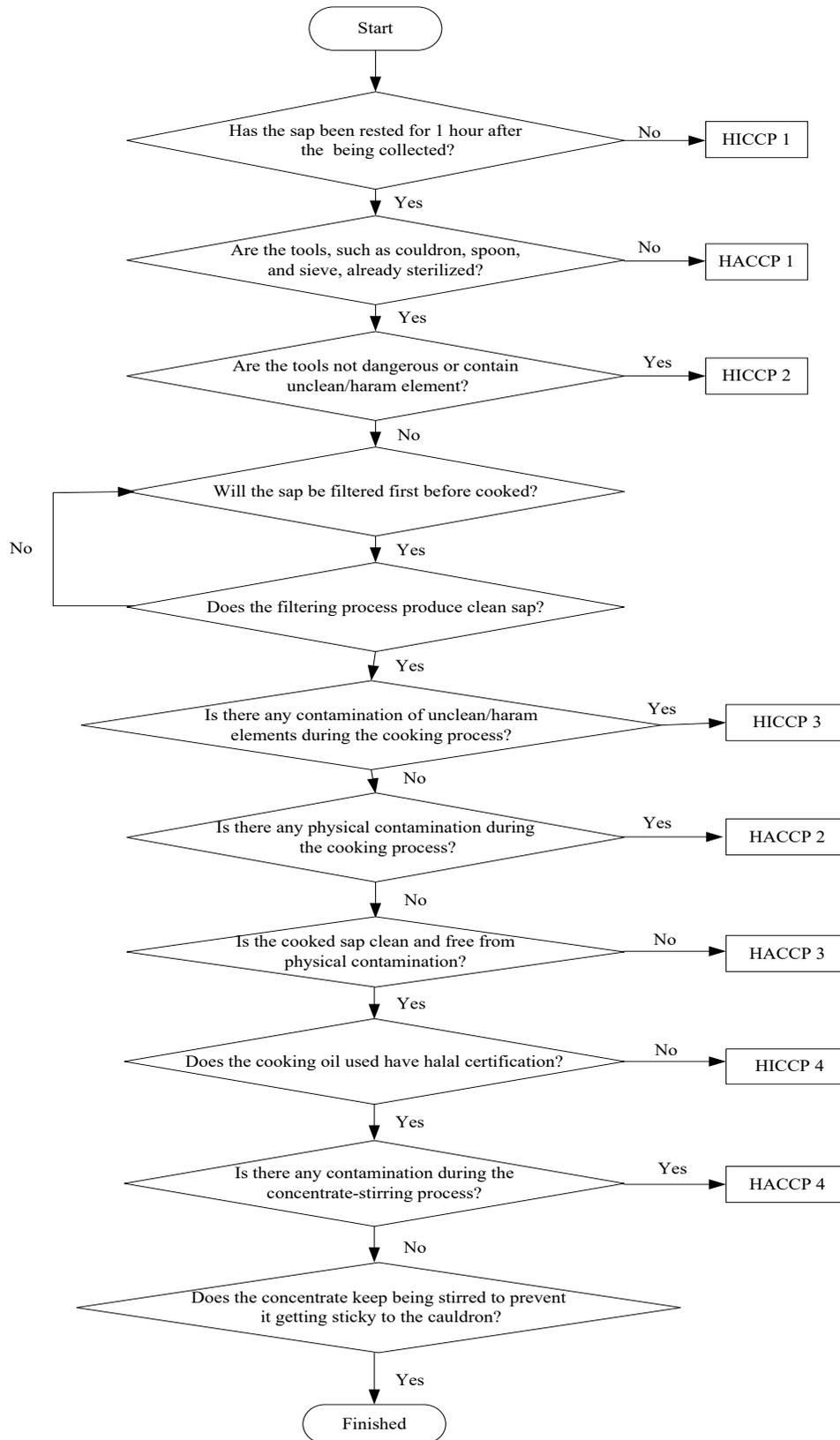


Figure 4. Cooking Process Control Flowchart Design

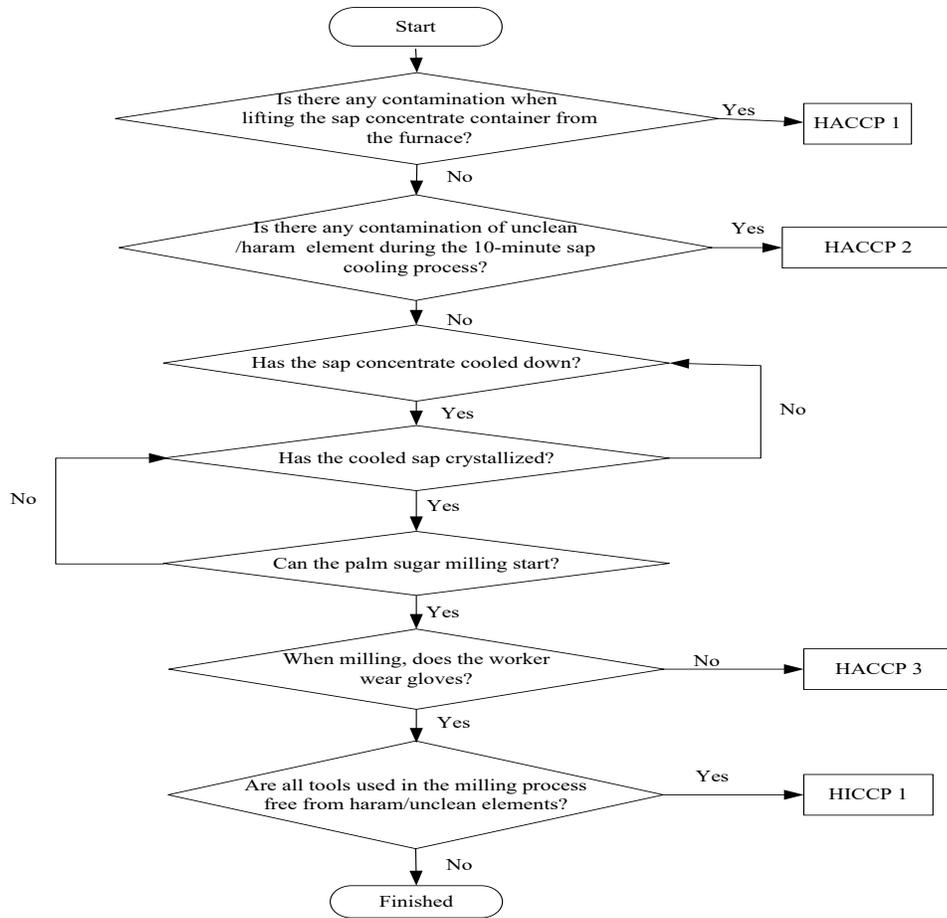


