

Quality Control of Food Products

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The history of the control of the quality of food can be traced far back to the early days of food production. From those early days, the manufacturer of food did assess the quality of food and attempted to maintain a high standard. In the ancient past, parameters of quality used to be measured on the basis of sensory evaluation i.e. by vision, taste, smell, touch, etc., and with the improvement of technology, instrumental measurement came in gradually. However, it is only in the recent past that quality control has been considered as a complete science by itself where a scientific approach has been made to exercise the control of quality.

In Sri Lanka, quality control of food is a neglected area. Except in a handful of industries, we still exercise the ancient methods of quality control restricted to sensory judgement of end-products. Scientific approach involving statistical methods of collecting data and interpretation of results are not being utilised sufficiently in our food industries. In order to achieve consumer satisfaction in quality in food, the subject of controlling of quality has to be considered as a distinct discipline and much more importance has to be given to this section of science. The management and workers in all food industries must realise that quality control is an important tool in gaining consumer-confidence in the products manufactured by them.

Quality Control — What is it?

When you talk of quality you always think of the consumer and his needs. In other words, the consumer is the ultimate decision-maker of quality. Quality in general is the sum total of all characteristics of a product as looked upon by the consumer.

The characteristics of a food item that reflects acceptability to the consumer are two-fold. The first category covers sensory characteristics such as appearance, taste and smell. The second category consists of hidden attributes which cannot be judged by sensory evaluation. These constitute the characteristics which if measured indicate wholesomeness or adulteration and harmfulness in a food.

The food manufacturer's aim should be to produce food which is easily marketable, and it is his task to see that his products are continuously bought by the consumers. For this reason he must be mindful of both categories of quality attributes mentioned above. He must give products which satisfy the senses of the buyer, but in the long run he must guarantee the wholesomeness and the purity of the product. If these two categories of attributes are looked after and the quality levels are maintained on both these categories then he could be satisfied that the consumers' needs have been met.

How to exercise Quality Control in Food. Measurement of Quality

The food manufacturer must keep in mind the quality required by the consumer and then build up the quality required at every stage of manufacture including the basic raw material.

Many industrialists of food in Sri Lanka tend to believe that it is the end product that should be examined for quality. But this is totally a wrong conception. Quality is something that has to be built into the product through every stage of production. This being the case, quality control has to be applied from the initial stages of processing.

Many functions are involved in the implementation of quality control. These functions are briefly discussed below:

- (a) Establishment of Standards Specifications— After thoroughly studying customers' requirements, production capacities and the cost factors, standards have to be laid down for raw materials, semi-finished products, finished products, methods of processing and practices to be followed.

Material standards must cover all characteristics that are directly or indirectly required to satisfy the consumer. These include all the necessary organoleptic requirements such as appearance, (even presence of insects, extraneous matter, etc.) colour, texture, odour and taste, etc. The requirements of these could be of a descriptive nature such as "characteristic odour of cardamoms" in the case of cardamom oil or can be of a reference type model nature, where reference is made to match with a type specimen, such as the colour of a reference sample in the case of tomato sauce. These organoleptic parameters should as much as possible be clearly defined to prevent ambiguity.

Given below are some important parameters for different groups of food items:

Fruits and Vegetables:

The emphasis on attributes differ very much depending on the end use. The important ones are wholesomeness, firmness, colour in different regions, odour and size and also the number of units per given mass.

Fruit Juices, etc:

Appearance, foreign matter, colour, physical stability, freedom from extraneous particles and flavour.

Cereals and Cereal Products:

Soundness, cleanliness, purity of the type, defectives such as damaged, shrunken and broken ones, dryness, size and hardness.

Meat and Meat Products, Marine Products:

Colour, odour, texture, flavour in the case of cooked ones, size and mass depending on the product and grade, number of pieces per given weight, type of cut, quantity of bone, shell etc., cleanliness.

Dairy Products:

Here the sensory attributes do not play a major role as those of composition and microbial—sanitary control are the decisive factors.

Spices and Condiments:

Flavour, colour, appearance, foreign matter, size, wholeness, insect and moulds.

