

Fruit Deep Processing Product Quality and Food Safety Risk Detection Scheme Based on HACCP System

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Abstract: According to the principle of Hazard Analysis Critical Point (HACCP) system, hazard analysis to each process step of juicy peach preserved fruit was carried out. It was confirmed that the 6 steps consisted of raw material checking, water treatment, classification, washing, vulcanize and packaging processes were the key control points of machining process to juicy peach preserved fruit. The product quality and food safety of preserved fruit were controlled effectively by means of establishing critical limits and implementing monitor program.

Keywords HACCP; Juicy peach preserved fruit; Food safety

INTRODUCTION

China is the largest producer of fruits in the world, located at the first of 13 countries which have the output of 10 million tons. At present, the fruit processing level is still very backward in our country, manifested in the following areas: 1) the number of enterprises is large but the scale of individual is small, and furthermore most of the enterprises are cottage industry factories which lack of technological content and scale effect (Kirby, *et. al.*, 2003) ; 2) The product is single and mainly produced by simple processing way, therefore lack of market competitiveness, many fruit processing is still continue juice, jam and other simple varieties. In recent years, the concepts of "green and natural" prevail, and thus the consumption of preserved fruit and dried fruit etc. lasts growing, have become the main force of fruit deep processing market (Gereffi, *et. al.*, 2009). It is expected that within the next five years, the annual increase will reach more than 10%. China's current per capita fruit juice consumption is just 1/10 of the world average, 1/40 of the developed countries average, possess a great growth space (Wallace, *et. al.*, 2001). The preserved fruit and dried fruit were produced with fruit and berry as raw material, which is processed into food to achieve long-time storage purpose after the process of physical, chemical or biological method (inhibiting the activity of the enzyme and the activity of spoilage bacteria or killing spoilage bacteria). Fruit procession can not only improve fruit flavor and effectively extend the fruit supply time, but also increase the edible value and economic benefit (Kokkinakis, *et. al.*, 2007). However, at the

same time the antimicrobial and antiseptic treatment would increase food safety risk due to the high complexity of the process, therefore, how to improve the food safety of preserved fruit, dried fruit food becomes an important issue.

HACCP (Hazard Analysis Critical Control Point) system indicates the critical control point of hazard analysis. HACCP system is a food safety assurance system which is internationally recognized and accepted, and the system is mainly to carry out safety control to the microbial, chemical and physical hazards in food. HACCP can ensure the safety of food in the processes of production, processing, manufacturing, preparation and consumption, is considered as a scientific, reasonable and systematic method for the hazard identification, evaluation and control (Hansong, *et. al.*, 2015). But it does not mean that it is an unacceptable threat to health. Identification of possible links in the food production process and then take appropriate control measures to prevent the occurrence of hazard (Yi, *et. al.*, 2015). By monitoring and controlling every step of the processing, the probability of occurrence for hazard is reduced.

HACCP is a safety control system from the standpoint of production point, is a system to ensure the quality safety of product from inputting raw materials to getting finished product and. The most prominent advantages for using of the HACCP management system are as follows:

1. Translating the inspection to the final product (i.e. inspection whether there is qualified products) into the control of potential hazards in the production process (i.e. prevention of substandard products);

2. Utilizing the least resources to do the most effective thing.

HACCP is the basis for determining product safety, the method of utilizing HACCP to control product safety is more reliable than the traditional product inspection method for food producers, and thus HACCP could be considered as a part of cautious defense in the implementation process. As the most effective measures to control food-borne illness, HACCP has been recognized by international and domestic and approved by the FDA and the World Health Organization Codex Alimentarius Commission.

This paper established a set of HACCP system which is suitable to preserved fruit and dried fruit production line. Hazard analysis, establishment of critical control points and taking corrective measures result in increasing the safety and improving the quality of preserved fruit, dried fruit products.

MATERIALS AND METHODS

Materials

This study took the preserved fruit production line of Qingdao Qingfeng Food Company as the research background. The fruit raw materials used by this company were juicy peach picked from Qingdao Laoshan Planting Base for the production of preserved fruit.

Basic principle and method of HACCP system

HACCP is a system management system which is composed of two parts: Hazard Analysis (HA) and Critical Control Point (CCP). It includes seven basic principles: Hazard Analysis (HA); determining the CCP; establishing the critical value of CCP; establishing the monitoring system of CCP; establishing the corrective measures; establishing the normal and effective operation procedure of HACCP system; perfecting the file management system. Relates to all processes in the production process of preserved fruit, dried fruit, there may be biological, chemical and physical factors leading to decline in quality, and the use of the contents and methods of HACCP system to control the production process, can improve preserved fruit quality.