Figure 5. Milling Process Control Flowchart Design

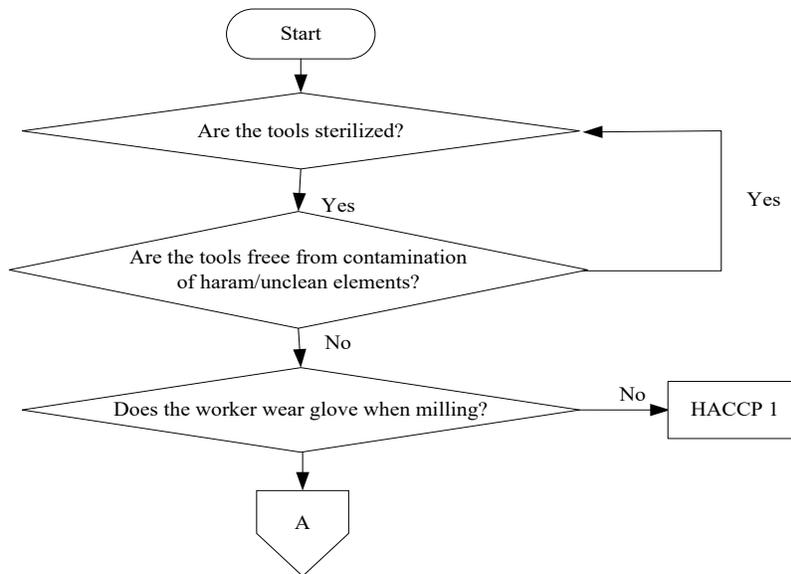


Figure 6. Sifting Process Control Flowchart Design.

