Available on-line at http://dse.usab-tm.ro/en/bjb.html
Banat's Journal of Biotechnology
2010, I(2),

QUALITY CONTROL OF ICE–CREAM PRODUCTS USING THE HACCP METHOD

Mirabela Panfiloiu[1], Monica Firczak[2], Delia Maria Perju[3], Gheorghita Simion[1]

[1]*S.C. Antarctica S.R.L. Timisoara,*
[2]*Sanitary–Veterinary and Food Safety Directorate of Timis County,*
[3]*Politehnica University of Timisoara*

Abstract. Ice cream is a product obtained from controlled raw materials, processed through pasteurization, homogenization, maturation, cooling, freezing, through keeping the air in composition, with or without glazer, and sell in different casseroles or waffle. For every product of ice cream a technical description is made. On this sheet one can find all the ingredients used, the physical–chemical and microbiological characteristics of the final product, the quality control rules applied and the particular analytical methods used for every product. The purpose of this paper is to describe the critical points in which hazard can intervene in the production process, the evaluation and the measures applied to prevent and control these critical points. This method is applied to all the technological processes for obtaining the ice cream based on milk and fruits.

***Keywords*:** HACCP control, ice–cream

Introduction

In the last years, there has been an increased accent on production regulation, food circulation and commercializing rules.

The evolution is spectacular both in terms of food products quality and in terms of performances to be recorded with the application of these good, healthy technological and hygienic means.

The HACCP system has become a synonym for sanitary security of food products. It is worldwide acknowledged as a systematic and preventive approach to control biological, chemical and physical dangers (hazards), by means of anticipation and prevention towards inspections and analyzes on finite products HACCP is a method which has to be applied by companies to secure the quality of food products, based on two main objectives:

- hazard analysis(HA=Hazard Analysis) and
- determining the points, during the creation process, in which these dangers are controlled (CCP=Critical Control Points) [MARIN, 2008, Ghid HACCP, 2006; Council D. 1993].

It is possible to apply the HACCP system in all the segments and components of the food chain, but all these sectors have to adhere to the Principles of Good Practice in Manufacturing and the General Principles of Alimentary Hygiene described in the Codex Alimentarius [MARIN, 2008].

HACCP is applied to all societies within the food/aliments domain (food production, food packaging, transport, storage, food serving and commercializing sectors), no matter the size or complexity, to offer the possibility to set the basis for obtaining safe alimentary products, to increase confidence among customers, supply partners, and supervision authorities. [MARIN, 2008, Ghid HACCP, 2006; Council D. 1993].

Basic Principles of HACCP. These are a group of operations, which include:

- identifying the contamination risks and evaluating these risks against their nocive effects on the direct consumers;
- identifying the critical control points (PCC), which, kept under control, are able to prevent, eliminate ore reduce down to acceptable limits the contamination risk;
- setting (establishing) the critical limits' for each PCC;
- setting (establishing) the monitoring system of PCC;
- establishing correction measures, in case one of the PCC is no longer under control;
- establishing the procedures to verify the effectiveness of the HACCP system;
- establishing which documents and recordings are adequate to meet the targets of the HACCP plan [MARIN, 2008].

The international legislation (93/43/EEC/June14th,1993 EC Council Regulation, EU Regulation 178/2002) as well as the Romanian legislation (150/2004 Law, Government's decision 924/August 11th 2005) regarding the food industry sets as a must the

use of a system based on the safety of products management, thus a HACCP system (Hazard Analysis and Critical Control Point– analyzing the risks within the hygiene management systems) in all the sectors and societies involved in the production, transport, storage, serving and commercializing food products [Ghid HACCP, 2006; Council Directive 93/43/CEE, 1993; Regulamentul (CE) nr. 178/2002; Hotărâre nr. 924, 2005].