Fats and Oils:

Colour, flavour, stability, consistency, clarity, viscosity and hardness.

Confectionery:

Odour, palatability, hardness, taste, consistency, insects and moulds.

Essential Oils:

Flavour and odour, colour and clarity.

The second important thing in a material standard is the hidden attributes which are characteristic of the product. These are parameters such as acidity, total solids, ash, protein, crude fibre, volatile matter, moisture, carbonations, fat content, and so on. These are the parameters from which the authenticity of the product can be ascertained.

The significant ones are listed below:

Fruits and Vegetables:

Bulk density, moisture, water insoluble solids, alcohol insoluble solids, soluble solids, acidity, crude fibre, juice extraction, salt, sugar, oil content, preservatives.

Fruit Juices, etc.:

Brix, acidity, sugar, viscosity, size of particles, titratable acidity, vitamins and minerals.

Cereals and Cereal Products:

Ash, acid insoluble ash, protein, wet-gluten, moisture and performance properties.

Meat and Meat Products, Marine Products:

Moisture, fat, protein, nitrites and nitrates, chlorides, pH, ash, sulphides and performance testing.

Dairy Products:

Moisture, fat, protein, casein, ash, milk solids (not fat), total solids, specific gravity, titratable acidity, lactose, viscosity, salt, phosphorus and chlorides.

Spices and Condiments:

Moisture, volatile oil, ash, acid soluble ash, starch, crude fibre, alcohol extract and filth.

Fats and Oils:

Refractive index, colour, melting point, solid fat index, free fatty acids, peroxide value, iodine value, monoglycerides, stability, smoke point, salt, and performance testing.

Confectionery:

Stability, sugar, preservatives, starch, milk and fat.

There are also some other parameters by which presence of certain substances which are injurious to consumers, could be judged. Some of these are the harmful elements like arsenic, copper, cadmium, mercury, zinc, heavy metals, and even pesticide residues in certain foods. Freshness in certain foods and freedom from spoilage are some of the primary characteristics the consumer looks for when he purchases a food item. A product can be spoiled at the raw material stage or it can get contaminated with harmful micro-organisms during any stage of processing. Whatever the cause may be, it is the manufacturer's responsibility to draw up standards to limit micro-organisms in order to have control on the extent of spoilage. Some of the common parameters are total plate count, viable count, E. Coli, Staphylococcus, Salmonella, Cl. perfringens, mould, etc. Material standards are not only required for the toxic product, but are also required for the items which get added to the basic product at some stage or the other. Even packing material has to be specified sufficiently. Standards for machinery and tools are also very important.

We have briefly discussed the type of material requirements for food under production. Specifications only for the product will not complete the necessary standards for a processing unit. During the course of production, various functions are involved and many practices are followed. Therefore, it is necessary that the methods for every stage of production should be well defined. Otherwise, if ambiguities arise it could finally end in an altogether different product in any manufacturing unit and specially in food industries—certain good practices have to be followed during the course of production. These practices are not only for the convenience and safety of the workers but are also important from the point of view of maintaining favourable conditions to arrive at a satisfactory product at the end of production. These are the handling, transporting, and other practices in a food industry. Most important is the hygiene. If this deteriorates it may lead to a situation where the entire factory may have to be closed down. Hygiene is very important for any

food factory and in many countries there is legislation to ensure that good hygienic practices are followed. Codes of practices have to be laid down for these. Standards are also required for methods of packing. Producing a very good quality food but with neglected packing will result in a complete loss to the manufacturer. This is a very sensitive line as far as the consumer is concerned. Packing is equally important as production, in the case of food.

Standards for marking are necessary and important because the consumer will be fully guided by the label which appears on the food item. Even in Sri Lanka there is legislation which makes it obligatory for any manufacturer of a food article to declare certain important factors to the consumer.

Standards established will not be complete if the other functions such as management procedures, codes of practice for workers, warehousing, sales, budgeting, inventory and other fields of this nature are neglected.

While setting up standards one has to take into consideration the regulations prevailing in the country and also those prevailing in other countries, if such food items are to be exported. In Sri Lanka, the saleable foods are covered by the Food and Drugs Act and the Regulations framed under this Act. For exports, certain food products are subjected to regulations of the Import and Export Controller and the standards laid down by the Bureau of Ceylon Standards.