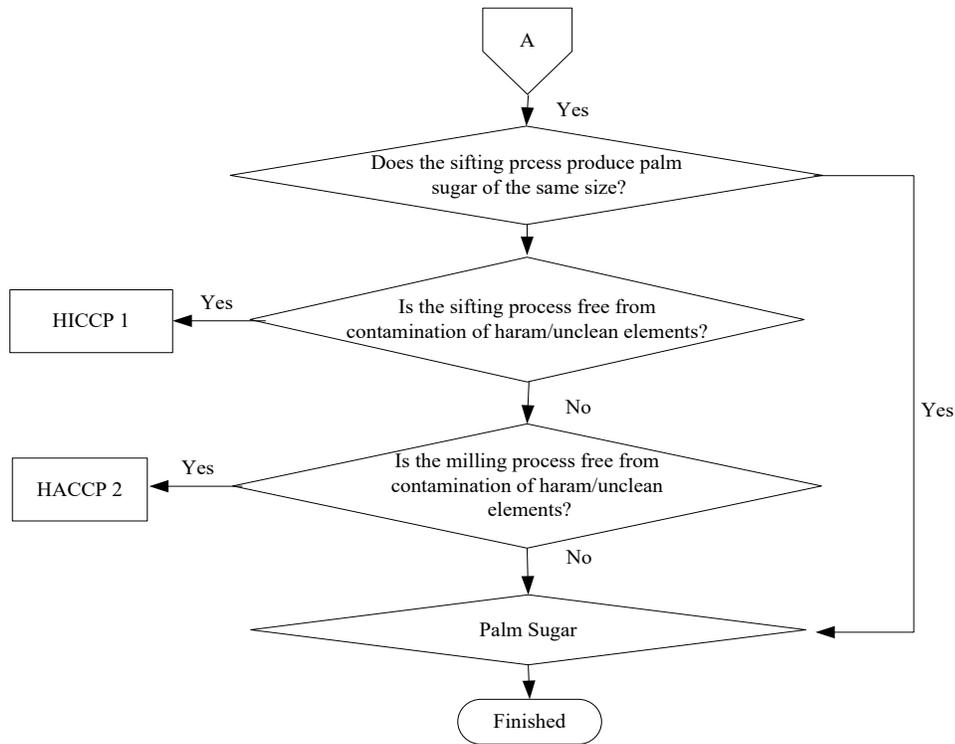


Figure 6. Sifting Process Control Flowchart Design (advanced).

