Research on quality control and safety management in food processing

Lele Zhang[*]

Department of Food Science and Engineering, Tianjin University of Science and Technology, Tianjin, 300457, China
[*]Corresponding author: 3110750678@qq.com

Abstract: *Quality control and safety management in food processing is an important area for ensuring the quality and consumer safety of food products. This study provides an overview of the latest research and applications conducted in this area. The studies cover food safety standards and regulations, food quality control, food process control, food safety risk assessment and management, food certification and traceability, and emerging technology applications. These studies aim to improve food production and processing processes, ensure consistency and stability of product quality, and effectively manage food safety risks.*

Keywords: *food processing, quality control, safety management, food safety, food quality*

1. Introduction

Quality control and safety management in food processing is an important part of ensuring the quality and consumer safety of food products. As the global food supply chain continues to expand and food safety awareness increases, the requirements for food quality and safety are becoming higher and higher. Therefore, it is of great theoretical and practical significance to conduct in-depth research and exploration on quality control and safety management in food processing. Food safety is a key issue in safeguarding public health and social stability. Over the past few decades, many national and international organisations have developed a range of food safety standards and regulations, such as the Hazard Analysis and Critical Control Point (HACCP) and the International Organisation for Standardization (ISO) standard for food safety management systems (ISO 22000). These standards and regulations require food producers and processors to take steps throughout the supply chain to ensure that relevant safety requirements are met at every stage of the process, from the procurement of raw materials to the delivery of finished products. The purpose of this paper is to provide an overview of the latest research and applications of quality control and safety management in food processing. We will discuss topics such as food safety standards and regulations, food quality control, food process control, food safety risk assessment and management, food certification and traceability, and the application of emerging technologies. By gaining an in-depth understanding and examining the latest advances in these areas, we can provide the food processing industry with more scientific and reliable quality control and safety management strategies to meet consumer demands for food quality and safety[1].

Food quality and safety control is to control the factors affecting food quality at all stages of food production, processing and distribution to ensure that the food can ultimately be eaten and consumed with confidence. Food quality and safety control is not only the behaviour of the government. Food processing companies, food distribution companies and food consumers should all be responsible for food safety control. Generally speaking, food quality and safety control is a social issue. In an environment where food quality problems are emerging in China, it is particularly important to explore methods of food quality and safety control.

2. Food safety standards and regulations

Food safety standards and regulations are an important basis for ensuring the safety of food products. National and international organisations have developed a range of food safety standards and regulations designed to regulate quality control and safety management in the production and processing of food products. Among these, Hazard Analysis and Critical Control Point (HACCP) and

ISO 22000 are widely used standards for food safety management systems.

HACCP is a system based on risk assessment and control to ensure food safety by identifying and controlling critical control points in the production process. HACCP requires food producers to conduct hazard analysis, identify critical control points, develop monitoring measures and establish corrective actions to prevent and control factors that may pose a risk to food safety.

ISO 22000 is an international standard that provides a framework for food supply chain management. It emphasises the comprehensive and systematic nature of food safety management and requires organisations to establish food safety policies, conduct hazard analysis, develop controls, and conduct internal and external audits and assessments.

In addition, food labelling regulations are one of the key regulations to ensure food safety. Labelling regulations require food producers to provide accurate and comprehensive information on product labels, including ingredients, nutritional information, allergens and instructions for use, to help consumers make informed choices and avoid food-related risks.

3. Food quality control

Food quality control is a key aspect of ensuring that food products meet the expected quality standards. Traditional quality control methods rely on the experience of quality control personnel and manual testing methods, but such methods suffer from subjectivity and unreliability. In recent years, with the development of technology, new analytical methods and techniques have been widely used for food quality control.

Spectroscopy is a commonly used non-destructive analytical method to detect food composition and quality indicators through the absorption, scattering and emission properties of light. Techniques such as infrared, ultraviolet and near-infrared spectroscopy are widely used in food quality control, enabling real-time and rapid analysis of food samples.

Chemical sensors are another important technology for detecting and measuring composition and quality parameters in food samples by interacting with specific chemicals. Gas sensors, electrochemical sensors and biosensors are all used in food quality control to improve the accuracy and efficiency of detection[2-3].

In addition, image processing technology is also widely used in food quality control. Digital image processing and computer vision techniques enable automatic detection and analysis of features such as food appearance, colour, size and shape, increasing the speed and consistency of inspection.

4. Food process control

Food process control is a key component in ensuring quality stability and consistency in the production and processing of food products. By monitoring and controlling key parameters such as temperature, humidity, pH and time, quality variation in the production process can be reduced and the quality of the final product can be ensured to the desired standard.

Sensor technology plays an important role in food process control. Temperature sensors, humidity sensors and pressure sensors are able to monitor key parameters in food processing in real time, providing feedback to help adjust and control processing conditions and ensure consistent quality.

Process modelling and simulation techniques allow for the simulation and optimisation of food processing processes. By building mathematical models, the effects of different parameters on food quality can be predicted and optimised and optimal processing conditions can be found.

Feedback control systems are an important means of achieving automated control. By connecting the sensors to the controller, the parameters of the process are monitored and adjusted in real time to ensure the stability of the product quality.

Food process control also involves statistical quality control methods such as Six Sigma and quality management tools (e.g. scatter diagrams, control charts and histograms). These methods allow the analysis and monitoring of quality variation in the production process and the timely identification and correction of problems.

