

The Food Technologist in the Food Industry - Role in Ensuring Food Safety

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Food Technologist

Introduction

Virtually every food item you see on the shelves of retail shops and supermarkets in the country would have had some input from a food technologist during its development. This article will elaborate on the role of the food technologist in the food processing industry in ensuring food safety. Who is a food technologist? A food technologist is one who uses science and engineering to develop, process and package safe, nutritious, wholesome and appealing food products.

Food technologists are basically scientists who are formally trained particularly in food chemistry, food microbiology and food engineering. Their knowledge of food chemistry and toxicology enables them to ensure the elimination of dangers of contaminants of environmental or process induced contamination while their knowledge of food microbiology and food processing enables them to prevent the occurrence of pathogens and microbial toxins in the food. In addition, they have also gained knowledge in food analysis, biochemistry, nutrition, marketing, economics and food packaging. However, all this knowledge is inadequate if they do not have a thorough understanding of the standards and regulations that govern the manufacture of food in the country. These regulations have been formulated mainly to ensure the consumer gets a safe food product. Hence, the raw materials used, especially the choice of food additives, the process technology adopted, the packaging material utilized and the storage conditions employed should be such that finally the product on the shelf is safe throughout its recommended storage life. A good food technologist would have a thorough knowledge of the potential risks to the consumer and would take adequate precautions to prevent them occurring throughout the food chain.

The food safety management system ISO 22000, introduced internationally in September 2005, covers all aspects of the safety of a food from production to consumption. The food company's food technologist plays a key role in the implementation of ISO 22000 by the firm as this system incorporates the development and implementation of a HACCP (Hazard Analysis and Critical Control Point) Plan. HACCP Plans cannot be established without a thorough knowledge of food technology.

Safety of Raw Materials Used in the Food Industry

The safety of raw materials used in the food industry depends on three main aspects - the use of uncontaminated ingredients, safe food additives and food grade packaging material.

The raw material used could contribute to hazards. They could be biological hazards like microorganisms present in the raw material itself, chemical hazards like naturally present toxins, agricultural chemical residues (insecticides, fungicides, fertilizers), pesticide residues, chemicals coming from animal feed, environmental pollutants and also physical hazards like metal contaminants, insects, stones, dirt and other foreign objects in the raw material. The food technologist would have to study all aspects of the incoming raw material prior to preparing the HACCP Plan to control such hazards.

Another major aspect contributing to the safety of a processed food product is the use of food additives. The need to extend the shelf life of a food product while retaining its appearance throughout has led to the use of food additives like preservatives, colouring substances, flavouring substances, emulsifiers and stabilizers, antioxidants, sweeteners in processed food products. Incorporation of these food additives, though only in small quantities, is strictly controlled by law and should be declared on the label of the food product. The industrial food technologist should have a sound knowledge of the permitted food additives, conditions of usage and their maximum permitted limits which vary according to the food product. Use of excess food additives could lead to the manufacture of unsafe food products for the consumer. It is the direct responsibility of the company's food technologist to ensure the correct use of food additives. He should not have to be brought to task by a Food Inspector implementing the country's food regulations which could even result in a court case.

The safety of a processed food product also depends on the safety of the food packaging material used. Formerly, the major food packaging materials used were paper, inert glass and metal cans. The use of appropriate lacquers as metal can liners is important and food lacquers appropriate for the product are chosen by the food technologist in consultation with the can manufacturer. However, a wide variety of plastics are now used in food-contact applications and it is important that such plastics do not affect the food with which they come in contact. Given the obvious importance of producing safe and wholesome food, with adequate shelf life, it is not surprising that the food industry is heavily regulated. One issue in the safety of food packaging is the potential migration of compounding ingredients, monomers or additives from plastics into food. In general, food diffuses into plastic packaging, enhancing the migration of unreacted monomers and potentially mobile additives from the plastic into the food.

The objective of food packaging legislation is to protect the consumer by controlling the contamination of food by chemicals transferred from the packaging. Standard migration tests are available based on prescribed food simulants; these tests include overall migration testing and specific migration tests (for individual chemical substances). The gradual development of lower detection limits for analytical methods has shown that many substances previously not considered as indirect food additives do actually migrate into food. The food technologist should keep abreast of these developments and ensure that the plastic materials used in food contact materials (including inks and adhesives used in laminates) are food grade and safe.

Safety of Process Technology adopted by the Food Industry

All food companies should follow Good Manufacturing Practices (GMP), including Good Hygienic Practices (GHP), to ensure the manufacture of a safe food product, even if they do not set up HACCP systems or obtain ISO 22000 certification.

