

Proceeding

International Seminar

CURRENT ISSUES AND

CHALLENGES IN FOOD SAFETY:

science - based approach for food safety management



editor:

Ratih Dewanti-Hariyadi

Lilis Nuraida

Desty Gitapratwi

Nelis Immaningsih

Purwiyatno Hariyadi



Southeast Asian Food and Agricultural Science and Technology (SEAFAST) Center
Bogor Agricultural University

**CURRENT ISSUES AND
CHALLENGES IN FOOD SAFETY**
SCIENCE-BASED APPROACH FOR FOOD SAFETY MANAGEMENT

Proceeding of The International Seminar
'Current Issues and Challenges in Food Safety:
Science-Based Approach for Food Safety Management'
Bogor, December 2-3, 2009

Organized by:

Southeast Asian Food & Agricultural Science & Technology (SEAFAST) Center
Bogor Agricultural University

International Commission on Microbiological Specifications for Foods (ICMSF)

Norman Borlaug Institute for International Agriculture
Texas A & M University

Editor:

Ratih Dewanti-Hariyadi

Lilis Nuraida

Desty Gitapradi

Nelis Immaningsih

Purwiyatno Hariyadi

Southeast Asian Food & Agricultural Science & Technology (SEAFAST) Center,
Bogor Agricultural University

2010

**CURRENT ISSUES AND CHALLENGES IN FOOD SAFETY
SCIENCE-BASED APPROACH FOR FOOD SAFETY MANAGEMENT**

Proceeding of The International Seminar
'Current Issues and Challenges in Food Safety:
Science-Based Approach for Food Safety Management'
Bogor, December 2-3, 2009

Editor

Ratih Dewanti-Hariyadi
Lilis Nuraida
Desty Gitapratwi
Nelis Immaningsih
Purwiyatno Hariyadi

Publisher

Southeast Asian Food & Agricultural Science & Technology (SEAFast) Center
Bogor Agricultural University
Bogor-Indonesia

National Library Republic of Indonesia
ISBN 978-602-96665-3-3

Acknowledgement

Thanks to Leo Wibisono Arifin, Yesica Dwi Ariesta, Amelinda Angela, Vita Ayu Puspita, Palestina Santana, Virna Berliani Putri, Zulaikhah and Nurwandi NC for preparing manuscript of this proceeding

Copyright©2010

Southeast Asian Food & Agricultural Science & Technology (SEAFast) Center,
Bogor Agricultural University
Kampus IPB Darmaga, Bogor 16680
www.seafast.ipb.ac.id

CONTENT

Preface	iii
Welcome Speech of Rector of Bogor Agricultural University.....	xi
Organizers	xv
Keynote Speech	
Cold Chain: Managing Food Safety for Fresh Produce and Frozen Food Product.....	1
<i>Derk Van Mackelenbergh</i>	
PLENARY PRESENTATION	
Microbiological Food Safety	
A Modern Approach to Food Safety Management.....	9
<i>Martin Cole</i>	
Use of Epidemiological Data for The Improvement of Food Safety ...	21
<i>Fumiko Kasuga</i>	
Implementation of Food Safety Management at Industry Level in Developing Countries: Is Gmp/Haccp Confusing?	29
<i>Ratih Dewanti-Hariyadi</i>	
Chemical Food Safety	
Controlling Allergens: Industry Perspective.....	41
<i>Soo Chuah</i>	
Food Safety Issues in Food Packaging - Aseptic Technology Approach.....	51
<i>Hari Yanto Tekno Yuwono</i>	
Science-based Approach to Food Safety	
Predictive Microbiology.....	61
<i>Tom Ross</i>	
Risk Analysis: Using Risk Assessment to Establish Risk Based Metrics	75
<i>Leon Gorris</i>	
Role of Microbiology Criteria and Limitations of Sampling.....	89
<i>Tom Ross</i>	

Safety of Food Biotechnology

- Safety of Food Biotechnology Products..... 103
James Maryanski
- Safety Assessment of Genetically Modified Food in Indonesia 111
Maggy Thenawidjaja Suhartono

