VI The Influence of Flavour Chemistry on Consumer Acceptance

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1 Introduction

Any discussion of flavour is concerned mostly with food, which at its most primitive is the fuel with which we fire our bodies to provide energy and with which we maintain the body in a healthy state. There are still some parts of the world where this prime function of food is dominant, resulting in a simple concern that enough familiar food should be available. In most communities however, an element of choice has developed and choice results in preference—which is where flavour comes in; for flavour is the main factor, along with texture and colour, which will influence consumer choice—consumer choice which is the lifeline through which all in the food and flavour industry survive.

Food, whether of animal or vegetable origin is alive in the biochemical sense even after it has been cropped, and will continue to change through enzymic reactions until or unless something is done to stabilize it. Flavour changes result from these enzymic reactions and also from simple chemical reactions which may continue before, during, and after any stabilization. These flavour changes may be attractive or the opposite. In either event they are a major area of interest for the flavour scientist who is concerned to optimize desirable flavours and avoid those which are unpleasant.

The history of flavour variations and hence choice begins with primitive man competing with animals for the natural crops; this clearly did not work too well for man who was weaker and less mobile than many of the other animals, and in any event the crops were highly seasonal. Eventually man started to grow his own crops—a major step forward particularly for the ones fortunate enough to be in fertile areas—but still suffering from extreme seasonal fluctuations, which led to alternating glut and famine. From this situation evolved several ways of preserving glut crops, and it is interesting to note that the basic methods of maintaining food in a fit condition to eat have not really changed over several thousand years.

One can dry food, originally in the air and sun, or desiccate it, *e.g.* with sugar, salt, *etc.* The food may be heated, which we now know destroys both micro-organisms and food enzymes; and this often results in a degree of concentration which, like drying or desiccation, reduces the amount of active water. An alternative approach is to preserve chemically, originally with spices, hops, *etc.*, or with burnt sulphur, to which have now been added other chemical preservatives. Another method discovered very early is to allow the food to decompose

(ferment) which leads to products which are attractive in flavour, and in which the alcohol or acetic acid provides a stabilizing effect. Finally, it should be remembered that the concept of animal husbandry is based, at least in part, upon keeping the animal alive 'on the hoof' until it is required. This is still the preferred method of distributing chickens in tropical markets, ensuring they are still fresh when purchased.

It may fairly be said that food technology commenced with the discovery of these processes, and food scientists and flavourists are still today very much concerned with this area—seeking to improve the efficiency of these processes as regards yield and nutritional quality and to optimize and stabilize the flavour.

2 Flavours—Selected Examples

The following specific examples are intended to draw attention to a number of facets which should influence the activities of the flavour scientist. It is sometimes tempting to liken flavours to perfumes and indeed the Flavourist Society has many joint meetings with its perfume counterpart. In many ways the development of flavours is technically similar to that of perfumes but they are rather different creatively, for the target is more visible and definable for the flavourist, and the consumer is comparatively well able to judge objectively how well the product has been formulated. There are, however, two types of flavour or flavour project, the simpler being the flavour of a defined material, which is the easier to describe and is comparatively static. More intriguing is the question of flavouring for a usually bland material. This includes more licence and is dynamic with respect both to time and to different consumers, and it is to this area that most of the following remarks are directed. The former, however, should not be neglected for the supply of real food commodities is finite and will easily be over-run as more of the Third World populace aspire to an adequate and more varied diet. The recent cocoa and coffee shortages are a reminder of how close this problem may be and this raises the question of how to cope with the situation. Agricultural efforts to grow more will, of course, continue but beyond this it will be necessary to produce synthetic foods, and in doing so to decide whether to imitate the natural and familiar commodity, or to offer essentially new types of foods.

The question of providing adequate protein is an interesting one. Vegetable proteins have been developed to supplement the limited and costly animal proteins, but technologists, who when formulating for the Western markets have targeted to make it like a familiar foodstuff, when developing vegetable protein products for the emerging nations have totally ignored texture and flavour or have formulated them to the Western diet. In either event, the resultant end product has been so totally unfamiliar to the target audience as to achieve only very limited success. There is a major opportunity here for food and flavour scientists to study more carefully the ways in which such products would be utilized within existing diets and to give attention to the types of flavours which are likely to appeal.

A. Fruit.—Fruit is an interesting foodstuff and includes a vast array of variously

preserved products which have evolved from essentially perishable material. The flavour characteristics of these various products—fruit juices, canned fruits, jams, wines, *etc.* are often profoundly different; and particularly for those fruits which are not indigenous the flavourist and formulation man must carefully review which version of the flavour will have the highest appeal in the particular new product he may be developing.

Another factor which can be discussed against the backcloth of fruit (although it is also relevant in many other areas, *e.g.* cooked meats), is the complex balance between volatile aroma with its associated taste, and the non-volatile taste factors including mineral salts and non-volatile organic materials. Moreover, these flavour considerations are intimately meshed with a colour, texture, and human environment matrix, so that an apparently simple project may indeed be quite complex.