To apply the HACCP principles is to take the following steps, as they appear described in the logical sequel of using the HACCP system:

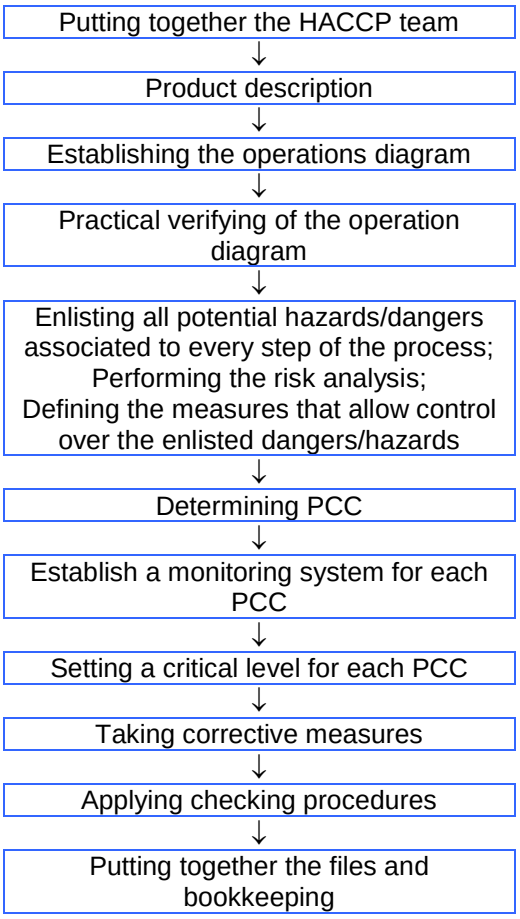

Figure 1. The logical sequel of applying the HACCP system

The purpose of the research

The main purpose of this research is to implement HACCP programmers' on the technological process of obtaining ice cream.

In the case study we follow the description of the means to identify potential hazards/dangers, the evaluation and assessment of the measures needed to prevent and control the– would–be risks/dangers.

Material and methods

In this work we have monitorred the temperature in the cooling room; we have monitorred the temperature in the case of obtaining vanilla ice cream and in the case of obtaining fruit ice cream.

In the cold room temperature has been recorded twice a day, for a month.

The technological scheme to make ice cream

The technological scheme explains in detail the conditions of the activities of production performed within the process stages [Manualul calitatii–uz intern SC Antarctica S.A.; Fisa tehnica a produsului–îngheţatei pe bază de lapte şi de fructe–uz intern].

The technological scheme for the making of ice cream is presented in Table 1.

The raw materials, the auxiliaries and the package should correspond to branch standards, and the currently applied legislation.

The purpose of auxiliary materials is to increase the satisfaction value of the products.

Sugar, emulsifiers, stabilizing substances, cocoa powder and milk powder are the main raw materials, and auxiliaries in use when making ice cream.

The stabilizing substances (the hydrocolloids) give viscosity, texture, consistency, organoleptic qualities and stability.

Emulsifiers reduce the interface tension between oil and water, improve the fat particles distribution, and control the di–emulsifying process.

The list of wrappings, raw materials and auxiliary is grouped depending on the type of ice cream.

To wrap the final product wrapping materials are used to correspond to hygiene norms.

Wrapping/packaging materials that are in direct contact with the product are polyethylene casseroles, polystyrene lid and polypropylene film, and the wrapping materials that do not directly contact the product are cardboard boxes.

Table 1.