TECHNICAL PRESENTATION

Managing the Safety and Quality of Fresh Produce

- Risk Assessment Of *Listeria Monocytogenes* In Raw Vegetables 121
Son Radu
- Good Agricultural Practice: A Vital Program for Ensuring
Microbial Safety of Fresh Produce..... 139
Maria Auxilia T. Siringan
- Biosafety of *Vibrio Parahaemolyticus* in Raw Salad Vegetables at
Retail and Farm Level..... 147
Tunung Robin
- The Effect of Blanching Method, Storage and Temperature to the
Characteristics of Cowpea Tempeh Substituted by 40% Soybean..... 167
Mery Tambaria Damanik Ambarita
- Microbiological Risk Assessment of Fresh Water Aquaculture
Fish in Malaysia: from Farm to Table..... 187
Rizal Damanik

Implementation of Food Safety and Quality Management at Industry Level

- Control of *Salmonella* in Nut Processing..... 199
Chaven Suchart
- Integrated Food Safety Management-Kraft Approach..... 213
Soo Chuah
- Shelf-Life Prediction of Seasoning Powder Made from Whole
Fermented Fish (*Peda*) by Using Arrhenius Method..... 221
Meta Mahendradatta
- Chemoreaction Drying and its Effect on Black Pepper Quality 235
Nur Wulandari

Application of NMR Based Metabolomics and Multivariate Data
Analysis for Quality Control of Herbal Material243
Nancy Dewi Yuliana

**Managing Food Safety and Quality in Food Services and Retail
Industries**

Managing Food Safety in Food Retail: A Lesson Learnt..... 259
Andi Nur'aida

Food Safety Management in Aerofood Angkasa Citra Sarana
(ACS) Catering Service..... 265
Hoerip Satyagraha

Formalin Contamination in Children's Street Foods at Schools in
Surakarta, Central Java, Indonesia 273
Indrias Tri Purwanti

Isolation Of *Enterobacter sakazakii* (*Cronobacter Spp*) from
Powdered Infant Formula and Other Dry Foods Obtained from
Bogor Area, Indonesia..... 281
Ratih Dewanti-Hariyadi

POSTER PRESENTATION

Inhibition of *Duku* (*Lansium domesticum*) Spoilage using Ozone.....287
Anny Yanuriati

Nutrition Properties and the Prospect of Six Amorphophallus
Species of Tubers in Java 299
Yuzammi

Gewang (*Corypha utan* lam.) as Local Food in Timor Island and
Its Nutritional Properties 307
Joko Ridho Witono

Two Stages Tea Chemical Withering during Peak Season..... 321
Dadan Rohdiana

The Physiology of Organs and Organism of *Mus Musculus*
Induced Repeatedly with Formalin-Contaminated Fish and
Chlorophyllin..... 329
Alfons Andrew Maramis

The Occurrence of <i>Pseudomonas sp</i> in Grouper Fish Fillets (<i>Plectropoma leopardus</i>) at Bone Pante.....	345
<i>Rieny Sulistijowati</i>	
HACCP Plan for Green Tea Product of PT GT and its Implementation	359
<i>Raniayu</i>	
Establishment and Implementation Sanitation Standard Operating Procedures (SSOP) in Green Tea Processing	369
<i>Ratna Handayani</i>	
Utilization of Leaves of Kunyit (<i>Curcuma domestica</i> Val.), Ruku- Ruku (<i>Ocimum gratissimum</i> . L) and Mangkokan (<i>Nothopanax</i> <i>cutellarium</i> Merr.) in Steamed Fish (<i>Rastrelliger</i> Sp) Processing.....	383
<i>Novelina</i>	
Effect Of Time-Temperature and Amylose Content of Rice on the Color and Texture of Rice-Based Emergency Canned Food.....	391
<i>Elvira Syamsir</i>	
Safety of School Children Foods in Indonesia	399
<i>Nuri Andarwulan</i>	
The Role of Women in Community Management of Biosecurity and Food Safety.....	415
<i>Eka Martiningsih</i>	

IMPLEMENTATION OF FOOD SAFETY MANAGEMENT AT INDUSTRY LEVEL IN DEVELOPING COUNTRIES: IS GMP/HACCP CONFUSING?

