

# Review and evaluate the available methods of extraction for approved natural colours in food and drink

Area of research interest: [Chemical hazards in food and feed](#)

Study duration: 2009-10-01

Project code: A01074

Conducted by: Food and Environment Research Agency (FERA)

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## Background

The Agency has commissioned this project to investigate the availability of methods to detect and quantify the levels of permitted natural colours in foods and drinks. This will enable the Agency to ensure the Acceptable Daily Intakes (ADI) for these colours, where set, are not exceeded. In order to monitor the level of these colours in food and drink we need to ensure that there are methods available for future Agency surveys and for Public Analyst laboratories (PA labs).

Although the project is entitled natural colours, some of the colours listed below may not be considered to be natural under labelling legislation or FSA labelling guidance documents.

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## Research Approach

The colours covered in the review were:

1. Carotenoids – Carotenes E160a, Annatto, bixin, norbixin E160b, Paprika extract, Capsanthin E160c, Lycopene E160d, Beta-apo-8'-carotenal (C30) E160e, Ethyl ester of beta-apo-8'-carotenoic acid (C30) E 160f, Lutein E161b, Canthaxanthin E161g
2. Curcumin E100
3. Cochineal – including carminic acid E120
4. Chlorophylls – including chlorophyllins and copper analogues E140-141
5. Beetroot red, betanin E162
6. Anthocyanins E163
7. Caramels – Classes I – IV E150a-d
8. Other – Riboflavins E101i-ii, Vegetable carbon E153, Calcium carbonate E170, Titanium dioxide E171, Iron oxides and hydroxides E172

The main aims were to:

- Collate information on existing published methods (literature review) and contact food industry, research organisations and national and international institutions for information on natural colour analysis.

- Critically assess methods available to see if they cover a wide range of foods and drinks, their fitness for purpose and whether they are transferable to PA labs.
- Identify any gaps in knowledge and recommend future research.

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## Results

Very few methods are available on the determination of titanium oxide in foods, and none for the direct determination of calcium carbonate and iron oxides in foods were found. Methods based on elemental analysis are likely to be the best approach for these colours but they require development and validation. No methods could be found for the determination of vegetable carbon in foods therefore a small number of methods for the analysis of industrial materials were reviewed. There are a number of validated methods for the analysis of riboflavin some of which have been collaboratively trialled and so would require little further development work. There are a large number of analytical methods available for carotenoids and anthocyanins, but most of these are to determine the level of colours in source materials (plants) or the analysis of non-food matrices. However, these could be readily adapted to the analysis of foods permitted to contain these colours. Other colours, such as the chlorophylls/chlorophyllins require broadening in scope with necessary validation to cover all foodstuffs permitted to contain them. Methods for curcumin are largely restricted to biomatrices other than food, some of which have been validated but require adaptation to the analysis of foods. There are relatively few available methods for the determination of cochineal in foods, however analytical methodologies are well established for source materials but these require further development to broaden the scope and to utilise modern technologies. Methods for beet red analysis are even less well established and require development of the method scope to encompass not only the main beet colour principles but also degradation products. The chemistry of the caramels is not well understood and analytical methods are based on the analysis of unidentified, but characteristic marker peaks. There is a need for the application of new analytical technologies to the development of methods for caramel.

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## Published Papers

1. Scotter, M.J. (2011) Methods for the determination of European Union-permitted added natural colours in foods: a review. *Food Additives and Contaminants Part A*, 1-70.

Research report

### England, Northern Ireland and Wales

PDF

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