

**DEVELOPMENT OF ISO 22000 BASED FOOD SAFETY
ASSURANCE SYSTEM FOR SRI LANKAN ORTHODOX BLACK
TEA INDUSTRY**

**BY
C. V. K. LOKUNARNGODAGE**



**Development of ISO 22000 Based Food Safety Assurance System for Sri
Lankan Orthodox Black Tea Industry**

**By
C. V. K. Lokunarngodage**

**Thesis submitted to the University of Sri Jayewardenepura for the
award of the degree of Master of Philosophy in Food Science &
Technology on 2015.**

DECLARATION

The work described in this thesis was carried out by me under the supervision of Dr. Indira Wickramasinghe, Department of Food Science & Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura and Prof. K. K. D. S. Ranaweera, Department of Food Science & Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, and a report or this has not been submitted in whole or part to any other university or any other institution for another degree.



.....
C. V. K. Lokunarangodage

Date: 29/06/2016
.....

We certify that the candidate is submitting this thesis with all corrections, additions and amendments attended in accordance with the comments and suggestions made by the examiners.



Signature

Supervisor

Dr. Indira Wickramasinghe

Senior Lecturer

Department of Food Science & Technology

Faculty of Applied Sciences

University of Sri Jayewardenepura

Gangodwila, Nugegoda,

Sri Lanka.



Signature

Supervisor

Prof. K. K. D. S. Ranaweera

Senior Lecturer

Department of Food Science & Technology

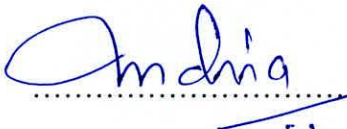
Faculty of Applied Sciences

University of Sri Jayewardenepura

Gangodwila, Nugegoda,

Sri Lanka.

We certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the University for the purpose of evaluation.



Signature

Supervisor

Dr. Indira Wickramasinghe

Senior Lecturer

Department of Food Science & Technology

Faculty of Applied Sciences

University of Sri Jayewardenepura

Gangodwila, Nugegoda,

Sri Lanka.



Signature

Supervisor

Prof. K. K. D. S. Ranaweera

Senior Lecturer

Department of Food Science & Technology

Faculty of Applied Sciences

University of Sri Jayewardenepura

Gangodwila, Nugegoda,

Sri Lanka.



*Affectionately
dedicated to my
parents,
brothers, sister,
teachers, friends
and tea
industry*

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ABBREVIATIONS

AFO	Assistant Factory Officer
BRC	British Retailer's Consortium
C – FSMS	Consultant – Food Safety Management System
CCP	Critical Control Point
CL	Checklist
COP	Cost of Production
CSR	Corporate Social Responsibility
CTC	Cut, Tear and Curl
D. Ref	Document Reference
D/GM	Director/General Manager
DF	Distribution Facilities
ED&F	Establishment Design and Facilities
ETP	Ethical Tea Partnership
F	Format/Form
FO	Factory Officer
FR	Firing Room
FSMS	Food Safety Management System
FSP	Food safety procedure
FSTL	Food Safety Team Leader
GAP	Good Agricultural Practices
GHP	Good Hygienic Practices
GI	Guide
GMP	Good Manufacturing Practices
HA	Hazard Analysis
HACCP	Hazards Analysis Critical Control Point
HI	Hazard Identification
ISO	International Standardization Organization
NCR	Nonconformity Report
O&MR	Organization and Management Responsibility
OPRP	Operation Prerequisite Programmes
P	Prevalence
PCS	Pest Control Systems
PH	Personal Hygiene
PR	Packing Room
PRP	Prerequisite Programmes
QAS	Quality Assurance Systems
RA	Risk Assessment
RBMM	Risk Based Management Model
RM	Raw Material
RP	Risk Profile/Report
RR	Rolling Room
S	Severity
SF	Storage Facilities
SR/GR	Sifting Room/Grading Room
SV	System Validation
TP	Test Procedure
TPT	Tea Polymerizer Trolley
TQM	Total Quality Management
WA	Withering Area
WI	Work Instructions

ABSTRACT

Tea is the most commonly drunk beverage in the world and the second most important drink after water. Sri Lanka accounts for 9% share of the world tea production and produces about 320 million kilograms of made tea. Sri Lanka is still the market leader for orthodox black tea. As Sri Lankan tea industry is highly export driven trade, it is necessary to satisfy demands set for statutory, regulatory, social and environmental responsibilities throughout the supply chain. Likewise, safety of food commodities including tea is a global phenomenon growing its importance everyday due to the concerns in public health and impact on global trade.

