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**Research Article**

# Using HACCP to Control Hazards in Fresh Noodles Processing Line

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**Abstract:** Quality assurance norm covering all the processing steps, from farm to table, have become obligatory and assume a fundamental role in process innocuousness. The HACCP system includes a series of inter-related steps, inherent to industrial food processing, including all the operations occurring from production to consumption of the food. A Fresh Noodle (FN), the fourth instant noodle, was an instant noodle without oil-fried process. Comparing with oil-fried noodle, Fresh Noodle (FN) has many advantages in some factors such as freshness, good taste and nutrition and so on. However, the critical problem about Fresh Noodle (FN) is controlling food microorganism that is solving its storage. This study evaluates the safety issues during the production of Fresh Noodle (FN) and it indicates how the hazards (including microbiological, chemical and physical) may be effectively controlled using a HACCP approach.

**Keywords:** Fresh noodle processing, HACCP

## INTRODUCTION

HACCP (Hazard Analysis and Critical Control Point) is a procedure for the identification, assessment and control of hazards in and indirectly risks from, food. Most current HACCP procedures focus on microbiological and physical harzards even though effective control requires consideration of all hazard classes (i.e., chemical, physical and microbiological hazards).

Hazard Analysis Critical Control Points (HACCP) is an effective means of ensuring food safety (Mayes, 1992) and HACCP principles have been incorporated into food safety legislation worldwide (Eu (European Union), 1992, 1993; for Europe, FDA (Food Drug Administration), 1972, 1989; NAS (National Academy of Sciences), 1985; Taylor, 1993; US Federal Register, 1994, 1995; for the US, Agriculture Canada, (1993) for Canada or ANZFA (Australia New Zealand Food Authority) (1992, 1996) for Australia and NewZealand). Consequently, HACCP is becoming an increasingly important component of commercial food production (i.e., agricultural and manufacturing) practices.

Noodles originated from China about 2000 years ago. They have not only been the popular main food of Chinese people all over the country, but are also widely propagated through the whole of Asia, Europe, America and even throughout the world. Now, noodles are a main food, second only to breads all over the world. Along with the development of the modern food industry, nutritive and functional foods have been developed further and the world food market has become more and more diversified. Therefore, it is an inevitable step to study and develop various forms of novel nutritive noodles. A Fresh Noodle (FN), the fourth instant noodle, was an instant noodle without oil-fried process. Comparing with oil-fried noodle, Fresh Noodle (FN) has many advantages in some factors such as freshness, good taste and nutrition and so on. However, the critical problem about Fresh Noodle (FN) is controlling food microorganism that is solving its storage.

The purpose of this study is to describe the application of HACCP principles at an industry level to derive appropriate fresh noodle safety control measures. This report summarises the key processes and application of the HACCP approach.

## MATERIALS AND METHODS

**Fresh noodle processing:** Fresh noodles are produced several raw materials such as wheat flour, starch and so on. And these raw materials must be checked strictly according to the specification. According to the formula, weighing, sifting and putting down the powder, then adding salt-water and mixing to be dough. Following mixing, the dough are compounded and

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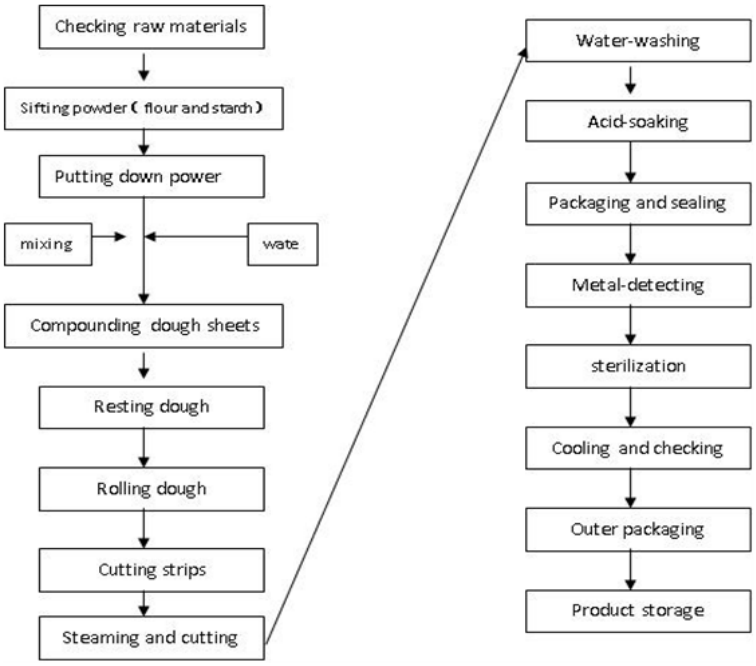


Fig. 1: A flow diagram illustrating the actual fresh noodle production process

conveyed to a rest room, which has certain temperature and humility. After resting, the dough are conveyed to rolling, cutting strips and then entering the steam cooker. Following steaming, the long noodles are cut and then went into water-washing chamber and conveyed to acid-soaking chamber. After acid-soaking, the noodles are packed, sealing and then metal-detecting and sterilization. Finally, the noodles are checked and outer-packed. A flow diagram illustrating the actual fresh noodle production process is shown in Fig. 1.