The right type of raw material need not necessarily give good quality finished products unless optimum processing conditions are used. The quality of products can be improved by adjusting the processing conditions depending on the quality of raw material available. This needs a thorough knowledge and understanding of the function and role of the different ingredients used in food products and their influence on different processing conditions and the quality of the finished products.

The food technologist should study the steps in the manufacturing process that lead to contamination by or survival or destruction, inhibition or growth of food borne disease causing or spoilage microorganisms (handling, heating, drying, chilling, freezing, fermenting, curing) and make an assessment of the hazards involved. The risk and severity of the hazards should be taken into account in a particular production process. Preventive measures such as hygienic design of food handling areas, hygienic design of equipment, establishment of an effective cleaning and disinfection procedure, pest control systems and ensuring the health and hygiene of the personnel should be established. Prevention of cross contamination and separation of raw and cooked material are also important in ensuring a safe end product. Heavy metal contamination could occur from poorly maintained equipment.

Maintenance of strict process control is necessary. A slight variation in process conditions *e.g.* temperature, may greatly harm the quality as well as the safety of the product. For example, consider the heat processing of low acid canned foods which allow the growth of and toxin formation by *Clostridium botulinum*. These thermal processes have been designed in such a way so that the remaining risk was in the

order of 10^{-12} , which is acceptable, such a process being known as a 12D process. These thermal processes have to be evaluated by qualified food technologists with practical experience in conducting heat penetration studies and thermal process evaluation to ensure the safety of the final product. Another example is raw milk which is subjected to a combination of time and temperature during pasteurization that will destroy those vegetative microorganisms often present in raw milk that cause food borne diseases. This pasteurization process cannot be depended upon to eliminate all microbial toxins or enzymes, bacterial spores or any chemical residues or contaminants such as antibiotics, pesticides and toxic metals. Other precautions should be taken to eliminate such hazards.

Calibration and maintenance of equipment used for testing, measuring and inspection is another area of responsibility of the food technologist.

Safety of Finished Products, Storage and Distribution

There are safety standards prescribed for most food products which have restrictions on pesticide residues, limits on food additives, contaminants, chemical and microbiological parameters and specific packaging requirements to ensure the safety of the final food product. These would be incorporated in a good quality assurance scheme set up by a food technologist so that final product testing to ensure good quality, safe products would be just a formality.

If transport, storage and distribution are not controlled, the safety of the food product reaching the consumer decreases. Pest control programmes should be installed, where applicable, in storage areas. Storage conditions should be such as to prevent contamination of the food product and microbial growth. Dried products should be packaged in materials that prevent the ingress of moisture and stored to prevent moisture pick up. The temperature of storage and distribution of frozen food products such as comminuted meat products, frozen prawns and ice cream maintained at $-18\text{ }^{\circ}\text{C}$ throughout to ensure a safe product to the consumer, while chilled foods should always be maintained at below $10\text{ }^{\circ}\text{C}$, except certain "sensitive" items which require a storage temperature below $4\text{ }^{\circ}\text{C}$.

Quality Assurance Programmes set up by food technologists would incorporate transport sanitation involving cleaning and disinfection of vehicles and pest control in addition to proper control of temperature and even relative humidity, if necessary.

New Product Development

When a food company wishes to develop a new food product, a team involving marketing, R&D, market research, operations, packaging, quality assurance, finance and the advertising agency studies various product concepts. The chosen concept, well defined by a screening process to the point where

specific product attributes (form, flavours, colours, functional characteristics, packaging, formulation constraints) are identified, is communicated to the product developer, the food technologist. The product should be formulated and processed to be physically, functionally and microbiologically stable over the prescribed shelf life period. Using his knowledge of the influence of factors such as pH, water activity, temperature, preservatives on the microflora that could grow in the product and the important interactions between these factors the food technologist, while developing a product, skillfully selects ingredients and processes. This choice is to prevent microbial spoilage, in particular contamination by pathogens and toxins; comply with national standards and regulations; accommodate typical deviations in raw materials and processing conditions; withstand typical distribution and handling stresses (jostling in trucks, warehouse storage temperatures) and tolerate major deviations in preparing instructions. Numerous products that have failed in the market place would never have been marketed if the expertise of a qualified and experienced food technologist had been obtained in product development.

After the developed product has successfully completed the in-house sensory testing of the bench prototypes, it is scaled up on pilot plant equipment which closely simulates commercial production machinery. Potential production problems as well as special equipment needs are identified and these problems are passed on to the process engineer who will have the task of optimizing processes and designing and selecting equipment to accommodate the new product. The HACCP approach is considered throughout the development process.

A food technologist in the industry also works on newly discovered ingredients to invent new formulations, modify foods, conduct experiments, produce sample products, design processes and machinery for making products in large quantities.