Ratih Dewanti-Hariyadi

SEAFAST Center and Department of Food Science and Technology
Bogor Agricultural University, Indonesia, rdewanti@uwalumni.com

ABSTRACT

Food safety management system built on a sound GMP/GHP and HACCP has been introduced and its implementation has shown to improve food quality and safety. The system is readily adopted by large industries; however, small enterprises have many difficulties in implementing food safety management.

In developing countries, in which most of the food industries are of small scale, implementation of food safety management system is still lacking. Several reasons underlying such problems were lack of infrastructures such as water, cold chain etc. and human resources. Other factors that may have interfered the implementation of GMP and especially HACCP is lack of understanding of the HACCP philosophy. In non-English speaking countries, language can be a barrier for understanding the HACCP principles. Additional constraints such as behavior or perception may also hamper the implementation of HACCP.

This paper will discuss several problems in implementing GMP/HACCP in developing country and issues regarding misconceptions and confusions that may occur during implementation of GMP and HACCP principles. Several case studies pertaining the implementation of GMP/HACCP in Indonesia will also be presented.

INTRODUCTION

Food safety has become important issues for both international trade and domestic market worldwide. A food safety management system built on a sound GMP/GHP and HACCP has been introduced and its implementation has shown to improve food quality and safety. However, the system is adopted mainly by large

industries, while small enterprises have many difficulties in implementing food safety management.

In developing countries, most of the food industries are of small scale which are using simple technology with inadequate knowledge in food safety. In Indonesia, for example, out of the 6 million units of food industry, most of them are of micro scale with less than IDR 200,000,000 assets and employs 1-4 people or small scale (IDR 200,000,000 - IDR 1,000,000,000 with 5-19 employees) (National Statistics Bureau).

GMP AND HACCP

Good Manufacturing Practices (GMP) is the foundation of food processing operation to achieve consistent quality and safety. GMP provides basic requirement that should be fulfilled to assure good practices pertaining the workers, the facility and environment, the equipment and process control. GMP is generic in nature, although it can be used to built a more customized guidance. It imposed preventive measures and its compliance can be observed visually. Documented implementation of GMP is generally manifested in the form of SSOP. In some country, GMP is mandatory.

HACCP is a preventive approach to minimize hazard in a food production. The system was built on a sound GMP as a prerequisite. HACCP is manifested in a document called a HACCP Plan. HACCP plan was developed based on the seven principles, namely: hazard analysis, determination of critical control point, critical limit, monitoring procedure, corrective action, verification procedure and documentation (Mortimer and Wallace, 2001)

IMPLEMENTATION OF FSM IN DEVELOPING COUNTRIES

Implementation of HACCP has been reported to improve assurance in food safety. However reports from many developing countries suggested that implementation is generally not smooth. Several issues concerning the implementation of GMP HACCP itself has been reported elsewhere and here are some of the issues

Industry size

Most of food industries in developing countries are of small scale that they may not meet the GMP standards. In Indonesia food industry accounts for 40% of the total industry, and it follows the general pattern of all industry (Table 1). Some of these industries arised from household activities done at home without strick task of the workers, location is mixed with household activities, may be pets etc. When this is combined with lack of infrastructures then the problems arised are even more. The problems would increase when the food produced is of high risk food.

Table 1. Number of industry in Indonesia*

Industry size	No. employee	Assets	Total number (units)
Large	>100	>Rp. 5,000,000	10,913
Medium	20-99	Rp. 1,000,000,000-5,000,000,000.	70,225
Small	5-19	Rp. 200,000,000 - 1,000,000,000	640,000
Micro	1-4	< Rp. 200,000,000	16,300,000

*)National Statistics Bureau, Republic of Indonesia

Infrastructures

Infrastructures in developing countries are common reasons for the limitation of GMP applicationies in food industry. Potable water or clean water for food handling, processing, cleaning and sanitizing is not always available. Criteria of clean water in Indonesia, for example, may not be sufficient for food processing. Big industries usually built their own water treatment unit, but smaller industry and food service establishment usually do not have easy access to potable water. In some cases, quantity of water is also a a problem in addition to the qualiy issues, especially in the case of street foods In this case, cleaning activity can become a source of contamination