**Safety and quality assurance:** Foodborne hazards considered included biological (microorganism, nature toxins), physical (foreign matter) or chemical (residues, heavy metals) agents, in, or condition of food with the potential to cause an adverse health effect. Biological hazards were mainly microorganism hazards (i.e., raw materials such as wheat flour, starch, water, acid and so on resulting from organisms or pathology associated with the unsafety of fresh noodles). Chemical hazards included residues from chemicals in the environment and those used farm and mill factory, including those which may be safe in small amounts but have a maximum residue limit. Physical hazards considered were those which may enter during primary production---examples include metal and other foreign matter. Potential hazards included those that may result in public health, social and/or economic impact but for which epidemiological evidence is lacking e.g., chemicals and toxins (World Health Organisation, 2003; Da Cruz *et al*., 2006; Berends and van Knapen, 1999).

## RESULTS AND DISCUSSION

**Hazard analysis:** An assessment was firstly conducted on receiving the raw materials and then checking the semi-products as a whole to determine if there were food safety hazards and food safety-related market access risks that should be controlled by checking the raw materials and the semi-products (Sun and Ockerman, 2005). The hazard analysis was conducted by reviewing the through chain risk profile for the fresh noodles for each of the hazards identified in Table 1.

**Identification of Critical Control Points (CCPs) and establishment of control measures:** A summary of decisions taken regarding CCP determination for the fresh noodle production processing is provided in Table 1. As a result of using the HA worksheet (Table 1), the HACCP team identified six CCPs. And they are checking the raw materials, sifting powder, acid-soaking, metal-detecting, sterilization, checking semi-product (Eves and Dervisi, 2005).

Having conducted the detailed hazard analysis for the process steps, therefore, all product is subject to these control measures.

The control measures for these CCPs were:

- Certified supplier with HACCP program
- Avoiding sift net broken and checking in time
- Controlling the acid solution pH and acid-soaking time strictly
- Rejecting noodles with metal inclusions

Table 1: HACCP worksheet for hazard analysis in fresh noodle production

| Item | Hazard | Does the hazard cause foodborne illness (Y/N) | Are effective measures available to prevet, eliminate or reduce the hazard to an acceptable level? | Is the item the critical control points (CCPS) (Y/N) |
|---|---|---|---|---|
| Checking raw materials | Biological: microorganisims<br>Chemical: residual; applied (food additives and preservatives); accidental (impurities) Physical: foreign matter | Y<br>Y<br>Y | Review supplier status; review alternative suppliers;<br>Document actions taken | Y |
| Sifting powder | Biological: microorganisims<br>chemical: background<br>physical: foreign matter | N<br>N<br>Y | Checking sift net regularly | Y |
| Putting down power and mixing | Biological: microorganisims<br>chemical: background | N<br>N | | N |
| compounding dough and resting | Biological: microorganisims<br>chemical: background | N<br>N | | N |
| Sheeting and cutting strips | Biological: microorganisims<br>chemical: background<br>Physical: metal | N<br>N<br>Y | Removing unqualified products by metal-detectuib | N |
| Steaming and washing | Biological: microorganisims<br>chemical: background | N<br>N | | N |
| Acid soaking | Biological: pathogen growth<br>chemical: background | Y<br>N | PH：2.7~3.1<br>Time of acid-soaking≥36sec | Y |
| Packing and sealing | Biological: pathogen growth<br>chemical: background | Y<br>N | | N |
| Metal detecting | physical: metal inclusions | Y | Removing unqualified products by metal-detection | Y |
| Sterilization | Biological: microorganisims | Y | Temperature of sterilization ≥94°C; temperature of noodles after sterilization ≥90°C; time of sterilization ≥30min ; | Y |
| Semi-product checking | Biological: pathogen growth | Y | Removing unqualified products | Y |
| Storing | chemical: background | N | | N |

- Controlling the noodle and sterilization temperature and sterilization time strictly
- Rejecting unqualified semi-products.

