

# The Implementation of HACCP in Ice Cream Industry

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**Abstract**— HACCP (Hazard Analysis Critical Control Point) was a preventive system concerned with food safety. This system has become a necessary for transactions involving food products. The purpose was to set up specific HACCP plan for ice cream processing in ice cream industry. A specific generic HACCP model was developed to improve safety and quality of ice cream produced in industry. This was based on actual conditions in the ice cream manufacturing in industry. Four CCPs were identified in the ice cream manufacturing process. The most important identified CCPs were ice cream mix filtration, pasteurization, metal detector, and cold storage.

**Key words:** Ice Cream, Critical Control Point, Corrective Action, HACCP

## I. INTRODUCTION

Ice cream is the very main and famous dairy product, which is one of the favorite food items in large segments of the population. It is a nutritionally enriched frozen dairy product consumed by all age groups particularly children mostly during summer. Ice cream is sold both in a package form (cups, cones and cartons) and in 'open' containers at retail outlets or ice cream parlors, which is distributed manually in scoops, cones or sundaes. The amount ingredients and the processing steps are very important to produce good quality ice cream are well known and employed worldwide. The formulation of ice cream may vary but a conventional mix typically contains a fat source, a protein source, and other functional ingredients including sweeteners, stabilizers and emulsifiers. In Ice cream processing there is blending all of the ingredients together and then pasteurizing, homogenizing, aging and freezing the mix. Number of processing steps contributes to fat structure development in ice cream. Food safety has become main thing in the word, making public health agencies and governments of several countries look for more efficient ways to monitor production chains. HACCP system is recognized as a management tool capable of ensuring food safety. The keyword of the system is "prevention" the identification of possible contaminations before they occur. Compared with another method of inspection and quality control based on the analysis of finished products, HACCP facilitates a stricter control of contaminations. The HACCP system is an important tool in the reduction of food borne diseases (FBDs), and it is a global reference in terms of food safety control. Food safety is recommended by the World Health Organization, the International Commission on Microbiological Specifications for Foods, the Codex Alimentarius and food regulatory agencies in various countries. The HACCP system is a use for the safe production of food products. It is developed as a "zero defects" program. It is a science-based system used to food safety hazards are controlled of unsafe food from reaching the consumer. It is an assurance system based on the prevention of food safety problems and is accepted by international authorities as the most effective means of

controlling food-borne diseases. HACCP is use in different field to control biological, chemical and physical hazards. To comply with legislation, but even more to maintain the image of 'preferred supplier', the food industry is very active in systematically identifying the critical control points in their production processes. It is important to develop food safety policy for the implementation of HACCP because most of the food borne diseases are due to poor handling practices. The implementation of HACCP will produce the safe food & suggest the control measure because will increase the quality of ice cream.

## II. METHODS

### A. HACCP Implementation in ice cream manufacturing unit

The aim of this study for implementation in the actual situation and match with the qualitative comparison because by using this system which provide the depth and careful scrutiny of ice cream process. The observations were recorded for the implementation, observations gave the compare details of phenomena that were difficult to convey with quantitative methods. Qualitative research is investigate and open-minded which is useful to this study as shown in figure.1

### B. Application of HACCP System

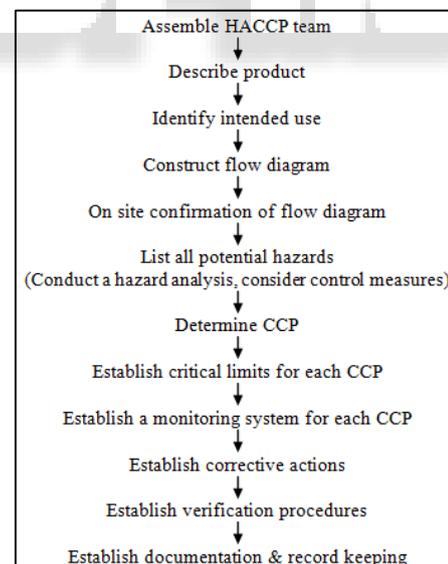


Fig. 1: Logical sequence for the application of HACCP  
The steps used to apply the HACCP system in ice cream manufacturing unit Products line were described by as follows

- The support of senior management of the company for food safety and HACCP application was sought and obtained.
- Each step in the process was outlined in sequence in the flow diagram from raw materials through processing, packaging and storage.

