

Recent trends in the use of food additives in the United Kingdom

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Abstract

The E number system for food additives was introduced in the 1960s and the E was intended to reassure consumers that permitted additives were safe. In the 1980s full ingredient declarations had to be provided on food products for the first time and manufacturers were permitted to use either the name or the number of the additive on the ingredient list. This paper outlines some of the trends in the sourcing, use and labelling of additives since the introduction of full ingredient listing. Generally, sourcing has become more global with a large number of suppliers being based in China. From an initial use of E numbers in ingredient lists, manufacturers are increasingly using the names of additives. This trend is being extended to avoid the use of anything the consumer might consider an additive, particularly in connection with colours and preservatives. Specifically, the colours used in the Southampton study on the impact of food colours on hyperactivity in children have largely been replaced by colouring foodstuffs, and the preservative used in the study, sodium benzoate, has been replaced by potassium sorbate in the majority of soft drinks.

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BACKGROUND

There are 363 different additives permitted in food in the European Union (EU); 362 are listed by number in EU Regulation 1129/2011¹ and the 363rd is steviol glycosides, sold as an intense sweetener (E 960)² added later in 2011. These 363 additives have 23 recognised different uses which are listed in Directive 2000/13³ and Regulation 510/2013⁴ and defined in Annex I of Regulation 1333/2008.⁵ The 23 uses are: as an acid, acidity regulator, anti-caking agent, anti-foaming agent, antioxidant, as a bulking agent, colour, contrast enhancer, as an emulsifier, emulsifying salts, as a firming agent, flavour enhancer, flour treatment agent, gelling agent, glazing agent, humectant, modified starch, preservative, propellant gas, raising agent, stabiliser, sweetener, and thickener. The additives include ascorbic acid (used as an antioxidant), citric acid (used in a wide range of products and produced at the rate of over a million tonnes per annum), and thermally oxidised soya-bean oil interacted with mono- and di-glycerides of fatty acids (E 479b) which is only permitted for use in fat emulsions for frying.

The use of food additives within the EU was only fully harmonised in 1988 with agreement on a framework Directive (88/107)⁶ followed by specific Directives on sweeteners (94/35),⁷ colours (94/36)⁸ and miscellaneous additives (95/2).⁹ Driven by the needs of the food industry for improved price, quality, consumer acceptance and shelf life, the additive industry responded, developing new additives and finding new uses for existing additives, requiring a steady stream of amendments which in time necessitated consolidation of the legislation in the form of a new framework Regulation in 2008.⁵ This was followed by a detailed Regulation, 1129/2011¹ specifying the conditions of use of individual additives.

The choice of which additive to use for a particular role in a product is affected by a number of factors, the most important of which

is the extent to which the additive can fulfil the technological role required. However, this choice is increasingly influenced both by legislation and by activists and commentators in the media. This paper will outline some of the changes that have taken place in the supply, use and labelling of additives in the UK since the introduction of a harmonised list of additives in 1988.

E NUMBERS

The E number system was introduced in the 1960s in the first additive Directive¹⁰ and the E was intended to reassure consumers that additives included within the system had been examined by the relevant authorities and were safe for use. In the 1980s full ingredient declarations had to be provided for the first time and manufacturers were permitted to use either the name or number of the additive. Many chose to use the E numbers, often to save space on the ingredient declaration. However, around the same time a number of publications appeared that suggested that consumers should be suspicious of these additives. Probably the best known was the book *E for Additives*¹¹ but the most pervasive was probably the so-called Villejuif¹² list, which purported to originate from a hospital in France and which identified additives as either toxic or suspect; for example, citric acid (*sic*) was identified as most dangerous. The list was bogus and had no connection with the hospital from which it was claimed to originate but it was circulated widely through concerned organisations and individuals. The E became identified not as a mark of safety but

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rather as a mark of concern, and consumers were encouraged to look for E numbers on ingredient lists and to reject products with a lot of E numbers.

The reaction of the food industry has been to progressively replace the number with the additive name and it is noticeable that few products now have E numbers in their ingredient lists. It is more common to see 'mono- and diacetyl tartaric acid esters of mono- and diglycerides of fatty acids' on the ingredient declaration for a loaf of bread than to see E 472e. It is questionable whether the consumer is better informed by the use of names rather than numbers.

The numbers in the E number system are used internationally,¹³ without the E prefix, and appear on ingredient declarations of products in many countries around the world where they do not seem to be regarded with the suspicion accorded them in the UK.