Another problem in infrastructure is the lack of *cold chain* as means of transportation and or establishment. This condition has resultted in the abuse of illegal chemicals such as formalin used as preservatives, for example the case with wet noodle and fish in

Indonesia which was reported a couple of years ago. Based on our study (Dept of Food Science and Technology, 2005), the abuse rooted from a combination of poor sanitation, GMP implementation and lack of cold chain. Poor hygiene and sanitation program for the workers, equipments, facilities and lack of cold chain has resulted in products with high load of TPC and thus shorter shelf life. Lack of cold storage magnified the problems of spoilage bacterial and mold growth thus prompted some irresponsible producer to use formalin to lengthen the noodle shelf life. It was also unfortunate that the major responses for this problem was to look for “preservatives” with similar killing properties as formalin, instead of enforcing and facilitating GMP. Our study showed that implementation of GMP significantly and consistently reduce the initial microbial counts of wet noodle (Table 2).

With many SMEs, building GMP, providing potable water, cold chain or establishment may require government intervention. In Indonesia, this can not be addressed by institutions mentioned in Food Safety Management regulation (PP 28/2004) but also other institutions such as Ministry of , while enhancing the roles of those already mentioned in the PP such as local district government in providing premises that comply with GMP.

Table 2. Initial load of microorganisms in wet-noodle*

	Wet-noodle type	Total Plate Count (Log CFU/g) at producer's level		
		Small industry (no of industry)	Laboratory	Small industry applying GMP (no. trial)
1	Raw	3.65 - 5.95 (n=8)	1.6	3.69 (n=2)
2	Cooked	1 - 7.2 (n=5)	1.0	ND

*DFST, 2005; ND= not done

Language

In non-English speaking countries, language can be a barrier for understanding FSM, especially HACCP principles (Merican, 2007; Suwanrangi, 2000) While GMP components are easier to understand, HACCP introduced several terms not commonly used in local language, and sometimes no equal translation is available. In

Thailand, term like “emerging pathogens” is not recognized. In Indonesia, hazard is translated into “*bahaya*”, “*kontaminan*” or “*cemaran*” which sometimes cause confusion and led to different interpretation. It is a challenge already to comprehend and absorb all of the HACCP terms and then it became even more difficult when they are translated into the local language.

Tradition

In some instance, implementation of GMP is hampered by tradition that has been part of the life style. This is especially true when hazard does not cause immediate effect or long term and when products have been known for a long time. Examples from Indonesia include : use of borax in certain traditional chips (*gendar*) in Central Java or red illegal colorant such as Rhodamin B in certain traditional chips from West Sumatera (*kerupuk merah*) are good examples for this case. People are unwilling to give up the consumption just because they are used to consuming the products and the health hazard are not apparent. For this problem, a continuous education program with good social approach is required.

Behavior/Attitude

Food safety management system based on GMP and HACCP is design to prevent hazard to become a risk to the society. Most of the actions are prevention in nature and this could be perceived as a high cost activity for certain industry, because of “the possibility of things for not happening”. Examples include putting on cover for the light bulb, use of non food grade materials for secondary container/cover that is not thought to be in contact with food materials. To change this behavior, continuous education has to be given. In Indonesia for example, we could use to the implementation of helmet use for motor vehicle and or seat belt as references.

Financial Cost

In many cases, the burden of the GMP and HACCP implementation in SMEs is the cost. Major financial cost actually lies in GMP for implementation or the prerequisite program for HACCP. A study showed the average cost of GMP/HACCP implementation of 14 companies in Turkey is shown in Table 3.

