

Implementing a sensory evaluation system in the manufacturing environment

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Abstract

Often the people responsible for implementing sensory evaluation systems have had no formal training in sensory evaluation and the task can seem quite daunting. This paper presents some elements that are considered important when planning the design and implementation of a sensory system for process control. Attention to the types of people involved, the setting of minimum standards of operation, the systematic application of the system, the realistic approach to ongoing maintenance, the base of consumer preference and the link to other functions such as marketing and research and development are explored.

Introduction

The people charged with responsibility for a sensory program may not have much formal training in sensory evaluation. They generally have a science qualification and a background in quality assurance and/or product development and work for a food company requiring a level of confidence in the sensory quality of their products. They probably also have recognised that there must be a better way to achieve this level of confidence than by a collection of management representatives meeting casually to taste product and pass opinion or by personally tasting large amounts of products themselves.

When planning the design and implementation of a sensory system in a manufacturing environment, consider the following:

- Involve the right people
- Set minimum standards for the system
- Treat the system as a quality system
- Think about what can realistically be maintained
- Base the system on consumer preference
- Link the system to marketing and product development

Involve the right people

People responsible for driving a sensory system must be interested in the area and truly believe in its worth. Whilst the employment of a graduate of a food technology course that encompasses sensory evaluation would be advantageous, it is not totally necessary.

The allocated person need only have a fundamental knowledge of science and experimental principles and a willingness to learn. The following methods of learning are recommended:

- Benchmark a sister operation, locally or overseas. This is usually of great value, as there is no problem with proprietary information and 'reinventing the wheel' may be avoided.
- Employ a consultant. Ensure your industrial knowledge is integrated with commercial advice.
- Attend a short course on sensory evaluation. These are frequently run and a two day course is usually enough to provide a good basis.
- Read about sensory evaluation. There are literature and standards which can be used for reference.
- Have a basic knowledge of statistical analysis and be prepared to learn more!

Allocate a champion per manufacturing site.

Allocate a champion of sensory evaluation, a person who is responsible for the ongoing effectiveness of the system. Depending on the size of the operation, this person may do this part or full time. This person does not have to be from the quality assurance or technical department. Allocating a person reporting into the production arm of the business would most likely facilitate implementation. The important thing is that the person is responsible for overall co-ordination of activities.

Management Commitment

Work out what is to be achieved and tell key people. Be realistic about what can be done, how long it will take and what is needed. It is important, as with other quality tool development, that management is aware of the potential benefits to the business. Sensory evaluation will ultimately affect several key performance indicators, such as customer complaints.

Set minimum standards

Panellist involvement and performance. The reliability of panel outputs should be the most important success criterion to the sensory scientist. This reliability can be assured through proper selection and training of panellists.

Implementing a screening process for potential panellists ensures the panellist is interested and available for panels most of the time, is reasonably healthy, is not adverse to tasting specific products and is able to detect the key sensory attributes at relevant levels. A standard training method for new panellists should be documented. This is best delivered by an accredited trainer and with accredited training material.

Once trained, panellist performance should be monitored and be communicated as part of panel reports. Panellist performance can be measured by checking spread of scores around the panel mean for particular attributes (calibration) or by mapping how one panellist scores the same product, presented a number of times, for a particular attribute (consistency). Routine addition of samples displaying known defects to the regular sample set is

recommended. If non-conformance in panellist performance is detected, timely follow up and training is important.

Panel Locations

Locate panels to minimise bias. Ensure panellists:

- Can concentrate on their tasks
- Are not biased by foreign odours
- Are comfortable
- Can adequately see the product
- Have all required tools to assess product
- Are not too far from their work stations

Sensory facility design is well documented in sensory texts and standards. The facility should be designed to provide what is needed; it does not have to be elaborate. It must be ensured that the productivity of the panel leader is not adversely affected by the set up.

Sampling of sensory product and panel scheduling

Sampling plans and panel schedules should be developed in conjunction with manufacturing teams and documented as part of process control measures.

Product sample preparation, storage and presentation

Instructions on what is required. For each product should be documented.

Sensory assessment and description of product

A procedure for assessing each product, a list of sensory descriptors and related definitions should be documented as part of training activities.

Product release criteria

Standards should be set for the minimum number of trained panellists required to release product for sale and the sensory specifications that must be met.

Treat the sensory system as a quality system. Document the system

Once the minimum standards for the sensory evaluation system have been decided, document them in the form of a policy and related quality system procedures and work instructions. This will ensure the system is:

- Well understood by all levels of organisation
- Easily transferred when training new

- panel leaders
- Auditable
- Continuously improving

Use the system to facilitate quality awareness

Involvement in a sensory panel can foster a sense of ownership for product quality. To ensure the sensory system is as closely linked to manufacturing quality as possible, employ people who actually run the lines. It is often difficult to get line operators to attend frequent and/or lengthy training and panel sessions. To relieve this, ensure sensory facilities are conveniently located, sampling plans and panel schedules are practical and developed in consultation with manufacturing teams, assessment procedures are not unnecessarily elaborate or lengthy and that time for training and panelling is accounted for in operators schedules. In addition, care needs to be taken that keenness to release product does not bias the assessment of quality. This must be addressed as part of quality awareness and cultural change.

Management Review

Management can and should be involved in the sensory system, either as panellists themselves or in some form of management review. It is recommended that management including Plant Manager and functional heads are aware of the sensory quality of product released for sale and of non-conformers picked up by the panel. If possible, schedule a daily, or at least weekly, showing of finished product and panel results. This is not a check on panel output but an exercise in quality awareness.