THE SUPPLY OF ADDITIVES

When the first additives Directives were being drafted, food manufacturers in Europe bought most of their additives from manufacturers and wholesalers who provided a range of compounds sourced from within Europe and North America. This situation has changed considerably and in the present day additives are manufactured worldwide, particularly in China and sold through a number of channels. An indicator of this trend is the number and nationality of exhibitors in the biennial Food Ingredients Europe (FIE) Exhibition, the largest such exhibition in the world. At the first FIE in Utrecht in 1986 there were few exhibitors from outside the EU whereas at the Paris exhibition in 2011 a total of 53 countries were represented and of the 1174 exhibitors, just 56% were from the EU. China was the country with the largest representation, having 259 exhibitors, equivalent to 20% of the total.¹⁴ The trend appears to be continuing. At the 2013 exhibition in Frankfurt there were 1236 exhibitors from 55 countries of which 303 came from China (24.5%).¹⁵

SODIUM BENZOATE

The most recent survey of additive consumption in the UK was published in 1993,¹⁶ based on studies in 1987 by a working party of the Steering Group on Chemical Aspects of Food Surveillance within the Ministry of Agriculture, Fisheries and Food (MAFF). This study had two objectives: to estimate the *per capita* intake of individual additives and to estimate the frequency with which additives were used in retail food products. The data requested related to the years 1984 to 1986.

The report of this survey includes the following comment on preservatives in soft drinks: 'The addition of sorbic acid to soft drinks is a comparatively recent development and to date, its use in this application been limited. At the time the data were supplied, sorbic acid was used in less than 1 per cent of carbonated beverages and less than 2 per cent of concentrated drinks'. The preservative of choice at the time was sodium benzoate.

A number of factors have impacted the public perception of sodium benzoate as a preservative since then, none of which relate to its effectiveness but rather to its perceived safety.

During the 1990s very small quantities of benzene were detected in soft drinks in which sodium benzoate was used as a preservative.¹⁷ The media had already been sensitised to benzene by its appearance in a mineral water in 1990¹⁸ and the

detection of very low levels (from 0 to 90 ppb) of benzene in soft drinks was publicised worldwide. Subsequent research showed that the benzene arose from a reaction between vitamin C and sodium benzoate in the presence of sunlight.¹⁹

In the light of the concerns, food control agencies in the UK, Canada, Germany and South Korea commissioned surveys in 2006 to determine the levels of benzene present in soft drinks. In the UK survey²⁰ approximately 70% of the samples did not contain detectable levels of benzene and only four contained over 0.1 mg L⁻¹ (the guideline value in WHO guidelines for safe drinking water²¹). The manufacturers of these four products were advised to withdraw their products.

In 2007 the results of a study at Southampton University in the UK on the impact of consumption of drinks containing a number of artificial colours and sodium benzoate on young children²² were taken to indicate that such consumption had an adverse effect on their behaviour. As a result UK soft drinks manufacturers began to investigate the use of potassium sorbate as a replacement for sodium benzoate.

In 2008²³ the Food Standards Agency repeated their 2006 study to determine levels of preservatives in soft drinks. This survey looked at levels of all preservatives in soft drinks rather than just concentrating on those containing sodium benzoate. Of the products sampled in 2008, 65.6% contained sodium benzoate, 52.8% potassium sorbate and 1% potassium benzoate. (The numbers total more than 100% because some drinks used both benzoate and sorbate.)

The trend away from benzoate and towards sorbate has continued since 2008. In the 2008 survey some 166 of the 250 products purchased contained benzoate. Of the 26 supermarket own brand products that contained benzoate at this time, a survey we carried out in November 2013 identified only two that still do. Indeed, of 290 varieties of own brand soft drink listed in November 2013 on the websites of four major supermarkets which offered internet sales, only six were identified as containing benzoate. In contrast, of 28 major international brands which were found to contain benzoate in the 2008 survey, 15 still do.²⁴

COLOURS

Colours were the first class of additives to be covered by a European Directive⁸ but have frequently been the object of critical comment by activist groups and others in the media. Probably the most important contribution to the debate on the safety of colours was the paper published in 2007 on the study at Southampton University,²² referred to above, on the possible effect of a cocktail of colours (Tartrazine E102, Quinoline yellow E 104, Sunset yellow E 110, Carmoisine E 122, Ponceau 4R E 124 and Allura red E 129) and sodium benzoate on hyperactivity in young children. The authors concluded that there was evidence that the behaviour of young children was indeed adversely affected by the consumption of drinks containing this mixture. As a result of this the Food Standards Agency (FSA), in 2008, asked food manufacturers in the UK not to use the six colours used in the study and requested an evaluation by the European Food Safety Authority (EFSA). The EFSA review concluded that the study did not provide evidence to require the banning of the colours but the EU decided that there was sufficient concern over the use of the colours that their presence should be accompanied by specific labelling.⁵ Products containing these colours are now required to have the following statement on the label: 'name or E number of the colour(s) may have an adverse effect on activity and attention in children'. The

FSA has continued to encourage the food industry not to use these colours and in 2011 published a guide²⁵ to help manufacturers to identify alternative colouring materials that could replace the six colours.