Table 3. Average cost of GMP/HACCP implementation of 14 food industry in Turkey*

No	Cost	€	%
1	Building, ground and planning of the surrounding	12,176	42.17
2	Hygiene and sanitation	5,162	17.88
3	Insect control	3,400	11.78
4	Personal training	2,057	7.13
5	Calibration, maintenance and repairing	6,076	21.05

*Mutlu et al., 2005

CONFUSIONS COMMONLY ENCOUNTERED REGARDING GMP/HACCP

GMP and HACCP goes hand in hand as a way to assure food safety. Implementation of HACCP requires GMP to be in place thus GMP is considered as the prerequisite for HACCP implementation. Often people are so fascinated by the HACCP principles that they do not take care of the more basic need, i. e. GMP. Implementation of HACCP principles with low compliance of GMP will create many problems. When infrastructure related to GMP implementation is lacking, it is best to first assure that the requirement is met. Step by step improvement must be planned by industries and in some instances government through their regulations to assure improvement of food safety. The food-star program launched by the National Agency for Drug and Food Control (NAFDC) in Indonesia is a good approach that needs to be strengthened. However, advancing facilities and basic also needs help from other regulations/policy such as those regulating small industry (local/district institution), bank credit, etc.

It is also important to understand that GMP and HACCP should be made into “self- food safety objective”, thus all efforts are made to produce a good quality and safe products, not just because of international trade pressure. This is a phenomenon that is suggested by Franco (2009) that in developing countries there is a tendency of having double standards in which exported foods are produced with a good food safety management while foods for domestic market have not received the same enforcement. In Indonesia and many

countries in SEA, risk assessment studies have been made mainly with seafoods since this food category is the most commonly exported foods.

When food industry is implementing HACCP and is establishing a HACCP plan, it is always important to evaluate their GMP implementation and verify whether the implementation has resulted in an acceptable level of conditions. Routine environmental evaluation, for example, is one of a good example. GMP is a generic requirement. Because of the lack of understanding, frequently there are drives to establish a specific GMP manuals by government. While they may be useful, GMP needs not to be differentiated such that too much resources is spent on making the GP derivatives.

On the contrary, HACCP is product specific, even sometimes it is location or line process specific. A generic HACCP plan may be made, however in reality, this plan will not fit all sizes and types. It is not always possible to have the same control measures and thus HACCP plan when the source of raw materials is totally different even though all of the production steps are the same. Also, a HACCP plan of the same products with similar quality criteria that were produced in an industry could be different because of the difference in the technology applied on the processing of the product.

Presence of different standard SQF 200, ISO 2200 : 2005 sometimes also confused people. This is especially true because of the different terms used. ISO 22000:2005 for example, introduced the terms operational prerequisite program in addition to pre requisite program and a distinction between corrective actions and correction. Fast development of food safety management worldwide has also introduced new metrics such as food safety objectives (FSO), performance objectives (PO), performance criteria (PC) etc that are supposedly built on GMP/HACCP and not to replace it.

Because of the above reasons, HACCP implementation have some constraints too. Establishing a HACCP plan in food industries has been a challenge, often call for consultant inputs because of lack in resources and or confidence. Several questions regarding HACCP principles, especially principle 1-3, are illustrated below.

Principle 1 : Hazard analysis

Conducting hazard analysis has to consider all hazards possibly present or entering the processing steps. Therefore it is important that no ingredient or no steps are missing in the flow diagram. When assessing hazard it is very important to have the scientific data regarding presence of a certain pathogen in a certain food and whether an outbreak of the pathogen as a result of consuming the food has occurred. A lot of time it is good to know the source of the hazard, since it will dictate the control measures that may be used to overcome the problem. The first HACCP principle is a very simple risk assessment in which the team assesses what kind of risk is still acceptable. When deciding severity of illness, many scientific publications or reported objectives can be found to make the justification. Often teams are also confused when determining the likelihood to occur or justify whether certain frequency is high, medium or low. Since HACCP plan is done to achieve self-food safety objectives then what is considered low. Small, medium or high frequency should be translated into what is acceptable for the company in terms of having a low quality or possibility of releasing a defective or hazardous product.

Principle 2: Determination of CCP

Determining the CCP can be done using the decision tree, however it does not always the case. In a more simple processing steps, a CCP can be determined with common sense. Sometimes there is an assumption that the number of CCPs has to be a certain number, thus the HACCP team keeps trying to look for the certain number of CCPs even though it is not appropriate.

Principle 3

Critical limit of a CCP should be established based on scientific data obtained from reference or other guidelines (for example guidelines for commercial sterilization). However, CL determination in an industry should always be based on the materials, processing steps, environment and GMP that is implemented in the industry. Critical limits based on other company or importing country company is therefore not appropriate. In the new food safety metrics, CL can be derived from performance criterion (PC) needed to

achieve certain POs and thus FSOs. When this is done, a CL does not only contribute to a safe product but also reduction of certain illness due to the food.