Supposing it is wished to formulate an orange powder drink. First it is necessary to decide who it is for, and then what it should taste like. Perhaps it is required to compete with low priced squashes and carbonates or maybe the higher quality fruit juice market. Assuming that it is the latter, the nutritionist will want to have his say, desiring a balance of all the nutritional factors which might have been present in the real orange juice. The flavourist, knowing that he must get as near to 'the real thing' as possible, must still decide whether the fresh or the canned juice flavour is his target. The importance of non-volatile taste factors has been mentioned. The General Foods product, 'Tang', is an excellent example of the way in which a very realistic orange juice taste can be achieved without the use of orange juice by a combination of high quality flavour with cloud and texture ingredients, and a deliberate rebalancing of mineral constituents towards those found in orange juice. In rather similar vein it has been found that for fruits which are relatively high in astringent tannins or polyphenolics, the inclusion of low levels of tannin or other bitter constituents can add realistic breadth of taste to a low juice or juice-free product.

B. Sweetness.—From fruit to sweetness is but a small leap. Sweet things can be delicious, and long before the development of a significant sugar-cane industry, honey had achieved an almost unique reputation; but if sweet things are delicious, people can eat too much of them as the high incidence of obesity in western civilization testifies. If people like sweet things which are bad for them, what is to be done? For many years synthetic, non-calorific sweeteners have been available, notably saccharin. But the sweet taste of saccharin is not perfect, being marred by a bitter taste and an aftertaste, and we can see the influence of the flavour scientist in achieving modifications, for example with ethyl maltol, monosodium glutamate, ribotides, *etc.* to extend and soften the sweetness character.

Even if an adequate sweetness is achieved there remains a physiological question about satiety, or satisfying the appetite. A formula with a reduced, but finite carbohydrate level can probably achieve satiety at lower calories, and achieve a far superior taste, especially if a very sweet natural sugar (*e.g.* fructose)

is chosen. The Beecham low calorie products marketed under the 'Bittersweet' brand are good examples of this approach.

Ethyl maltol is just one example of a compound not itself sweet in the true sense but extending the overall impression of sweetness. Certain fruit juices have this sort of characteristic. For example, pineapple can increase the impression of sweetness, beyond that which can be shown analytically, when blended with orange; whilst the Florida orange, apart from analysing as sweeter or less acid, also has a sweeter aroma than typical mediterranean oranges. Whenever it is necessary to eke out natural sweetness, whether for low calorie or cost considerations, more use could be made of these natural examples and indeed, perhaps more fundamental information would come to hand from a closer scientific study of ingredients which seem to have this characteristic.

In foods the use of sugar for desired sweetness mainly involves problems of cost and nutrition, but for some more compact products it is simply not possible to get enough sugar in to achieve the desired sweetness rating. Toothpaste is a very good example which is thus dependent upon high strength artificial sweeteners, and if as seems likely, at least in North America, saccharin and cyclamate are banned, the achievement of adequate sweetness is a significant challenge to the flavour scientist. Obviously he will search for new artificial sweeteners, recognizing more contemporary ground rules in which safety is crucially important, although cost can within reason be accepted. Some of the flavour submissions now coming forward show that significant progress can be achieved by bringing together ingredients having a synergistic tendency to enhance the sweet character. Often, however, these flavours are rather less conventional, at least for use in toothpaste. So the questions of consumer acceptability and perhaps even re-education will have to be tackled.

C. Bitterness.—Although bitter things tend to be regarded as nasty, there are clear exceptions, particularly for the adult palate in which the non-sickly character of a bitter product may have high appeal. The active ingredients of medicines, however, often have intense bitterness, presenting the formulation and flavour team with the dilemma of whether to wrap up the bitter factor (*e.g.* by encapsulating), to mask it, or to complement it. This last approach is one which holds great promise and indeed, there are a number of recently introduced medicinal products in which this approach has been successful. Another approach to this problem is the development of loose chemical derivatives, often chelate compounds which have reduced bitterness but readily dissociate before absorption (*e.g.* guaiphenesin, chlorhexidine).

D. Milk.—From ancient times milk has had an almost unique nutritional status and aura; the perfectly balanced food on which babies can and do grow. Even beyond breast feeding, mothers recognize its nutritional value and surely every mother tries to get her growing children to take their daily quota. Also, it is one of the few foods the farmer produces without actually losing the source!

Milk, however, does not keep well, and this has led to the development of the

whole gamut of methods of preservation involving pasteurization, sterilization, concentration, and lactic fermentation.

In the U.K. we are still accustomed to find our milk on the doorstep, but distribution problems have necessitated a search for better stabilization whilst retaining the well-known character of fresh milk, *e.g.* UHT sterilization, and more delicate spray-dried treatments for producing dried milks.

Another question which arises is whether all children actually like milk. If not, how can the flavourist help? Traditionally mothers sought to lose the milk, in milk puddings or in strongly flavoured beverages such as cocoa, but in more recent years a variety of other flavours have been offered to improve the palatability and acceptability of fresh milk and of milk-like beverages, *e.g.* soft fruits, malt, caramel, *etc.* More recently still, cultured milks (yoghurts) have become very popular, both plain and in a variety of flavours; these are limited shelf-life products with special dynamic flavour problems.