The ice cream technological scheme

PROCESS	PROCESS DESCRIPTION
1. Reception of raw materials	At the reception weighing or measuring, verifying the existence of documents and organoleptic organoleptic analysis.
2. Storage of raw materialsSto	Takes place in the warehouse for raw materials at a suitable temperature and humidity.
3. Weighing raw materials	Weighing is base on a prescription.
4. Transport of raw materials	It takes place in covered containers and transported by a trolley.
5. Mixing and pasteurisation	Pasteurization is a heat treatment and occurs at a temperature of 65–70°C for 18–45minutes.
6. Filtering	Filtering is done to remove foreign bodies, to avoid clogging and ensure homogenization stomacher.
7. Weighing flavorings and colorings	It is made by a prescription containers cleaned and disinfected.
8. Flavoring and coloring	It is accomplished by adding heat–sensitive substances in the mixture cold.
9. Homogenisation	Homogenization takes place at 120–200 bar in order to obtain a mixture composition more stable, balanced and smooth texture.
10. Cooling	Cooling aims to achieve high efficiency maturation, inhibit the growth of microflora and determination of fat emulsion.
11. Curing	The maturation (4–6°C) solidify the fat, protein substances hydration occurs and decreases the amount of fresh water free.
12. Slicing and packaging individual	Manual or automatic dosing and packing takes place on a stick, the wafers, cups, cones, containers. At the same time, carry out adding toppings.
13. Partial freezing (freezerare)	It consists of partially frozen water mixed in ratio of 35–50%, with the formation of crystals and the incorporation of air occurs in the mix.
14. Freezing and storage	Toppings are stored in the cold room temperature between –18 to –25° C.
15. Labelling and marking	If the ice cream containers are made with the Videojet printer ink, where candy and ice cream waffle is done by stamping automated packaging process, and the rest of the items specified on the package.
16. Tempering room/tunnel cogelare	It aims to strengthen the remaining ice by freezing water approx. 5%, and is performed at temperature –32 to –40° C.
17. Packing collective	It takes place in cardboard boxes.
18. Storage of finished product	State storage is packaged at a temperature of –18 ...–25° C, and aims to reduce the risk of contamination. Avoid thawing and ice recrystallization.
19. Delivery	It is made with refrigerated cars, cleaned, loading temperature is below –18° C protected action under the ramp. Are accompanied by documents: Notice of slips, Quality assurance, Conformity Statement

Results

Table 2.

Identified would–be hazards

Process	Danger's type	Danger's description (hazard)	Risk class
Pasteurization	Biological	Bacteria, mould, viruses	3
Storage	Physical	Irreversible damage of the finite product	3

The following have resulted from analyzing and evaluating the process of making and of packing ice cream, and these critical points are presented in Table 2.

Table 3.

Monitoring the temperature in the cold room

Period	Temperature	
	morning	night
1–31.07.2008	–25°C	–25°C

Table 4.

Monitoring temperature when obtaining ice cream at 81°C pasteurization

Date	Type	Quantity(l)	Duration pasteurization
1.07.2008	vanilla	1800	54 min.
	fruits	1200	36 min.
2.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
3.07.2008	vanilla	1200	36 min.
	fruits	1200	36 min.
4.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
5.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
6.07.2008	vanilla	1200	36 min.
	fruits	1200	36 min.
7.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
8.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
9.07.2008	vanilla	1800	54 min.
	fruits	1200	36 min.
10.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
11.07.2008	vanilla	1800	54 min.
	fruits	1200	36 min.
12.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
13.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
14.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
15.07.2008	vanilla	1200	36 min.
	fruits	1200	36 min.
16.07.2008	vanilla	600	18 min
	fruits	600	18 min
17.07.2008	vanilla	1200	36 min.
	fruits	1200	36 min.
18.07.2008	vanilla	1200	36 min.
	fruits	1200	36 min.
19.07.2007	vanilla	1800	54 min.
	fruits	1800	54 min.
20.07.2008.	vanilla	900	27 min.
	fruits	900	27 min.
21.07.2008	vanilla	1200	36 min.
	fruits	1200	36 min.
22.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
23.07.2008	vanilla	1800	54 min.
	fruits	1200	36 min.
24.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
25.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
26.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
27.07.2008	vanilla	300	9 min.
	fruits	300	9 min.
28.07.2008	vanilla	1800	54 min.
	fruits	1200	36 min.
29.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
30.07.2008	vanilla	1800	54 min.
	fruits	1800	54 min.
31.07.2008	vanilla	1800	54 min.
	fruits	1200	36 min.