ILLUSTRATION OF FSM IMPLEMENTATION IN INDONESIA

The first case study was the development of a HACCP plan in for an instant drink in a food industry. The product is manufactured through grinding of sugars, flavor and coloring. With such a low aw and high sugar content, it is concluded that there was no significant biological and chemical hazard. However, intensive grinding has been concluded as the source of physical hazard thus an instalment of metal detector. At the time that the assessment was conducted, the metal detector request is still pending at the top management level. The study suggested that top management had to have similar vision and understanding when implementing a GMP/HACCP.

Another example of study was conducted in a *nata de coco* company. Nata de coco is a popular dessert in Asian countries consisting of cubes of nata in light syrup. Nata itself is a fermented product, i.e. bacterial cellulose produced by *Acetobacter xylinum*. The general flow diagram of the nata de coco processing is shown in Figure 1. During the HACCP plan development, it is concluded that vegetative microbial pathogens are not the main concerns because of the heat treatment received. Problems that arised was mainly due to physical contaminants from equipment, environment and workers. Implementation of a HACCP plan has addressed the issues and evaluation of the implementation between September 2004 until June 2005 suggested a reduction of rejected product fom 14.43 to 5.32%, which could be translated into USD 43.000 (unpublished data in conjunction with EC-AseanEconomic Cooperation, 2005).

The third case study compared food safety management applied in two different frozen shrimp company. The study was conducted independently for a different objective at different time, but it is a good esson lerned. Company A and B both are large industries that processed frozen shrimp for export. Both companies have implemented GMP and due to the regulation in Indonesia, have also implemented HACCP plan. Company A received raw material from traders while company B received raw materials from farmer

supervised by the company. In fact, the company owned 3500 ponds located in the vicinity of the processing plant. A small study carried out in company A showed that *Salmonella* was frequently found in raw materials entering the plant. The study also showed that chlorination of product and GMP compliance only resulted in small reduction of *Salmonella* finding (Dewanti et al., 2005). Meanwhile, company B could eliminate chlorine use and still obtained a lower *Salmonella* frequency in the product. Export data of the two companies showed high disparity in terms of their export performance: company A has 20 rejection while company B got only 1 rejection between November 2004-April,2005 (www.oasis.org)

References

- Departement of Food Science and Technology (DFST) 2005. Improving Quality & Safety of Wet Noodles: approaches at producer level. Research Collaboration Report on DITP, PT ISM Bogasari Tbk. And Australian Wheat Board (in Bahasa Indonesia)
- Dewanti et al., 2005. Improving quality and asafety of seafood in PT Centra Pertiwi Bahari, Lampung. Report of Research Collaboration (in Bahasa Indonesia)
- EC-Asean Economic Cooperation. 2005. Guidelines on HACCP, GMP, Comprehensive GHP for ASEAN food SMEs. http://ec.europa.eu/food/training/haccp_en.pdf
- Franco, B. 2009. Food Safety Management Issues in Latin America. Paper presented at the COLMIC 2009 Symposium. Uruguay, October 2009
- Merican, Z. 2007. GMP and HACCP : are you confused? Paper Presented at Symposium on Current and Innovative Approaches to Microbiological Food Safety Management organized by ICMSF, ILSI-SEAR, AVA. Singapore, October 3-4, 2007
- Mortimer and Wallace. 2001. Hazard Analysis Critical Control Points. Aspen Publishing.
- Mutlu, S., Bal, T., Say, D. and Emeksiz, F. The adoption and implementation of the food quality system (HACCP) in

Mediterranean Region of Turkey. Cahiers Options
Mediterraneennes 61:201-217

Suwanrangsi, S. 2002. Experiences in the application of HACCP for Export and Local Markets: The case in Thai Fisheries. In Hanak, Boutrif, Pabre, and Pineiro (eds). Proceeding of the International Workshop. CIRAD-FAO, 11-13 December 2000, Montpellier, France.