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Study on implementation of HACCP in fruit and vegetable processing unit (Onion dehydration unit)

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Abstract
HACCP, or the Hazard Analysis and Critical Control Point System has been recognized as an effective and rational means of assuring food safety from primary production through to final consumption, using a "farm to table" methodology. The application of this preventive oriented approach would give the food producer better control over operation, better manufacturing practices and greater efficiencies, including reduced wastes. The purpose was to set up specific HACCP plan for onion dehydration processing plant in an existing fruits and vegetable plant in Jalgaon, Maharashtra. A specific generic HACCP model was developed to improve safety and quality of dehydrated onion produced in this plant. This was based on actual conditions in the onion dehydration plant, the seven principles of HACCP and several existing generic models of HACCP using qualitative approach. Three CCPs were identified in the production of dehydrated onion in the manufacturing plant. The most important identified CCPs metal detector, post shifter and magnet. However, the HACCP plan in this study has not been implemented in the onion dehydration plant. The HACCP system in this study for onion dehydration line manufacture is developed step-by-step based on the twelve steps mentioned in the literature review. The prerequisite program was provided to deal with some hazards before the production to simplify the HACCP plan.

Keywords: CCPs, food safety, HACCP, onion dehydration

Introduction
The food processing industry sector in India is one of the largest in terms of production, consumption, export and growth prospects. Important sub-sectors in the food processing industries are: fruit and vegetable processing, fish processing, milk processing, meat and poultry processing, packaged/convenience food, alcoholic beverages and soft drinks and grain processing. The HACCP program deals with control of factors affecting the ingredients, product and process. The objective is to make the product safely, and be able to prove that the product has been made safely. The where and how are the HA (Hazard Analysis) part of HACCP. The proof of the control of the processes and conditions is the CCP (Critical Control Point) part. Flowing from this basic concept, HACCP is simply a methodical and systematic application of the appropriate science and technology to plan, control and document the safe production of foods. HACCP is not the only method in ensuring that safe food products are manufactured. The plan will be successful when other procedures are in place such as sanitation standard operating procedures (SSOP's) and by using good manufacturing practices (GMP's). Although the Minnesota Food Code does not require them, these programs are fundamental in the development of a successful HACCP plan. SSOP's should include personal hygiene practices as well as daily sanitation of the food contact surfaces and equipment. Good sanitation practices are the foundation of manufacturing and preparing safe food. HACCP was originally developed as a "zero defects" program and considered to be synonymous with food safety. HACCP is a science-based system used to ensure food safety hazards are controlled to prevent unsafe food from reaching the consumer (Mortimore and Wallace 1997). The use of Hazard Analysis and Critical Control Point (HACCP) based quality assurance has a wellestablished place in controlling safety hazards in food supply chains. 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 (Stanley *et al*. 2011) [3]. It is a proactive system for assuring safe production of food by emphasizing prevention rather than inspection. Addresses all types of hazards – microbiological, physical and chemical and reduces the risk of contamination.

Transforms commodities into branded products and provides international acceptance. Demonstrates conformance to international standards and regulations and requirements of overseas markets, Focuses on identifying and preventing hazards from contaminating food, Permits more efficient and effective government oversight primarily because the record keeping allow investigator to see how well a firm is complying with food safety laws over a period rather than how will it is doing on any given day. Give the responsibility for ensuring food safety appropriately on the food manufacturer or distributor and increase consumer confidence. It is important to develop a food safety policy and strategy for the implementation of HACCP because most of foods borne diseases are due to poor handling practices. The implantation of HACCP system will provide safe food to the consumer and will improve the quality of food. The present work was undertaken wit

Objectives

- To verify the proper implementation of HACCP in view of its performance.
- To study the hazards and their control measures which occurs in fruits and vegetable industry.

Material and Methods

The research work on "Study on implementation of HACCP in Fruit and Vegetable Processing Unit (Onion Dehydration)" was conducted in Jain irrigation system Ltd. Jalgaon, Maharashtra during Jan-May 2015. Various methodologies followed for this research is presented in

Procedure

- A review of fruit and vegetable processing unit (Onion Dehydration unit)
- Survey of HACCP working plan
- Follow up interviews with HACCP team, food handler, consumer
- Identify the guidelines of HACCP Identify the problem in HACCP work plan

Following steps are involved selection of industry

- Collection of primary data
- Collection of secondary data
- Study the critical control points in industry

Application of HACCP system

The steps used to apply the HACCP system in Onion dehydration processing unit Products line were described by (Mahmoud *et al*. 2010) [1] as follows.