Close the quality loop

Panel results can be used to:

- Release vs specification
- Demonstrate trends in product sensory quality and suggest correlations with process parameters
- Provide 'diagnosis' of a customer complaint or other quality enquiry
- Monitor panellist performance
- In addition, the utilization of panel results is a vehicle for lifting the profile of the sensory system. Ensure results are visibly used. Post copies of trend graphs on notice boards, use results in team meetings and management review meetings. If panel results indicate a defect

that would otherwise have gone unchecked, it should be highlighted.

What can realistically be maintained?

Realistic sampling and panel plans

There is often a tendency to oversample and overanalyse. Assess processes for sensory control points and focus a sampling on these.

- Sampling plans should provide an adequate level of confidence that any variation from specification will be detected
- As a rule of thumb, panellists should not be expected to taste more than six samples in a sitting, less if carry over of flavour is expected.
- The sensory attribute list should contain those most critical to finished product acceptance, e.g. 'firmness in mouth' for noodles, acidity for orange juice, and those that cannot be measured by another analytical means

Quick and easy method of data collection

Ensure the scaling and method of data collection provides production teams with information on the quality status of their product in a timely fashion. There are different levels of sophistication available:

- Paper questionnaires with a scale that allows quick identification of product status, i.e. pass/fail type scales
- Computerised systems which can employ a sensitive scale such as nine point or continuous line scale, convert it to a number and compare to predefined specification

Whichever method is used, choose one that minimises post panel data manipulation for product release. Computerised systems are ideal for longer term trending of product quality and panellist performance. The assessment of sensory attributes, directly on line, can facilitate immediate corrective action.

Care for panels

Many problems associated with sensory systems are related to the motivation level and general interest or commitment of the panellists. The ongoing care of a panel is the most time consuming activity of the sensory scientist or panel leader and this

is usually the part of the system that losers focus first.

Usually when a department, plant or line are entering into panel training, the experience is a novelty and sensory training is generally fun. However, over time circumstance can erode motivation, e.g. as the panel get a little more used to the panelling task, as the panel leader gets involved with other duties, as decisions that seemingly demonstrate a disregard for panel findings are made.

The panel needs to be nurtured, i.e. it needs to be entertained, reassured that it is important and playing a valued role in the business, rewarded for its efforts now and then and in almost constant communication with the panel leader in one form or another. The panels also need to be disciplined, i.e. the panel needs a structured procedure, feed back on its performance and how to correct its performance when it is not optimal. It needs to be led by example.

The following is a list of some simple things that can be done to 'care' for the panel:

- Use the panel regularly
- Provide feedback of performance, i.e. calibration and consistency, and follow up any non-conformances promptly with training.
- Ensure the sensory results are visibly used in decision making and feed this back to the panel, highlighting the ways in which plant sensory results are playing a wider role in company development and quality improvement projects.
- Reward the panel with a treat at the end of panel sessions and at Christmas time or on birthdays with a lunch or morning tea.
- Ensure sensory training contributes to any skill based pay structures in place

- Have sensory duties put onto panellists job descriptions
- Ensure management 'lead by example'. Management should visibly support the sensory system by utilising results in decision making and attending any panels they are scheduled to attend.

Base the system on consumer preference. A sensory specification should include those sensory attributes critical to consumer preference, with optimal levels and acceptable levels of variation.

The definition of a sensory specification should be part of a product design specification. Realistically many existing products do not have well researched sensory limits. The activities associated with setting the sensory specification are normally outside the scope of the manufacturing sensory system.

Sensory research to understand key sensory attributes and consumer tolerance levels is quite a complex area. Essentially, this is a three step process.

Broad screening for key sensory attributes

Refine a list of sensory attributes which are thought to be important for product acceptance. This judgement is mainly based on what is already known, internally, about the product and consumer acceptance and external information such as customer and consumer communications.

Refined screening for key sensory attributes

Products demonstrating differing levels of key sensory attributes as measured by a trained panel, should be produced, and assessed by consumers, in a statistically designed experiment. In this way we can study main and interaction effects, on consumer liking, of a number of sensory attributes simultaneously.

Determine optimum levels

Key attributes can now be systematically graduated, within reasonable extremes,

and studied for optimum levels. Response surface methodology can be used in this case. For example, suppose the screening process had highlighted that sourness and sweetness were two key drivers of consumer liking in a fruit drink, and that they provided an interaction effect, i.e. one affected the perception of the other. Samples providing combinations of say three levels of sourness and sweetness could be produced (a total of nine samples) and researched with consumers. A response surface can be calculated by plotting co-ordinates of attribute levels vs consumer liking scores. A region of optimum acceptance, or a specification level, for sourness and sweetness can be determined.

In this type of work it is vital that sensory attribute levels can be related to formulation and/or process conditions, e.g. the scores for sourness and sweetness can be related to levels of acid and sugar.

Link the system to marketing and product development

The sensory system developed in the manufacturing environment should be both fed by and feed in into the research and development and marketing functions.

Besides the obvious flow of information in and out of the panel to both the marketer and product developer, in terms of product sensory quality required and produced, there is another important link. There must be synergy between what the marketer thinks the consumer wants, what the developer thinks they have designed, what the plant think they have made and what the marketer is communicating to the consumer. Although each function has their own technical terms for what it is they think they are doing, there are common sensory attributes which can be used by all. It is quite important that any assessment done in the plant relate to what is really driving the consumer, what is being focussed on in product development and what the product positionings are based on.