Employment of Food Technologists in Sri Lankan Food Industry

Prior to the early nineteen seventies, there were only a few qualified food technologists in Sri Lanka who had qualified abroad and were employed by government organizations. The private food processing industries which were starting up in the country, depended on graduates in basic sciences to handle their technical functions. Taught courses in Food Science and Technology began in the Sri Lankan universities in the late nineteen sixties, initially at post graduate level, then as specialisations of the Agricultural degrees and finally as basic degrees in Food Science and Technology at undergraduate level. These persons graduating as qualified food technologists were often

academically oriented but soon picked up practical aspects when employed by the food processing industries where they could put their theoretical knowledge into practical applications.

Now the managements of the Sri Lankan food processing industries have realized the importance of employing qualified food technologists to handle their technical functions and there is a good employment potential for such graduates. The need for development of HACCP plans in their quality assurance systems has been a major criteria which has come into play when employing a qualified food technologist to handle technical functions in a food processing industry.

A food technologist with a multidisciplinary approach to technical problems can upgrade any food processing industry by way of trouble shooting, new product development, product diversification, setting up improved quality assurance systems etc, all aspects which ensure that the company produces safe food for the consumer.

Complying with the latest food quality management system ISO 22000 ensures that the company produces a safe food which has been evaluated throughout the food chain. A qualified food technologist has to be a key member of the team to set up the ISO 22000 system in the company as this system incorporates the principles of HACCP for food hygiene which can only be set up with a thorough knowledge of food technology. The flow diagram of the actual production process has to be studied thoroughly to analyse and identify the potential hazards (physical, chemical and biological) and the HACCP plan drawn up to prevent the hazards occurring by effective control measures and to designate Critical Control Points. None of this can be done without the input of a qualified food technologist along with the production and engineering personnel.

The safety of the materials used, including food additives and packaging materials, the safety of the process technology (temperatures, levels of food additives etc) and ensuring that the quality assurance system set up is adhered to throughout production, storage, transport distribution up to point of sale is the responsibility of the food technologist. Often the top management, though fully supporting the food safety management system installed, is not technically qualified and depends fully on the food technologist for all technical decisions. A wrong decision could mean that the product spoils prior to the date of expiry, leading to a bad name for the company and even closure of the company, incurring heavy financial loss. Thus the food technologist in the food processing industry plays a very important role in ensuring the safety of the food produced by the company.

Graduateship (25th Batch Passing out) Silver Jubilee Commemoration Fund

In order to celebrate the passing out of the silver jubilee batch of Graduate Chemists in 2008, various events have been organized by the College of Chemical Sciences in 2007 & 2008. A silver jubilee raffle was launched last year to cover the expenses and also to form the nucleus of a fund to provide more scholarships and bursaries. In response to our appeal very generous contributions were made and assistance was rendered by a majority of students, lecturers, former students, members of staff and other well wishers. A handsome donation of USD 1000 made by former student Mr. A. Sirilal A. Gunasekera (CEO, Tautomer Chemicals Pvt. Ltd.) for the raffle fund is especially acknowledged with thanks.

Using the annual income of the fund, it will be possible to provide financial assistance for some of the activities of the student association and also provide more scholarships, prizes, and bursaries. As a first step, the third prize on the overall results and one of the three Best Performer Prizes for Practical Chemistry at the Graduateship examination 2007, were awarded in memory of the late Professor R S Ramakrishna, at the 2008 convocation. We take this opportunity to gratefully thank all those who cooperated by purchasing and selling raffle tickets, contributing in cash and giving donations in kind for the prizes.

Inter-University Debating Competition

This is one of the important events organized in order to commemorate the Silver Jubilee of the Graduateship programme, scheduled for later in the year at Adamantane House, Rajagiriya. Teams from several universities & our College are expected to participate. The topics for the debate are based on Chemistry and its applications to social and economic development.

Membership News

The following persons have been either transferred or admitted to the categories of membership and designations from January - May 2008.

Transfer to Fellow

Dr. R D Guneratne

Transfer to Member

Mrs. K P Y N Karunaratne

Admission to Associate

Mrs. P D S Perera

Admission to Licentiate

Ms. R P Navaratne

Ms. P M U D K Pethiyagoda

Ms. I L M Wickramasinghe

Ms. N D Herath

Ms. R P Withange

Obituary

Noel Jayatunge, B.Sc. Special (Lond), F.I.Chem.C.,
Born 1915 Died 2008

Mr. Jayatunge was appointed Assistant Analyst by the Governor on July, 1938. He with Mr. S Ramanathan were the first Ceylonese to be appointed directly to the Staff Grade in the Government Analyst Department. In August 1952, he left to the United Kingdom on a Colombo Plan Scholarship and worked in the Public Analyst Laboratory and other Institutions such as Government Chemists Laboratory, London. While in UK he sat the Branch E examination of the Royal Institute of Chemistry UK. This is a professional examination required by the Public Analysts for their reports issued under various Ordinances to be accepted by courts. He returned in August 1954 and worked mainly in the Food and Drugs Division. He was appointed Government Analyst in 1968 and he retired on February 28, 1974. He was a member of the Chemical Society and then the Institute of Chemistry. He served on the Admissions and Ethical Practices Committee for a number of years. Mr. Jayatunge died on March 20, 2008 and the funeral was a private family event.