A study was carried out to identify and assess the major food safety violations occurring in manufacturing process of low grown orthodox black tea, while identifying the food safety measures satisfy ISO 22000 requirements. Stratified disproportional random sampling was used where qualitative data was weighted averaged against GMP requirements and converted in to quantitative values to be used in statistical analyses. All stakeholders in tea manufacturing process were interviewed through the gap analysis and internal audits. The impact of HACCP based FSMS on improving food safety was evaluated and new hybrid documentation system was developed. The document system developed was improved based on the audit findings and real time application in industry as a user innovation strategy where progressive changes were incorporated to the design. In addition, traceability practices and their compliances were examined, while proposing possible solutions for identified major drawbacks. The traceability was evaluated using a checklist, end product sampling, open ended interviews, observations and internal document studies. Accordingly, an extended gap was observed in tea fermentation process without proper equipment and appropriate technologies to provide better hygienic conditions and optimum environment for tea polymerization where a prototype was developed to bridge the gap. Further, information availability for adequate food safety systems was rarely available. Webpages were developed to bridge the information gap. As to the results, average compliance levels achieved in the area of GMP on the reference sample was 68.81% due to the incomplete system developments, lack of expert knowledge in the industry and also due to the inappropriate practices. The organization and management responsibility was strongly correlated with Establishment Design and Facilities while quality assurance systems became the second contributor. Further, Quality Assurance Systems had a strong to moderate correlation with all the factors. Pest Control Systems had the weakest correlation to improvement of food safety. Personal

Hygiene was not satisfactorily developed. Thus Establishment Design and Facilities were the major root cause for food hygiene problems identified, where storage facilities were also affected due to the same problem. Conditions and processing operations that were connected with the fermentation were found very unhygienic in manufacturing orthodox black tea. Thus continuous attention and top management commitment with additional capital investments were found crucial in improving design and facilities. It was also found that quality assurance systems were not adequately developed and implemented, which was the root cause for hygienic problems in tea industry. HACCP based food safety systems have enabled an environment to improve GMP tools where factories with HACCP based FSMS had better infrastructure and systematic operations with trained operators. The efficiency of processing, recording and personnel hygiene were satisfactorily improved in factories with HACCP and 5S, where 5S has played a major role in improving infrastructure and training of workers. Based on the above analyses, the generic model was developed to bridge the gaps in quality assurance, which is a user friendly customizable paper based model along with required documents and formats. The operator level documents were prepared in local language and 5S work instructions were enriched with food hygiene requirements instead of developing a new set of work instructions where harmonization, modification and adaptation were found very effective. Synchronization reduced the number of documents used in FSMS and frequency of recording to a greater extent while improving the effectiveness of recording.

Major traceability issues were first observed in leaf collection which was caused due to the involvement of smallholder growers. This was intensified in grading operations due to complexity of separation and small specific amounts produced. Bulking and blending process further extended complexity. Increased number of suppliers led to increased mixing of different made tea. In such situations, traceability up to tea bush, grading, blending and traceability of end product back to supplier were not fully complying. Nevertheless, supplier records, traceability after packaging, at dispatch and after dispatch were in full compliance. Other factors had varying degree of compliances which make the complete traceability unachievable. The development of fermentation trolley used food grade stainless steel gastronome pans on a stainless steel trolley rack with easy cleaning and added features for systematic handling. It reduced the risk of contamination while reducing heat build-up in the product for required conditions. Results revealed that temperature build-up on Tea Polymerizer Trolley, can remarkably reduce to the optimum levels than do plastic crates and tiled floor.