Haccp Model Application In The Production Of Canned Grapefruit Segment

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ABSTRACT
Canned grapefruit segment is both consumed directly and used in cakes and other bakery products as well. In the products like canned fruit with high acidity some mould and yeast can appear, spore forms of some bacteria can survive. There is a questioning matter in using chemicals for peeling. Partly penetration into the fruit tissue of chemicals used depends upon the processing time, temperature and concentration.
HACCP (Hazard Analysis On Critical Control Points) being applied during the production of canned grapefruit segments will eliminate the existing risks and provide a more safely produced food getting rid of the hazards.
In this study, applying the 7 principles of HACCP system 5 critical control points were determined.
Key words: HACCP, grapefruit, chemical peeling

GREYFURT DİLİM KONSERVESİ ÜRETİMİNDE HACCP (KRİTİK KONTROL NOKTALARINDA TEHLİKE ANALİZİ) UYGULAMASI

ÖZET
Greyfurt segment konservesi hem doğrudan tüketilebilmekte hem de pasta ve benzeri ürünlerde kullanılmaktadır. Asitliği yüksek greyfurt konservesi gibi ürünlerde bazı maya ve küfler üreyebilmekte, bazı bakterilerin sporları canlı kalabilmektedir. Greyfurt dilim (segment) zarlarının kimyasal yolla soyulması için kullanılan kimyasallar süre, sıcaklık ve konsantrasyona bağlı olarak meyve dokusuna kısmen geçebilmektedir.
HACCP (Kritik Kontrol Noktalarında Tehlike Analizi)' in greyfurt dilim konservesi üretiminde kullanılması, mevcut risklerin elemine edilmesi ve tehlikelerin ortadan kaldırılarak daha güvenli bir ürün üretilmesini sağlayacaktır.
Çalışmada HACCP sisteminin yedi ilkesi uygulanmış ve beş kritik kontrol noktası belirlenmiştir.

1. INTRODUCTION

Grapefruit (Citrus paradisi) which is also known as greyfurt, pamelo, kaopan and buntan is a fruit having a high amount of vitamin C. It is used in the production of fruit juice, frozen concentrated, pectin and canned segments like other citrus fruits. Inner fruit sections segment membrane of which are peeled are both consumed directly and used in bakery products such as cakes. Although some research has been recently done on using enzymes during peeling (Prakash et al., 2001), membrane of segments is peeled with chemicals in general.
Some mould types arising from the raw meterial during the production of foods with high acidity such as canned grapefruit are Penicillium**,** Fusarium, Alternaria, Botrytis and Sclerotinia (Acar, 1999). Most easily mould and yeast can increase during processing of this sort of products (Kale and Adsule, 1995). Saccharomyces and Torulopsis as yeast, Mucor and Aspergillus as mould and Bacillus and Clostridium as bacteria are the microorganisms which can be seen at the production stage. Furthermore, some bacterias like Escherichia coli and Streptococcus faecalis can be conveyed with the raw material. Spores of Bacillus and Clostridium can survive despite the application of heat, but can not turn into the living form due to the high acidity (Acar, 1999).
There are three crucial contamination sources in the production of fruit and vegetable products. These are surface microflora of the raw material (1), the equipment used in the plant (2) and the personnel (3). A raw material of high quality is necessary to obtain a good manufactured product. Since the beginning number of microorganisms is very important for a safe food production, the number of microorganisms arising from the raw material must be as few as possible (Larousse and Brown, 1997). The most important factor showing the share of a food commodity in both its domestic consumption and international competition is that the food produced is a safe one. As well as microbiological risks, using the chemicals with correct concentrations when peeling the membrane of segments is necessary for both the sufficiency of peeling and the chemicals' being penetrated into the fruit flesh. Eliminating the risks arising from the factors like choosing on acidity resistant tin and washing during the production of canned segment is also extremely important for a safe food production.

At present, food safety programmes are formed to produce safe food and to reduce the existing risks. However, the efficiency of this safety programme only depends on the integrated system named as HACCP and the application of the units in the system (Bryan, 1999). The purpose of HACCP system is to determine the risky factors in advance which can appear during the production and to monitor them (Riswadkar, 2000). HACCP differs from the approach based on the control of the finished product and it requires that the actions which make it possible to prevent the risks be

determined on time and at the right place (Mc Swane and Linton, 2000, Sperber, 2001). The safe food production is obtained through the preventative and corrective actions found out for these risks (Buchanan and Whiting, 1996).

The food firms in EC countries have been forced to apply HACCP since the end of 1995 (Caswell and Hooker, 1996), but the system is not applied in the whole world and every production branch. HACCP is required in the countries importing the products like canned grapefruit segments for the production of safe food. The success of HACCP system depends upon the basic conditions such as Good Hygien Practise (GHP), Good Laboratory Practise (GLP) and Good Manufacture Practise (GMP) (Adams, 1994, Huggett, 2001).

The aim of this study is to apply HACCP during the production of canned grapefruit and define the basic conditions determining critical control points (CCP) at production stages for a safer production.