The analysis and evaluation concluded that pasteurization is the most appropriate stage high potential risk in getting ice cream.

Discussion

In the process of obtaining ice cream, vanilla and fruit ice cream it can be noticed that the value of temperature remains constant in all the 31 days that the process has been monitored. (*Figure 1 and 2*).

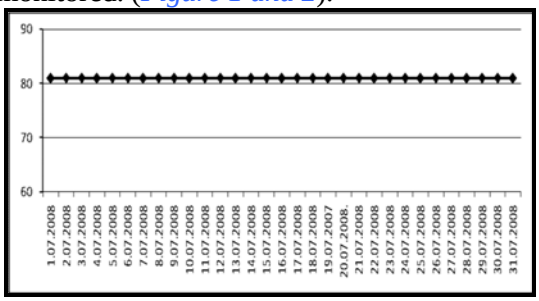

Figure 1. Monitoring of pasteurization temperature in the process of obtaining vanilla ice cream

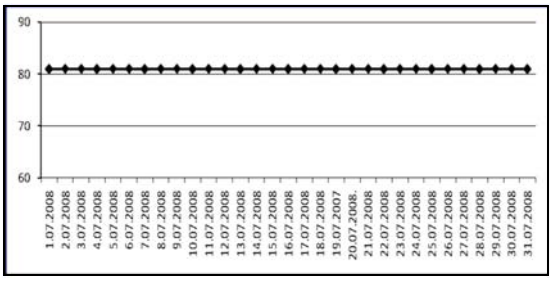

Figure 2. Monitoring temperature of pasteurization in the production of fruit ice cream

Control measures and corrective actions are presented in Table 6.

Table 6

Control measures and corrective actions

Stage	Pasteurization
Major danger(s)	NTG. B. Yeasts and molds *BacT coliform. BacT vinegar. Leuconostoc lactic Salmonella*
Control measures	Monitoring pasteurization Sensor Calibration temperature.
Critical Limits	81ºC
Monitoring	At 30 min
Measures and corrective actions	Revision pasteurizer, Temperature Sensor Calibration regular, personal training.
Records, Documents	Pasteurization Sheet

Available on-line at http://dse.usab-tm.ro/en/bjb.html
Banat's Journal of Biotechnology
2010, I(2),

Conclusions

1. Maintaining the system was operational safety is ensured if the ice is planning a performance of the main actions of such system:
   - internal audit will be done quarterly;
   - for requirements analysis training and retraining will be done quarterly operating; and
   - HACCP plan reassessment will be made annually.
2. For operators of food producers to be certified as ISO, HACCP plan must be made mandatory, its implementation is specific to each company.

References

1. Marin, V. (2008). "*Ghid national de bune practici pentru siguranta alimentelor. Sistemul de siguranta alimentelor HACCP. Produse de patiserie si cofetarie"* Ed. Uranus Bucuresti.
2. *** *Ghid naţional de bune practici pentru siguranţa alimentelor–Sistemul de siguranţa alimentelor HACCP* (2006) Ed. Uranus, Buc.
3. *** Council Directive 93/43/CEE, the 14 of June 1993, regarding food products hygiene.
4. *** Regulamentul (CE) nr. 178/2002 al Parlamentului European si al Consiliului din 28 ianuarie 2002 de stabilire a principiilor si a cerintelor generale ale legislatiei alimentare, de instituire a Autoritatii Europene pentru Siguranta Alimentara si de stabilire a procedurilor in domeniul sigurantei produselor alimentare
5. *** Hotărâre nr. 924 din 11 august 2005 privind aprobarea Regulilor generale pentru igiena produselor alimentare
6. Manualul calitatii–uz intern SC Antarctica SA
7. Fisa tehnica a produsului–îngheţatei pe bază de lapte şi de fructe–uz intern.

Received: September 21, 2010
Accepted: November 23, 2010