- The support of senior management of the company for food safety and HACCP application was sought and obtained.
- A team was formed which included: production manager, production engineer, Consultant of food hygiene and sanitation, consultant of food microbiology and a Technician from the laboratory.
- Products were described in terms of ingredients, processing, packaging, storage and distribution.
- Each step in the process was outlined in sequence in the flow diagram from raw materials through processing, packaging and storage.
- In order to identify the hazards the following actions were undertaken:
- Observing operations. Each product preparation process was observed for:
- Receipt of raw materials, storage, heat treatment, and packaging
- Personal hygiene, education, health, cleanliness, habits, premises, equipment, floors, walls and ventilation (working conditions).

Contamination can be dangerous, causing serious diseases.

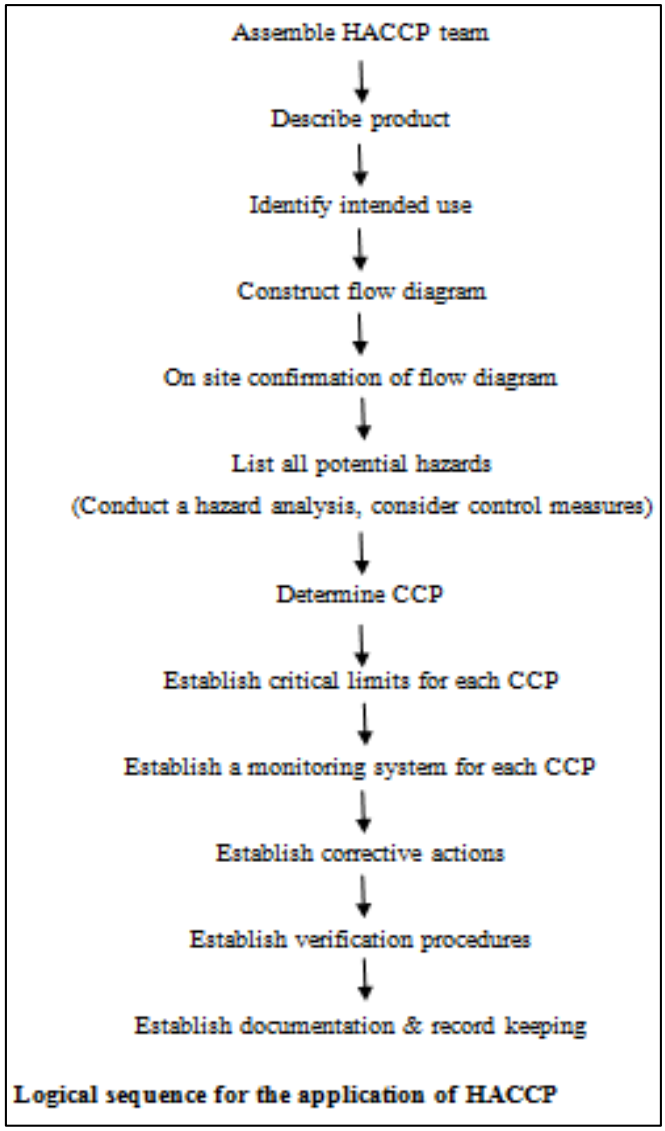

Fig 1: Logical sequence of the application of HACCP

Application of HACCP system

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Evaluation of the Physical and chemical Onion dehydration quality before and after HACCP implementation

Adverse reactions to chemicals present in food can be classified as food intoxications or food sensitiveness. Generally, each of us is vulnerable to food intoxications if the exposure is high enough. The most well-known examples of food sensitiveness are food allergies. These are typically induced due to an abnormal reaction of the immune system. Chemicals provoking food intoxications can be classified in various manners as e.g. food additives, residues, contaminants and endogenous substances.

Physical contamination can occur at any stage of the food chain and therefore all reasonable precautions must be taken to prevent this type of contamination. Physical contaminants are characterized as additional matter or alien objects normally not existing in food that can cause injury, disease or psychological trauma to the organism.

According to their nature, mechanical contaminants can be classified in three groups:

- Mineral (soil, stones, dust, metals, glass, fibre, etc.)
- Plant (weeds, leaves, stems, etc.)
- Animal (mites, insects, rodents, etc.)

Radioactive contaminants are also included among physical contaminants. They are invisible and can be only detected by special instruments. Radioactive contamination can be dangerous, causing serious diseases.