2. APPLICATION OF HACCP IN GRAPEFRUIT PRODUCTION

The grapefruits (Citrus paradisi var. Marshseedless) used in this study were supplied from Mersin (Turkey) in the Mediterranean Region. The fruits which are in good condition were used. The minimum diameter of the fruit used in the production is 8 cm and the maximum one is 10 cm. The production was done according to the production line given in Figure 1 in a private factory producing canned grapefruit segments in Susurluk, Balıkesir.

In this research four different can (gold lacqued) types (A 10, A 5, A 2 and ½ kg) were used. As pasteurisation duration 20, 18, 16 and 15 min were applied according to can sizes given above, respectively.

In this research, seven internationally accepted principles were taken as a base (Mortimore and Wallace, 1997):

1. Describing probable hazards and required preventative measures to monitor them.
2. Determining its CCP s on steps where safety must be managed.
3. Establishing the critical limits which must guarantee that its CCP s are being monitored.
4. Setting up a system to follow the control of CCP.
5. Determining corrective actions when CCP is out of control.
6. Establishing procedures to verify the HACCP system is working correctly.
7. Arranging the required reports and documents

By applying the brain storm on each step of the process, the raw material and the subsidiary material, every matter which may create a risk on the product for health has been assessed and the hazard, its cause and the preventative measures have been given on Hazard Analysis Forms. With the Application of Register Forms of Decision Tree, its CCP' s have been detected questioning whether they are real hazards or not. After detecting CCP s, the process step of its CCP, CCP number, the critical limits, following methods (procedure frequency), corrective actions, what the hazard is and who the responsibility belongs to have been assessed by establishing the HACCP control systems.

3. CRITICAL CONTROL POINTS (CCP) AND DISCUSSION

The application of HACCP in the production of canned grapefruit segments was given in Table 1. Five CCP s were determined as a result of this study. The hazards were grouped as chemical, physical and microbiological ones.

Among the main chemical hazards defined by Hoornstra et al. (2001) as well are pesticide residues, heavy metals, ammonia, ions like nitrat and nitrit and machine oil. There may be contaminants like pesticide in the raw material grapefruit. The product can be contaminated by detergent, disinfectant and wastes of machine oil during the process of sorting and by the ions contained in water at the calibration stage. When peeling the membrane of segments, the products are treated in NaOH solution with 2-3 % lower concentration for 55 seconds. After an effective rinsing, the acidity is regulated with phosphoric acid solution of 0.5-1.0 % for 45 seconds. Applying a second washing, no chemical waste is seen in the grapefruit segments. Environment, system and water used at calibration stage and subsidiary material tinned can can create a microbiological hazard. In addition, a failure in can seaming and a system defect in pasteurization can cause microbiological hazards to appear.

The reason why the raw material grapefruit does not form a microbiological hazard is that it has got high acidity. Total acidity of the raw material grapefruit is 0.7-2.8 %(as anhydrous citric acid). Some mould like Penicillium, Fusarium and Alternaria can develop in citrus fruits having such a high acidity. One of the most hazardous among them is P.expansum which can synthesize patulin toxin. The optimum pH value that the microorganism needs to synthesize patulin is between 3.0 and 6.5. No hazard is expected in the raw material grapefruit since the pH value of it is under these figures.

The pH value of canned grapefruit segments (natural) the filling liquid of which is grapefruit juice is 2.5-3.0 and the pH of the one the filling liquid of which is syrup (solution made of saccharose) is 2.8-3.2. In the products with high acidity like canned grapefruit, except the moulds and yeasts mentioned before, Bacillus coagulans, B. stearothermophillus, Clostridium butyricum and non-spore formed lactic acid bacterias can increase during production (Acar, 1999); and they can contaminate at all process steps defined as microbiological hazard with this study.

Physical hazards arising from the system, environment and personnel start to appear from the peeling stage. The hazards are mainly dust, soil, glass, metal pieces and similar unknown substances. This HACCP study was made effective with the applications of GMP, GHP and GLP; so a safer and a good quality production of canned grape fruit segments was achieved.

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Raw material (Citrus paradisi var. marshseedless)
↓
Calibration (Diameter: min. 8 cm, max 10 cm)
↓
Blanching (80-100°C, 4-8 min)
↓
Peeling of outer skin(albedo with flavedo)
↓
Fragment←Dividing into segments? Whole segment
↓
Segment control
↓
Peeling of segment membran (NaOH 2-3%, 80-88°C, 55 sec)
↓
Washing and cooling (2-3°C)
↓
Regulation of acidity (adding 0.5-1% phosphoric acid, 10-20°C, 45 sec)
↓
Sorting(membran and seed control)
↓
Tin cleaning (steam flushed and washed rotating)
↓
Filling? Magnetic control
↓
Saccharose solution(20-25 brix, 80-85°C)? Syrup pouring? Natural type:With grapefruit juice(10 brix, 60-70°C)
↓
Tunnel exhaust (70-80 °C, 2-5 min)
↓
Seaming (60-70°C)
↓
Pasteurisation and cooling in tunnel (86-88°C, 15-20 min)
↓
Drying
↓
Coding
↓
Paletting
↓
Incubation(21 days in storage conditions)
↓
Can packaging and transport

Figure 1. Production line of canned grapefruit segment