We worry about whether milk will still be on the doorstep as years go by, but for the world population at large, a more profound question of absolute availability arises; and if milk will not be available in adequate quantity, what alternatives may arise? Among these could be soya milks, *i.e.* based on vegetable rather than animal protein, which raises yet again the question for the flavour scientists—'should he eliminate or mask the characteristic soya flavour, or seek to complement it so that an acceptable, if new, taste is developed?'

In view of its very good nutritional image it is ironical that nutritionists in recent years have been asking whether milk is really so good for us after all. In the United States and Scandinavia particularly, the development of filled milks having vegetable fats in place of the animal fat constituent has occurred. As yet no wide movement of milk-based products on to filled milk bases has occurred but perhaps, in the future, there will be cheese based on filled milk, or maybe the cow will disappear as a source of milk (whole or filled), and force the food technologist to create a whole range of vegetable cheeses!

3 Agronomic Evolution

Most basic foods whether animal or plant based are undergoing a continuous process of development targeting for new strains which are more economically grown, resist diseases, and have better 'consumer characteristics'. The consumer characteristics which are chosen are often related to marketing and distribution, *e.g.* uniform size, shape, good colour, and good shop-keeping qualities. Flavour, however, is often neglected and here is yet another opportunity for the flavour scientists to play a part. The opportunities are not so obvious in fresh foods if their natural integrity is to be preserved, but easy opportunities occur during processing whether at home or in the factory. Even in fresh foods injections of tenderizers, water, *etc.* into meat, chickens, and so on are not unheard of; why not flavours?

This means that as fast as the agronomist is breeding flavour out of our foods, so the food scientist and flavourist should be studying the best flavoured species to capture their analytical secrets for grafting on to inferior flavoured products.

Much of this flavour identification does of course occur, but not always with a differential slant on the flavour quality of different strains. How often have the assurances of the pundits been heard that white shelled eggs and battery eggs are just as good, taste just as good, as brown, free range eggs?

The agronomic evolution must of course proceed since food is needed in ever increasing quantities. But the flavourist can work alongside to ensure that flavour is protected and even developed as the food yield advances.

4 Other Countries

Many foods which grow elsewhere, especially those which travel well and to which we were introduced during England's colonial pre-eminence are already familiar, and many of these foods now seem as natural in the U.K. as elsewhere for they can be grown sometimes with a little early protection from the winter frost. In recent times, however, less stable products from more tropical regions which will not grow here have been introduced, sometimes successfully, and perhaps the flavour scientist can help in capturing these as well as the long-familiar flavours for use in manufactured products here.

Another aspect is consideration of foods and flavours for overseas territories, including the Third World, for virtually all our normal products have filtered through to white colonial areas, *e.g.* Bowyers and Walls sausages are as conspicuous in Australian, South African, and Far Eastern supermarkets as they are in Tesco.

However, in less developed communities this is not so and these people will often require somewhat different products and flavours from those with which they are more familiar, as selected and screened by religious and cultural taboos.

Profound differences arise between regions, *e.g.* Far Eastern territories such as Malaysia and Singapore, dominated by a culturally advanced but different Chinese people having most delicate palates and with a high health food interest. It is evident from observing these marketplaces that the products enjoying high success do not conform closely to those in more western communities. There can be exceptions, however, where by conscientious effort a product at first absolutely unfamiliar can gradually succeed if it has intrinsic merit, *e.g.* 'Ribena' is based on blackcurrants which simply do not grow in that part of the world, yet Hong Kong has the highest *per capita* consumption of 'Ribena' in the world.

For territories having a shorter cultural history, rather different problems arise and here one may cite Nigeria where a high proportion of the mass population is emerging from a much simpler, primitive past. With less entrenched views it might be thought they would be more easily led, but new ideas are treated with suspicion, and new products and flavours need to be compatible with basic staples and life styles until or unless these change.

Communication is important in any project but requires special care on development work for overseas markets. Typically, information will have to be obtained, expressed and communicated as follows: (*a*), Local market studies lead to definition of consumer product requirement; (*b*), Product Brief relays this information to Product Development team, usually in U.K./Europe or U.S.A.;

(*c*), Flavour Brief is passed to selected Flavour Houses, from which specially tailored flavours arise; (*d*), Product(s) arising from 'informed selection' by development team and specialist panels is passed to overseas market for consumer testing; (*e*), Consumer findings, and any Product revision needed are relayed back to Product Development team; *etc.*

It will be very obvious that the opportunities for error or misunderstanding are high; and in the author's experience there is a need for regular face-to-face discussions to reinforce and elaborate on the essential written briefs. Also, people concerned with overseas projects need to involve themselves in these markets; and similarly the flavourist will need to have a feel for the particular market, which can often be achieved by regular feedback from Regional Flavour House personnel.