Production technology process of juice peach preserved fruit

Production process of juice peach preserved fruit is shown in Figure 1.

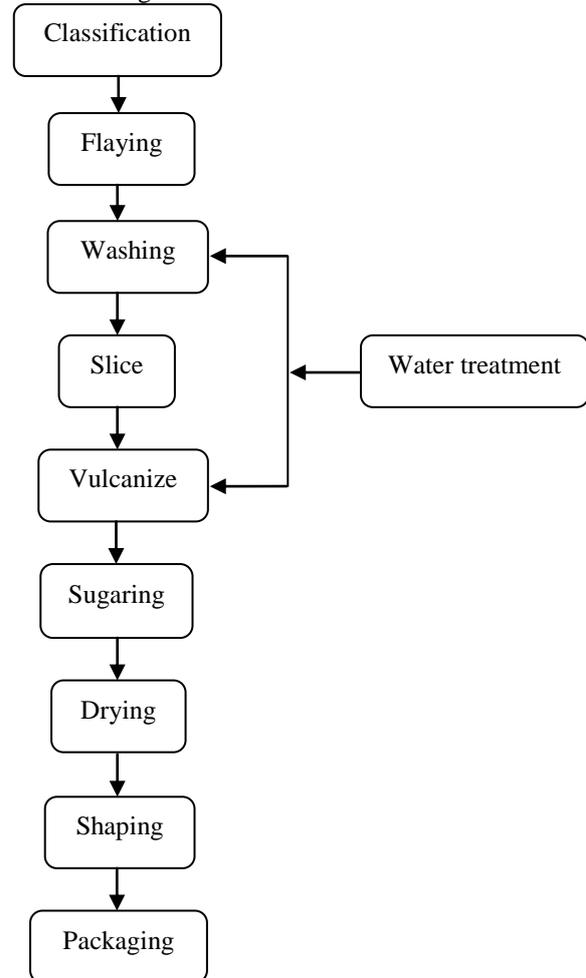


Figure 1 Production process of juice peach preserved fruit.

Food safety influence factors analysis of juice peach preserved fruit

Hazard analysis has been carried out to each production process of the production technology process, the main risk factors and significant degree occurred in production process have been researched and CCP in the production process of juice peach preserved fruit has been determined as shown in Table 1.

Table 1 Food safety influence factors analysis of juice peach preserved fruit.

Procedure	Potential Hazard identifications	Significant hazard identification	Warranty of significant identification	Hazard analysis identification	Warranty of CCP
Raw material checking	pathogenic bacteria pollution; pesticides, heavy metal, hormone; insects, dust and other impurities	Yes	Raw materials infected by hybrid microbe; Pesticide remnant, heavy metal in soil	Yes	It was hard to remove hazardous substance and chemical hazards produced by bacterial contamination in subsequent handling
Water treatment	pathogenic bacteria pollution; heavy metal; silt and other	Yes	Microbial pollution, ion content, rigidity,	Yes	Water was used in the processes of washing, vulcanize and sugaring,

	impurities		pH value		there was not subsequent handling to remove the hazard
Classification	pathogenic bacteria pollution; insects, dust and other impurities	Yes	Unqualified raw materials polluted by pathogenic bacteria entering follow-up processes	Yes	It was hard or incapable to remove hazardous substance and chemical hazards produced by bacterial contamination in subsequent handling
Flaying	pathogenic bacteria pollution	No	Flaying requirement has been not achieved; equipment was not sanitary and material was polluted in the process of flaying	No	Hazard can be reduced or removed in the process of washing
Washing	pathogenic bacteria pollution; metal ions pollution; silt and other impurities	Yes	Water quality did not conform to standards in the process of washing; Production equipment was polluted by harmful bacterium resulting from the incomplete washing	No	It was hard or incapable to remove hazardous substance and chemical hazards produced by bacterial contamination in subsequent handling; physical hazard in raw material can be removed in subsequent handling
Slice	pathogenic bacteria pollution	No	Production equipment was polluted by harmful bacterium	No	Subsequent handling can control the hazard
Vulcanize	pathogenic bacteria pollution	Yes	Hardener may be polluted	Yes	Vulcanized time was too long, and humidity was suitable for microbial growth to make injurious ingredient permeate, the hazard can't be removed
Sugaring, Drying	No	No	The biological, chemical and physical hazards wasn't introduced	No	If equipment, operating conditions and staff's sanitation meet requirements, hazardous factors would not be introduced
Packaging	pathogenic bacteria pollution	Yes	Harmful components in packaging materials contaminated food; packaging damage resulted in the secondary pollution	Yes	Harmful components in packaging materials migrated into food, the packing materials did not conform to standards resulting in the secondary pollution, and these caused direct damage to consumers