The application of the remaining HACCP principles in relation to the CCPs is detailed in Table 2.

**Establishment of critical limits and monitoring procedures for each CCP:** The use of more than one monitoring technique may be necessary to assure reliable operation of the fresh noodle processing. Therefore, several methods were used in our study (Horchner *et al*., 2006; Casani *et al*., 2006). The process of checking the raw materials is a major concern. The control measure during the process is monitoring of the specification and re-detecting each item.

During the processes of acid-soaking and sterilization, acid-solution pH, acid-soaking time and sterilization time, noodle temperature, sterilization temperature should be kept constant and within a limit indicating no biological hazard in these processes. Acid-solution pH and acid-soaking time higher than those within the limit should not be applied in order to avoid affecting the taste of the fresh noodles (Table 2). Table 2 describes some examples of hazards, control parameters and measures, critical limits, corrective actions for the six identified CCPs in the fresh noodle processing line.

**Establishment of corrective actions and verification procedures:** The HACCP plan should include a set of actions to be followed when the monitoring measurements indicate that either one CCP or several CCPs are not under control in order to avoid safety hazards (Table 2). The cause of deviation should be identified in order to both choose the appropriate action and to prevent recurrence.

Verification procedures are necessary in order to ensure that the HACCP plan is functioning effectively. Taking into account the raw materials from suppliers, the specifications are suggested for verification purposed. The critical limits should be those required for fresh noodle.

## CONCLUSION

The increasing consumption of produce has resulted in increasing concern by the food industry with respect to the safety of these products. Quality assurance norm covering all the processing steps, from farm to table, have become obligatory and assume a fundamental role in process innocuousness. The HACCP system includes a series of inter-related steps, inherent to industrial food processing, including all the operations occurring from production to consumption of the food. An HACCP system should be developed

Table 2: HACCP table identifying critical control points and application of remaining HACCP principles

| CCPs | Hazard | Critical limits | Control | Monitoring frequency/ documentation |
|---|---|---|---|---|
| CCP1: Checking raw materials | Biological chemical physical | Specified tolerance for each item | Certified supplier with HACCP program | Certificates of conformance for each lot |
| CCP2: Sifting powder | Physical (metal and other foreign matter) | Sift net is good | Checking sift net | Certificates of conformance for each lot |
| CCP3: Acid-soaking | Biological (pathogen growth) | Acid solution pH of 2.7~3.1 | Acid solution pH | Record acid solution pH each 20 min |
| | | Acid-soaking time of ≥36s | Acid-soaking time | Record acid-soking time each shift |
| CCP4: Metal-detection | Physical (metal inclusions) | Free of metal matter | Compliance with product specifications | Continuous monitoring of metal matter |
| CCP5: Sterilization | Biological (pathogen growth) | Noodle temperature of ≥90°C | Noodle temperature after sterilization | Record noodle temperature each 1 hour |
| | | Sterilization temperature of≥94°C | Sterilization temperature of | Record sterilization temperature each 30 minutes |
| | | Sterilization time of≥30分钟 | Sterilization time | Record sterilization time each shift |
| CCP6: Semi-product checking | Biological (pathogen growth) | Free of unqualified products | Semi-product | Record whole semi-products |

| CCPs | Personnel responsible | Corrective action (for exceeding limits) | Verification procedures |
|---|---|---|---|
| CCP1: Checking raw materials | Receiving or designated operator | Reject as supplier | Regular review of records and supplier |
| CCP2: Sifting powder | operator | Replace the sift net; place product on hold (i.e. retain, release or destroy) | Regular review of records |
| CCP3: Acid-soaking | Acid-soaking operator | Place product on hold (i.e. retain, release or destroy); adjust pH and time according to specification | Regular review of records |
| CCP4: Metal-detection | Metal-detecting operator | Reject unqualified products | Regular review of records |
| CCP5: Sterilization | Sterilization operator | place product on hold (i.e. retain, release or destroy); adjust temperature and time according to specification | Regular review of records |
| CCP6: Semi-product checking | Operator | Reject unqualified products | Regular review of records |

for every food production line and adapted for the individual products and processes.

Now, the HACCP plans for minimally processed fresh noodles are well established and have been used successfully by processors for two years, being based on the same seven principles and risk categories common in the control of meat, poultry and fish. These principles are conducted in the following order:

- Conduct a hazard analysis
- Determine the critical control points
- Establish the critical limits
- Establish monitoring procedures
- Establish corrective actions
- Establish verification procedures
- Establish record-keeping and documentation procedures.

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