While the original research only related to six artificial colours, all colours were implicated by association and industry has moved to replace colours that have to be declared as additives and to replace them with fruit and vegetable extracts. The food products that are most likely to contain colours are soft drinks and sugar-based confectionery. The 2013 survey of 290 supermarket own brand soft drinks mentioned above showed that the only colours used in these products were β -carotene, anthocyanins and caramel, with only 13 products containing caramel. It is now common for the colour in supermarket own brand cola drinks to be provided by barley malt extract rather than caramel.²⁴ The range of fruit and vegetable concentrates used in sugar based confectionery and soft drinks is considerable and includes: apple, aronia, black carrot, blackcurrant, carrot, elderberry, grape, hibiscus, kiwi, lemon, mango, nettle, orange, passion fruit, pumpkin, radish, red cabbage, safflower, spinach and spirulina.

The use of these ingredients is not without its challenges as they tend to be less light- and oxygen-stable and more sensitive to pH than the additives they replace and a great deal of development is under way to increase their stability. It is recognised that there is a difficult legal boundary between food colour additives, which have been extracted from natural foodstuffs, and the colouring foodstuffs themselves. The critical question is the degree of extraction and whether the ingredient retains the essential character properties of the source material. Guidance notes from the European Commission on this subject were endorsed by the majority of representatives of Member States at a meeting of the Standing Committee on the Food Chain and Animal Health on 22 November 2013. The notes recommend that food business operators should begin to follow the principles in the Guidance from 1 January 2014 and that all products placed on the market after 29 November 2015 should follow the Guidance.

SWEETENERS

In the UK Ministry of Agriculture Fisheries and Food (MAFF) report of 1993¹⁶ saccharin was the most commonly used intense sweetener, being present in 307 products compared to aspartame in 122 and acesulfame K in 11 (this last is unsurprising as it had only been permitted in the UK in 1983). Since that report three further intense sweeteners have been approved for use in the EU – sucralose (2002), the salt of aspartame and acesulfame K (2003), and steviol glycosides (2011) – and the landscape of sweetener use has changed considerably. No sweetener has an identical sweetness profile to sugar and they are frequently used in combinations of two or three. The results of a study²⁴ in spring 2014 of all 525 soft drinks on the website of a major supermarket (see Fig. 1) illustrate the change in the use of intense sweeteners since 1993. Aspartame and acesulfame K are now present in nearly twice as many products as sucralose or saccharin. Unlike the other intense sweeteners, steviol glycosides (or stevia) is an extract from the leaves of the plant *Stevia rebaudiana* Bertoni and this aspect was anticipated to provide an extra motivation for its use. It was much promoted before it was approved but initial uptake has been slow, much as it was with acesulfame K. To date one international brand has been reformulated to use it and a number of niche products have been developed to use stevia as the sole sweetener.

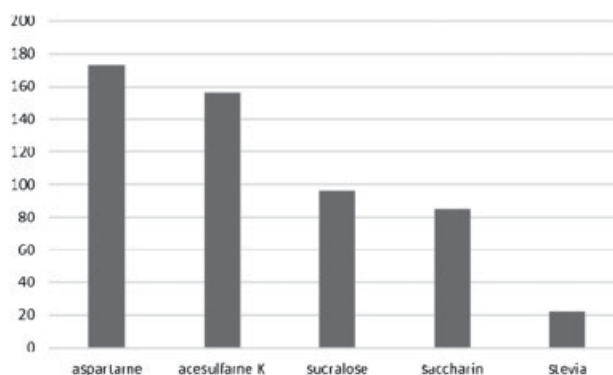


Figure 1. Sweeteners in soft drinks in a UK supermarket.

CLEAN LABEL

The movement away from the use of E numbers and the changes in use of food colours are part of a wider trend, known in the industry as 'clean label'. While there is no agreed definition of this term, it is generally taken to mean the desire for labels to contain nothing that may be interpreted as artificial or chemical. Research among consumers²⁶ suggests that 58% of men and 74% of women in Europe and the United States read the labels when shopping for foods or beverages, which would explain on-pack claims such as '100% natural ingredients', 'no artificial colours or preservatives', 'none of that artificial colour or preservative stuff' and 'the colouring in this product is made from natural sources'. The drive to free ingredient labels of anything apparently chemical or artificial has impacted other additives, not only colours and preservatives. For example, modified starches have been a great success in the last 40 years in providing texture to processed foods but the pressure in the industry is now to use physically or enzymically modified starches which can be declared merely as origin starch (maize, tapioca, wheat, potato etc.) to replace both chemically modified starches and other thickeners such as the chemically modified celluloses.

CONCLUSION

Since the introduction of the E number system in the 1960s, the E has changed, in the mind of the consumer, from representing safety to the reverse and it is now taken as an indication of the presence of something unknown, and therefore potentially worrying, in food. This has resulted in a move away from the use of numbers in ingredients lists to names. In turn, this approach is being extended to only including ingredients that the consumer might be expected to recognise or that appear to be physical extracts of natural raw materials. Supermarkets, in particular, have also shown themselves to be very keen to remove any additive which has received adverse media attention. These two factors will ensure that the drive for ingredient lists to contain only familiar or apparently natural materials will continue to generate challenges both in sourcing and formulation for the foreseeable future.

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