Establishment, control and corrective measures of Critical Control Point

After confirming the hazard factors of each production process, an effective HACCP system of juice peach preserved fruit was established. Aiming at six critical control points in the process of juice peach preserved fruit production, critical limit, monitoring system, control mean and correction measure of each critical control point were determined (See Table 2).

Make HACCP schedule

According to six critical control points in the process of juice peach preserved fruit production, HACCP schedule including file records, HACCP system evaluation and so on were redacted.

Archived file of HACCP system

Archived file of HACCP system contained the production records of critical process; the content, place, time, reason and processing method record

when CCP appeared out of control; health management record, etc. HACCP records would be kept at least 3 years.

HACCP system evaluation

To ensure the normal operation of the HACCP system and make CCP be in control, the HACCP system need be evaluated regularly. The evaluation content includes: regular inspection of HACCP file records; regular proof of the instrument of equipment;

archived file of HACCP system was reviewed regular by the HACCP group who confirmed that the system was in normal operation and write a review report. If the accident that the CCP is out of control appear, the HACCP team need to review whether the critical control limits and monitoring measures are appropriate, and instructed the relevant departments to be corrected (Zhao, *et. al.*, 2015).

Table 2 Critical Control measures of HACCP for juice peach preserved fruit production

Control point	Limited	Index	Method	Frequency	Monitor	Control means	Corrective actions
Raw material checking	GB2758-1	Maturity, microorganism, physical and chemical index	Sensory, chemical and microbial detection	Per batch	Buyer, inspector	Providing the proof of product control when supplying raw materials	Supplier evaluation system was established
Water treatment	Meeting the requirement of drinking water	Microorganism, pH value, content of chlorine	Chemical detection	Per shift	Inspector	Checking water quality regular	If water quality testing is not qualified, the water can not enter the washing and other follow-up process
Classification	Standard set by enterprise	Maturity, degree of bacterial contamination	Sensory detection	Per shift	Operating personnel, inspector	Strict classification according to the standard	Raw materials were reclassified
Washing	Meeting the requirement of drinking water	Water quality, degree of bacterial contamination	Chemical detection; microbial detection	Per shift	Operating personnel, inspector	Checking water quality and washing situation regular	Washing again or abandoning
Vulcanize	Standard set by enterprise	Concentration, temperature and time of hardener	Chemical detection; microbial detection	Per shift	Operating personnel, inspector	Controlling concentration, temperature and time of hardener	Improving techniques or abandoning
Packaging	Standard set by enterprise	Tightness; packaging material security	Packaging tests	Per batch	Operating personnel, inspector	Strengthen workers' operating rules; workshop health management	Product scrapped; repackaging; improving packaging techniques

RESULTS AND DISCUSSION

In order to evaluate the operation and application effect of the HACCP system for juice peach preserved fruit, the HACCP system of processing enterprises should be verified, so as to continuously improve the effectiveness of HACCP system. Verification includes: confirming verification of critical control points (record, review and targeted sampling inspection), verification of HACCP system (audit and sampling inspection of final products), etc. Based on the basic principle of HACCP safety control system, 6 critical control points consisted of

raw material supply, water treatment, classification, washing, vulcanize and packaging through the analysis of process of the peach fruit. In the production process, through the control of critical control point, the quality of low sugar preserved peach can be effectively controlled, the unqualified products were avoided and the safety of preserved fruit was improved.

CONCLUSION

HACCP quality control system can effectively ensure the quality and safety of food, but it need to be combined action with ISO9000, GMP, SSOP, and

other quality management and quality assurance system standards together to achieve the guarantee of product quality and safety indeed. HACCP is also a developing system, new applications that are harmful for new process and new technology may also make the critical control points or monitoring mode change. With the change of production conditions we should determine the CCP, enact the critical range, monitoring system, control measures and corrective measures again to ensure that the HACCP in the production is effective and sustainable.

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