Results and Discussion

In this dissertation work data was collected within Jan - May of 2015. Data was collected through two type primary data collection and secondary data collection. This study was done in Jain Irrigation Systems Ltd. Jalgaon. The HACCP system in this study for Onion dehydration line manufacture is developed step-by-step based on the twelve steps mentioned in the literature review. The prerequisite program was provided to deal with some hazards before the production; therefore, to simplify the HACCP plan. By answering the questions in the decision trees, the critical control points were determined.

Finally, the HACCP control chart was developed to include components of several HACCP principles which are critical limits, monitoring, corrective action and responsibility.

Corrective action of onion dehydration ccp

Table 1 shows that product critical control points and HACCP plan in this plan mentioned their hazards, control measure, limits, critical limits and frequency. There is three CCP Metal detector, post shifter, magnet.

1Ccp Metal detector-

Corrective action-stop processing and metal detector repair/correct the metal detector check again with the test pieces.

2Ccp post shifter-

Replace the damage sieve.

3Ccp magnet-

Cleaning of magnet bank carefully making sure that all the material sticking on magnet bank is collected.

Table 1: HACCP Plan of CCP

Product	Critical Control Point (CCP)	HACCP Plan
Dehydrated Onions	CCP-1(CCP-1(123456 78&9).	**Point:** Metal detector **Hazard: Physical-** Metal, Metal dust **Control measure:** Metal detector **Limit:** Metal detector:CCP-1(1235678&9) Sensitivity Fe material: 0.4mm Non Fe material: 0.5mm SS material: 0.7mm **Critical limit:** Test piece must get rejected in all three consecutive attempts of checking. **Frequency:** every 4 hrs.
	CCP-2	**Point:** Post sifter (Integrity of post sifter sieves) **Hazard:** Physical-foreign matter **Control measure:** Sieves-For Powder : 50mm GO & GR : 20mm Spl GO, Spl GR, GO-2 : 16mm GR-1 : 1.4mm **Limit:** Intact & Undamaged sieve(s) of post sifter(s) **Frequency**: once in shift
	CCP-3	**Point:** Magnet **Hazard:** Physical- Metal, Metal dust **Control measure:** Gauss value of magnet **Limit:** Cleaning the magnet and Measure the metallic material in ppm **Frequency:** twise in shift

Buildings and facilities must be of sound construction and good repair and designed to: permit easy and adequate cleaning and proper hygiene; minimize pest and environmental contamination; minimize cross contamination; provide adequate lighting in inspection areas; provide potable water supply; provide personal hygiene practice; control surrounding areas to reduce entry of dust, runoff, pests and other potential contamination sources.

Equipment used in the process must be designed, constructed, maintained and operated to allow for: effective cleaning of surfaces; contamination control; calibration and maintenance to ensure control.

Persons who process product should establish hygiene practice to ensure: washing of hands prior to contact with product; training is provided on critical control points, allowable tolerances and corrective actions required.

All employees must: be provided documented procedures to ensure the processes do not pose a health risk; adhere to documented procedures; be involved in the preparation of a HACCP system.

A documented sanitation program must exist that includes: equipment cleaning; housekeeping audits and associated corrective actions; pest control; waste disposal; bin inspections.

Incorporated into the existing documentation there must be: process flowcharts and critical control points; monitoring mechanism for these control points; corrective action process; traceable records.

A formalized customer complaint process must exist that includes a product recall process.

Table 2: Physical and chemical Hazards and their control.

S. No.	Physical, Chemical Contaminants	Source	Control measure
1	Stone, mud	Raw material, abrasive peeler	Raw material inspect and sorting, flume washing and rock trapping, peeler washing and destining
2	Metal	Machine part, welding burr	Effective maintain metal detector, magnet separation
3	Plastic	Brush wash, plastic bag, piece	Flum washing/ rock conveyor trapping, bag checking before use, inspect and sorting
4	Thread/string	Raw material bag	Removal during inspect and sorting, flum washing, cleaner
5	Rubber	Dryer, milling	inspect and sorting, removal during shifting post shifter
6	Pest	Direct entry	No direct entry to plant, effective pest control programs like shed pest control, installation of air curtains, inseticutor
7	Oil	Conveyors	Effective maintains programs
8	Grease	Cutter	Effective maintains programs, food grade grease
9	Hair	Associate	Personal hygiene specially designed

Conclusion

HACCP should become part of the culture of the 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 (packaging, warehousing, transportation), the implementation of HACCP provides recognizable value. The reduction of identified CCPs number is necessary since it will lead to ensure the safety of food products for consumption therefore the safety of consumer, decrease of the overall cost hence increase the net outcome of the company.

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