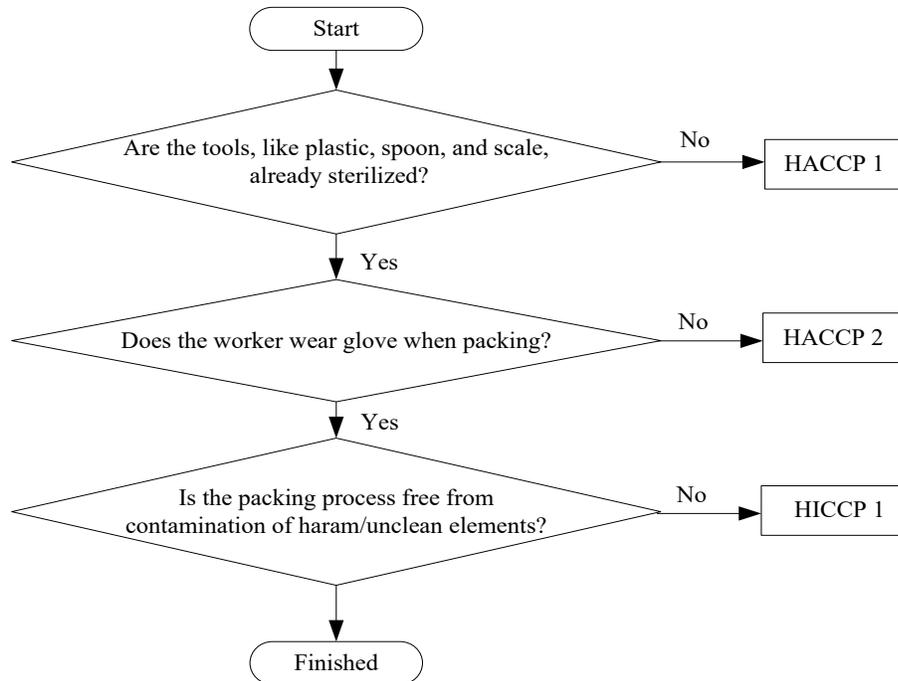


Figure 7. Packaging Process Control Flowchart Design

The flowchart design for all stages of palm sugar production, from tapping the juice to the packaging process is attached in Figure 3-7. From the flowchart design that has been compiled, it can be seen that the contaminants that occur during the palm sugar production process both in terms of food safety and the halal assurance system. The process of tapping water sap is the initial process to obtain sap water by collecting water that comes out of the male bunches on the palm tree. During the process of tapping the sap water in Figure 3, there is a physical hazard contamination in the tools used, such as dust, hair, soil, insects. Meanwhile, from the halal guarantee system, namely the presence of alcohol contained in the previously used sap water storage device, it can result in contamination of fresh sap water. Furthermore, in the cooking process, the activities carried out to produce concentrated sap which can be processed into palm sugar through the process of grinding and sifting. The sap water used for the production of palm sugar with the criteria of sugar content > 12 and pH level > 6 but if the sugar content and pH level are less than the specified limit then the sap water cannot be used for the production of palm sugar because there is no granulation/crystal process-crystals in concentrated juice. In this cooking process contamination can occur from workers, the environment and equipment because the production process is carried out manually.

5.5 Determination of Critical Control Points in Palm sugar Production Process Activities

Based on the results of the control flowchart design that has been carried out at all stages of the production process, there are 22 components of HICCP and HACCP contamination. Table 3. contains HICCP and HACCP contamination in palm sugar production.

Table 3. HICCP and HACCP Result on Palm Sugar Production Process

No	Activity	Contamination	Description
1	Sapping Process	HICCP 1	Contamination on equipment used, that contained haram/unclean element.
		HICCP 2	Used and uncleaned jerry can that contained haram/unclean elements
		HACCP 1	When sapping, the jerry can was not closed which allowed physical contamination such as the entry of wood chips, insects, etc
		HACCP 2	When workers were sapping, there were physical contaminations such as soil, sand, and wood chips entering the jerry cans.
2	Cooking Process	HICCP 1	The sap that had been in the container / jerry can for more than an hour already contained haram / unclean elements
		HICCP 2	Equipment that has previously been used must be sterilized, otherwise it will contain haram/unclean elements.
		HICCP 3	During the cooking process, there was no contamination from unclean/haram elements
		HICCP 4	The cooking oil used did not contain haram/unclean element.
		HACCP 1	The equipment did not have chemical and physical contamination.
		HACCP 2	The cooked sap did not have physical contamination such as from wood chips, insects, and sugar.
		HACCP 3	During the cooking process, there was no contamination from physical contamination.
		HACCP 4	During the sap stirring, the sap did not have contamination from the workers.
3	Milling Process	HICCP 1	The miller contained unclean/haram element.
		HACCP 1	Physical contamination when lifting the sap concentrate container
		HACCP 2	Physical contamination when cooling down the sap concentrate, such as the entry of soil, sand, or hair.

Table 3. HICCP and HACCP Result on Palm Sugar Production Process (advanced)

No	Activity	Contamination	Description
3	Milling Process	HACCP 3	Physical contamination from workers due to not wearing gloves.
4	Sifting Process	HICCP 1	Contamination that contained haram/unclean elements on sieve equipment.
		HACCP 1	Contamination from workers not wearing safety gears.
		HACCP 2	Physical contamination when sifting, such as the entry of hair, soil, wood chips, and plastic.
5	Packaging Process	HICCP 1	Contamination that contained haram/unclean element.
		HACCP 1	Physical and chemical contamination on used equipment that was not sterilized.
		HACCP 2	Direct contamination from the workers

6. Conclusion

From the results of research in terms of food safety, there are three types of hazards, namely physical, chemical and biological hazards, while from the halal guarantee system there are elements of haram/impure. of all activities in the production of palm sugar, there are overall critical control points, namely 13 food safety (HACCP) and 9 halal assurance systems (HICCP).

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Biography

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