- Observing operations for: Receipt of raw materials, storage, heat treatment, and packaging.
- Personal hygiene, education, health, cleanliness, habits, premises, equipment, floors, walls and ventilation (working conditions).

Measuring operations are: Time and temperature applied during the production and storage of products were measured and recorded.

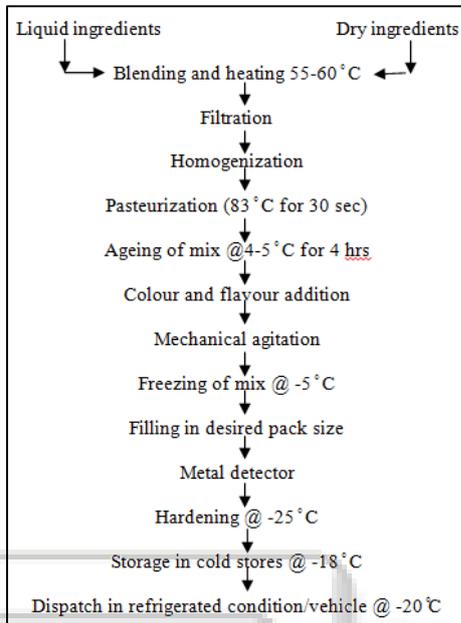


Fig. 2: Flow Diagram of Ice Cream processing

### III. RESULT AND DISCUSSION

In this study the HACCP system for ice cream plant was developed step by step on the basis of twelve steps mentioned in the materials and methods as per United Nations Codex Alimentarius Commission's HACCP and guidelines for its application (revision of 2003), the overall technical process of ice cream production will be drawn, and a hazards analysis can be performed. CCPs will be subsequently selected Based on government regulations and industry standards, critical limits can be established, as well as monitoring procedures, corrective measures, records, documentations, and verifications. The decision tree method will be implemented to select the CCPs. This method is visual, easy to- understand alternative to the numerical charts and statistical probabilities in other decision. The quality of the raw materials is very important because it will determine the quality of finished products. Simple visual checks at reception are useful tools to guarantee raw materials of good quality. Presence of condensation in containers or of spoiled packaging material represents a risk. Correct handling of raw materials is an important in system.

#### A. Possibility of hazard occurrence in ice cream ingredients suggestive measures to control hazards as per HACCP

Following hazards were identified in the milk and cheese processing steps and following corrective measures were suggested for control of hazards. Hazards were identified by HACCP team using HACCP checklist involving the study from various literature sources, scientific documents, case studies. The possible hazards identified by the HACCP team are mentioned below;

Ingredients	Microbial	Hazards Physical	Chemical	Control measures
Milk	E-coli, staphylococci, salmonella, shigella	Foreign matter, Adulterant	Pesticides, neutralizer, aflatoxin, sanitizer	Filtration and lab testing proper implementation of GHP and GHP
Skimmed milk powder/cream	Pathogenic bacteria e.g. Salmonella, Shigella, Staphylococcus and listeria and spore forming bacteria e.g. Bacillus and Clostridium and yeast and Mold	Impurities and foreign materials	Mycotoxin, residues of antibiotics and food additives	Certified suppliers and complains with raw materials specifications
Sugar	Spore forming bacteria e.g. Bacillus and Clostridium	Impurities and foreign materials	Environmental chemicals and heavy metals	Certified suppliers and complains with raw materials specifications
Carboxy Methyl cellulose	Not usually	Impurities and foreign materials	Environmental chemicals and heavy metals	Certified suppliers and complains with raw materials specifications
Packaging material	E.coli	Dust	Non food grade	Certified suppliers and complains with raw materials specifications

Table 1: Possible hazard analysis of ingredients and their control measures.