Australian National Chemistry Quiz - Award Ceremony 2007

The 11th Award ceremony of the Australian National Chemistry Quiz conducted by the Royal Australian Chemical Institute was held on the 25th of April 2008 at Adamantane House. The Chief Guest on this occasion was Mr. T Kandasamy, Retired Government Analyst.

11795 students in year 11 (Junior Divisions) and 9118 students in year 12 (Senior Division) from 135 and 138 schools respectively took part in the competition. The examination was held in 42 centers located in all districts in Sri Lanka. In the Senior Division, Ms Sameera Jayarathna of Devi Balika Vidyalaya, answered all questions correctly. She was awarded the full scholarship to enroll for the Graduateship programme in Chemistry (2009/13).

The following students were presented with plaques & certificates awarded by the RACI & prizes offered by the Institute of Chemistry Ceylon.

Results *Senior Division*

Best Performers

Sameera Jayarathna (Devi Balika Vidyalaya, Colombo)

Second Best Performers

Himeshi de Silva (Visaka Vidyalaya, Colombo), Udari Samarasiri (Visakha Vidyalaya, Colombo), Udayanga Kaluwila (Central College, Anuradhapura), Sameera Ramasinghe (Rahula College, Matara), Meth Bandara (Trinity College, Kandy)

Third Best Performers

Pasindu Aluthwala (Ananda College, Colombo), Shehara Ariyaratne (Visakha Vidyalaya, Colombo), Amita Arudpragasam (Colombo International School), Samanthika Gunarathne (St. Bridget's Convent, Colombo), Danekka Loganathan (St. Bridget's Convent, Colombo), Heshani Odara Niyagama Gamage (Southlands College, Galle), Tharindu Eranga Premasiri (Richmond College, Galle), Dhanuska Ranasinghe (Trinity College, Kandy)

Junior Division

Best Performers

Janaka Bandara (Maliyadeva Boys College, Kurunegala), Heshan Rajapaksha (Maliyadeva Boys College, Kurunegala), Avinash Sooriyarachchi (Nalanda College, Colombo), Jiwon Yun (Colombo International School)

Second Best Performers

Haresh Kalsara Abeyasekara (Central College, Anuradhapura), Priyanka Anusha (Ferguson High School, Ratnapura), Dinesh Bandara (Maliyadeva Boys College, Kurunegala), Manthila Jayakody (Maliyadeva Boys College, Kurunegala), Chinthaka Rathnayake (Maliyadeva Boys College, Kurunegala), Lathika Senanayake (Maliyadeva Boys' College, Kurunegala), Buddhika Senevirathne (Maliyadeva Boys College, Kurunegala), Chathumal Perera (Trinity College, Kandy), Chathuska Rambukwella (Trinity College, Kandy), Sarith Ruwan Bandara (Trinity College, Kandy), Wasana Ranaweera (Southlands College, Galle), Dasuni Pathirana (Visaka Vidyalaya, Colombo), Mihira Kasun (D S Senanayake College, Colombo), Sachith Senevirathne (Ananda College, Colombo)

Third Best Performers

Sachini Abeyratne (Visaka Vidyalaya, Colombo), Sachithra Dinukshi (Sirimavo Bandaranayake Vidyalaya, Colombo), Isuru Fernando (St. Sebastian's College, Moratuwa), Rajith Gunnehewage (Royal College, Colombo), Savithru Jayasinghe (Royal College, Colombo), Nuwan Kuruwita (Royal College, Colombo), Haritha Wickremasinghe (Royal College, Colombo), Lakshan Dassanayake (Maliyadeva Boys' College, Kurunegala), Kavinda Ekanayake (Maliyadeva Boys' College, Kurunegala), Rasika Bandara (Maliyadeva Boys' College, Kurunegala), Hasantha Malavipathirana (Sujatha Balika V, Matara), Pamod Banjitha Muhandiramlage (Mahinda College, Galle), Oshini Wilfred (Maliyadeva Balika M V., Kurunegala), Dinusha Samaliarachchi (Ananda College, Colombo), Rivindu Weerasekara (Ananda College, Colombo), Seniru Welgama (Ananda College, Colombo), Arun Rajaratnam (Trinity College, Kandy), Nisal Bandaranayake (Trinity College, Kandy)