(b) Methods of Testing

Once the standard specifications are established, the method of testing these specifications have to be drawn up. These will have to be clearly written to avoid ambiguities. Each test method must include details of apparatus, reagents, procedure, calculation and report of results.

(c) Checking of Quality

"Control" is to check if the process has been done in conformity with the ordered standard and deal with the unfavourable phenomena by corrective action.

In order to maintain the standard, the product in different stages must be checked for compliance with the standard. However, to conduct this supervision completely one cannot be assured unless he checks everything and the contents involved in every process. But such 100 per cent supervision not only costs a great effort but is a big loss because the goods are broken and consumed during tests and this makes it impossible to check all of them. Thus it becomes desirable to have some means to cut down this laborious testing.

It is at this stage that statistics come to our aid. Statistics helps us to cut down this extensive examination. An efficient sampling scheme drawn up statistically

could be used for determining the number of units and frequency of sampling and testing so that quality may be evaluated with maximum reliability at minimum cost.

Sampling methods and scale of sampling differ from product to product. It depends on the nature of the product. The sampling method should be statistically backed to ensure that the examination of sampling gives sufficient guarantee that the results give a good reflection of the quality of the entire lot under consideration.

In homogeneous food items where there is little variation, examination is easy as only a few samples may have to be drawn. However, there are many food items where sampling is fairly extensive. When samples are tested other statistical aids are used to interpret the results. Control charts form an important tool here.

The result of processing always has a variation. Causes which affect results of processes are numerous and we cannot control them 100 per cent. Here I would like to recall the temperature chart which we use in the control of our body temperature. In temperature charts, the temperatures are plotted several times a day and by studying the relations between these values and the normal value 37°C, we judge whether our body temperature is normal or not. Similarly, we collect data in food production and statistically determine the controlling limits. When the results of process are plotted on a chart, we can ascertain whether the production processes are maintained in a normal state or not.

(d) Corrective Action

If the process gives results going out of control, then corrective action has to be taken to eliminate the cause for changing the processes in a control state. There can be several reasons for a process to go out of control. These are:

1. Carelessness or lack of thought when workers have to work in compliance with the standard.
2. Lack of sufficient education or training to do so or misunderstanding of standards.
3. Inadequacy of standards.
4. Non-suitability of the raw, material or the production machinery going out of control.

Item 1 is the responsibility of the production worker but 2 to 4, the management has to solve.

The following steps are suggested as solutions:

- (a) Try to make the workers to work in accordance with the standards and a further revision of standards.
- (b) Re-educate the workers with consideration of possible errors in previous education or insufficient education. In many cases, you will find that inappropriate teaching is the cause.

- (c) In spite of repeated teaching the worker only continues to make errors due to carelessness. In a situation like this, you must consider personnel transfers and aptitude placements.
- (d) Revision of standards—A standard without revision is useless. Revise your standard if necessary until it becomes a document that can be implemented without any difficulty, of course without ignoring the consumers' need. Control is easier with this type of standard.
- (e) Change of objectives—Not only standards but sometimes objectives and aims are found impossible to accomplish and must be changed.

Quality Control Department

If quality control application is to be organized systematically, it will be necessary initially to establish a Central Quality Control Department. This should be a well recognized section having direct relations with every other department including that of research and development.

Education and Training

Even though quality control could be exercised by the establishment of a Central Quality Control Department in the organisation, it has to be mentioned here that quality is something that every person in the food industry has to contribute in some form or other to ensure that what is aimed is finally produced. The line workers, their supervisors and engineers must understand at their level what is exercised in order to attain quality.

They must understand how a control chart is drawn and what the production processes have got to do with the control charts. Therefore, they must know their basic statistics. They must know sampling, testing and reporting of results required for quality control. Special training and education required for this purpose has to be provided to every worker in the industry. In this way, the industry will benefit the most because it will establish in every worker what is called "quality mindfulness". This is a practice which is followed in some of the developed countries where this kind of practice has definitely shown results of quality upliftment in a very short period of time.