Processing steps	Microbial	Hazards Physical	Chemical	Control measure
Receiving of milk	Unhygienic contacts Salmonella Staphylococcus	Extraneous matter	Starch	Implementation of GMP, Effective filtering
Mixing Ingredients	Pathogenic bacteria, spore Forming bacteria and yeast and	Different impurities	Different chemical	Standard operating procedures and good manufacturing

	mold listed in different raw Materials	and foreign materials listed in raw materials or workers	hazards listed in different raw materials	practices
<b>Filtration</b>	Not usually	Impurities and foreign materials	Not usually	Maintains of sieves
<b>Pasteurisation</b>	Un-hygienic contacts ,salmonella, staphylococcus, Coxiella, burneti Mycobacterium tuberculosis	Extraneous materials	Not usually	Strictly control pasteurization time and temperature
<b>Ageing</b>	Microorganism contamination and growth	Not usually	Not usually	Strictly control aging condition, keep relevant facility clean and sealed
<b>Freezing</b>	Microorganism contamination and Growth	Not usually	Not usually	Keep the inlet and its surrounding air clean, filter screen must sterilized in advance
<b>Filling and packing</b>	Pathogenic bacteria, spore Forming bacteria and yeast and mold from workers, environmental or unsanitary machines	Impurities and foreign materials from unsanitary machines and workers	Not usually	Sanitation standard operating procedures and good manufacturing practices
<b>Storage in cold stores</b>	Pathogenic bacteria, spore Forming bacteria and yeast and mold from workers, Unhygienic conditions of cold storage.	Not usually	Not usually	Proper temperature control, Sanitation standard operating procedures and good manufacturing practices

Table 2: Possible hazard analysis of ice cream processing steps

The hazard analysis of processing steps was done by the HACCP team to ensure safety of product at processing line the hazards identified are mentioned as following

*B. To determine the Critical Control Points (CCPs), their Critical Limits and Monitoring*

The critical control points in ice cream manufacturing steps were determined on the basis of CCP decision tree. The

CCPs identified are mentioned in table 3 For each CCP critical limits were identified and monitoring procedures was decided in case of any failure at CCP corrective actions can be taken which include Temperature control checks, maintaining proper Ph, aw control, microbial testing of end product. Conduct equipment calibrations in case, failure of CCP occurs due to improper working of equipment.

CCP	Significant hazard	Critical limit	Monitoring	Corrective action	Record	Verification
Filtration CCP P1	Impurities and foreign materials	60 mesh	Integrity of sieves, clogging	Hold batch and re-sieving, Maintenance sieves	Filtration log	Integrity of sieves
Pasteurization CCP B1	Microbial hazard	>83°&<87°C for 30 sec	Temperature and time	Sent for re-pasteurization	Pasteurizer log book	Using a portable thermometer/timer to verify automatic temperature controller
Metal detector CCP P2	Metal pieces	Fe-0.4mm Non Fe-0.5mm SS-0.7mm	Metal pieces	Hold batch and conduct root cause analysis	Metal detector log	Proper working of metal detector
Cold storage CCP B2	Microorganism contamination and Growth	-18° C	Store temperature	Effective temperature control, Cold	Cold storage temperature	Integrity of cold storage, calibration of temperature

				storage structure need to be modified if its design contains major defect	log	sensors.
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Table 3: HACCP plan for ice cream

C. Advantage and Effect of HACCP on the Industry

The HACCP system is use for food safety management, and also use for controlling in food handling to impedire food safety problems. HACCP is based on anticipation and minimize the reliance on end product inspection and testing. Enhancing food safety, other advantage of applying HACCP which include more effective use of resources, savings to the food industry. HACCP accrescere the responsibility and degree of control at the level of the food industry. A properly implemented HACCP system leads to greater involvement of food handlers in understanding and ensuring food safety, thus providing them with renewed motivation in their work. The application of the HACCP system can aid examination by food control regulatory authorities and promote international trade by increasing buyers' confidence. Any HACCP system should be capable of oliging change, such as advances in system design, changes in processing procedures or technological developments.

IV. CONCLUSION

HACCP should become part of the culture of the food processing plant. It provides a strong tool for continuous improvement. Some pillars of a robust HACCP program are Supply Quality Assurance. GMPs (Good manufacturing Practices), the direct application of HACCP is difficult in industries that do not produce food. But for industries that are associated with the food production industry (manufacturing, packaging, warehousing, transportation), the implementation of HACCP provides recognizable value. The reduction of identified CCP number is necessary since it will ensure the safety of food products for consumption and safety of consumer and will decrease the overall cost hence increase the net outcome of the company. further studies are require to confirm the HACCP system in ice cream processing plant.

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