In the face of the problem of inconsistent food quality inspection standards in China, it is

recommended that government departments strengthen the enforcement of laws and regulations related to food quality and safety. Firstly, government departments should carry out a comprehensive survey, uniformly stipulate the quality standards of similar foods in each region, and formulate relevant laws to fill the gaps in quality and safety inspection. Secondly, in the face of the misconduct of the food quality inspection department, the negligence of the quality inspectors should be severely criticised in conjunction with the relevant laws, so that the quality inspectors will be aware of the importance of their work; thirdly, the legal effect and enforcement should be improved, so that the food processors that do not comply with the quality inspection standards or the food suppliers that do not comply with the quality standards should be punished in accordance with the relevant laws and regulations and the amount of the fines be increased. In serious cases, enterprises may be prosecuted or processing plants may be seized. The opportunity to "criticise" and "order rectification" of the food processing industry has been removed, and irresponsible behaviour of the food processing industry and related industries is firmly not tolerated.

5. Food safety risk assessment and management

Food safety risk assessment and management is an important tool to ensure food safety. Various potential food safety risks exist in food processing, such as microbial contamination, chemical residues and food fraud. By identifying, assessing and managing these potential risks, appropriate preventive measures can be taken to reduce the probability of food safety risks.

Food safety risk assessment is the assessment of potential hazards associated with food through scientific methods. It involves steps such as hazard identification, hazard characterisation, exposure assessment and risk assessment. By taking into account the potential of the hazards and the actual exposure of food consumers, the level and priority of food safety risks can be determined.

Food safety risk management is the development and implementation of appropriate management measures based on assessment. It includes the development of risk prevention, monitoring and control measures, as well as the establishment of food safety management systems and emergency response mechanisms. Food producers and processors should follow food safety standards and regulations, develop appropriate operating procedures, and conduct regular internal audits and external certification to ensure that food safety risks are effectively managed and controlled.

Small and medium-sized food processing enterprises and related enterprises (food packaging, food transport) are unable to ensure food quality. Most of the reasons are that these enterprises have limited capital and use manual production and processing. Not only can they not scientifically control the quality of their products, but they also cause man-made food quality problems. Therefore, encouraging SMEs to replace poorly controllable labour with advanced technology is a basic means of controlling food quality and safety in food production and processing. To help SMEs get out of financial difficulties, government departments can grant appropriate tax exemptions and reductions to SMEs that actively use advanced food processing machinery and technology, or cooperate with other social organisations, such as universities and scientific research departments. Small and medium-sized food processing and packaging producers are provided with appropriate technical support and guidance. Public interest organisations can conduct food quality and safety seminars and public interest activities, inviting SMEs to participate, to promote the benefits of using advanced production technologies to improve product quality, and to promote the reform of production and processing operations by those in charge of SMEs to ensure food quality and safety.

6. Food certification and traceability and emerging technology applications

Food certification and traceability is an important means of ensuring the quality and safety of food. Food certification is the confirmation that food producers and processors meet specific quality standards and regulatory requirements through audit and certification by an independent third party. Common food certification systems include ISO 9001 (quality management system certification), ISO 14001 (environmental management system certification) and FSSC 22000 (food safety management system certification).

Food traceability refers to the recording and tracking of information on the entire process of food production and processing in order to achieve traceability of food sources, processing flows and distribution channels. Through the traceability system, affected food batches can be tracked and retraced in a timely manner so that quick action can be taken to reduce exposure to food safety

incidents[4-5].

In food processing, the application of emerging technologies also offers new opportunities for quality control and safety management. For example, analytics based on big data and artificial intelligence can help monitor the food supply chain, identify abnormalities in a timely manner and perform predictive analysis. New technologies such as gene editing and nanotechnology are also playing an important role in food quality improvement and safety control.

In many cases, food problems do not arise from a single cause. Problems can occur at all stages of food production and distribution, from the time it rolls off the production line to the time it appears on a family's table. One food additive is harmful to the human body, and the resulting chain reaction may threaten the health of tens of thousands of people. Therefore, it is very important to establish an early warning mechanism for food quality and safety. The establishment of such an early warning mechanism is not a large-scale action by the Government, but a stringent quality inspection from the production, procurement, processing, packaging, transport and sale of food raw materials, and stringent quality checks at all stages of the food supply. Chains should be established. Linkage and Resonance. For example, supermarkets should conduct comprehensive data collection on food sources. Once a customer responds to a food quality problem at a supermarket, the supermarket should immediately identify the cause of the quality problem and provide early warning to other links in the supply chain to avoid further problems. Food products with quality problems in the market. Establishing an early warning mechanism for food quality and safety is a long-term and arduous task. With the progress of food quality and safety control, it is believed that this mechanism will become more and more perfect and eventually become the most effective means of control.

7. Conclusion

Quality control and safety management in food processing are essential to protect the health and rights of consumers. This paper reviews the latest research and applications in the key areas of food safety standards and regulations, food quality control, food process control, food safety risk assessment and management, food certification and traceability, and the application of emerging technologies. Quality control and safety management in food processing is a complex and important task. Only through the development of scientific standards and regulations, the adoption of advanced technologies and methods, and the strengthening of monitoring and management can the quality and safety of food products be guaranteed, consumer demand and trust in food products be met, and the sustainable development of the food industry be promoted.

China's current food quality and safety control is constrained by the food safety quality control system and the production technology of food processing and related enterprises. In order to strengthen food quality and safety control, safeguard people's dietary safety, and promote the growth of economic benefits in the food industry, it is recommended that the government strengthen food safety supervision and enforcement.

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