

Food Microscopy

(AN ANNOTATED BIBLIOGRAPHY)

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PART IIA. MAJOR INGREDIENTS: CEREALS AND FLOURS

A number of ingredients can form the major components in a whole range of manufactured food products. These include cereals and flour, starch and gluten, eggs and egg products, fats and oils, milk and milk powders, sugar and water. Consideration of the microscopy of these ingredients is valuable in that it provides a foundation for the study of more complex products in which these ingredients may be combined in various ways.

CEREALS AND FLOURS

The microscopical structure and composition of cereal grains, such as barley, maize (corn), millet, oats, rice, rye and wheat, have been studied by light microscopy, and both histological and histochemical techniques have been employed. Fluorescence microscopy and electron microscopy have also been used. The light microscope is used to identify the pests of cereals and flours, and is also used for the qualitative and quantitative analysis of cereal grains in feeding stuffs. The effects of various reagents (*e.g.* alkali) on cereal grains have been studied microscopically. The wetting of cereal grains and flour has been investigated, especially in relation to wheat conditioning for milling. Much work has been done on the milling of corn and wheat, on the relationship between structure and milling quality, and between milling and starch damage. The fractions produced by air classification have also been characterised.

The microscopy of cereal flours has been mainly concerned with particle size distribution, and with particle structure. The microscope has been used for the identification of, and detection of adulteration in cereal flours. The determination of bran and germ in flour is also possible. Wheat protein has had detailed structural examination, particularly by electron microscopy.

The microscopical structure of "popped cereals" has been studied, and the cooking and gelatinisation of cereal products, such as rice and wheat flour have been investigated by histological and histochemical techniques.

All these aspects have been covered in considerable detail in the following papers, which constitute a selection of about half the available papers on the microscopy of cereals and flours. Abstracts of papers presented at the Annual Meetings of the American Association of Cereal Chemists (AACC) are published annually in *Cereal Science Today* and are a good reference source, particularly on biochemical and structural aspects.

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ERRATUM

1st Quarter, 1974, page 22.

The author has drawn attention to a statement in the paragraph dealing with the Fertilisers and Feeding Stuffs Regulations, 1973, which is misleading in that it indicates EEC Directives in which methods of analysis may be found. The following, supplied by Mr. Weston of the Government Laboratory, is a correct list of EEC publications relating to fertilisers and feeding stuffs and their methods of analysis.

FERTILISERS AND FEEDING STUFFS

DIRECTIVES ACCEPTED IN TREATY ACCESSION

1. *Council Directive 70/373* dated 20/7/70 establishing Community methods of analysis for sampling and analysis (Minor amendment 72/275 dated 20/7/72).
2. *Council Directive 70/524* dated 23/11/70.
Additives in feeding stuffs
(amendments: *1st Commission Directive 73/264*, 27/7/73)

2nd	"	"	73/275, 27/7/73)
3rd	"	"	74/7, 13/12/73)
4th	"	"	74/38, 17/12/73)
5th	"	"	74/180, 26/2/74)
6th	"	"	74/181, 26/2/74)
7th	"	"	74/182, 26/2/74)

and (*Council Directive 73/103*, 28/4/73)
(urea replaced by non-protein nitrogenous compounds).
3. *1st Commission Directive 71/250* dated 15/6/71.
Methods of analysis for feeds: HCN, Ca, CO₂, ash, acid-insoluble ash, chloride chlorine, mustard oil, lactose, potassium, sodium, sugars, theobromine, urea, lupin alkaloids, urease activity of soya.

DIRECTIVES AWAITING IMPLEMENTATION

4. *2nd Commission Directive 71/393* dated 18/11/73.
Moisture, volatile nitrogen bases, total phosphorus (V) and crude oil.
(U.K. has entered reservations on the oil method.)
(Moisture in milk products, animal and vegetable oils and mineral substances excluded by *Commission Directives 73/47* of 5/12/72.)
5. *3rd Commission Directive 72/199* dated 27/4/72.
Methods for starch (polar), crude protein, 'digestible' protein, free and total gossypol.
6. *4th Commission Directive 73/46* dated 5/12/72.
Annex I : moisture in oils, Mg (AA), crude fibre.
Annex II: retinol, thiamine, ascorbic acid.

7. *5th Commission Directive 74/203* dated 25/3/74.
Annex I: starch (pancreation).
Annex II: amprolium, ethopabate, dinitolmide, nicarbazin and menadione (K₃).
8. *Council Directive 74/63* dated 17/12/73.
Maxima for undesirable substances and products in feeds (this should be brought into force 1.1.76).
9. Commission proposal on marketing feeds [*COM(71)93*] currently under discussion March, 1974.
10. Proposed Council Directive on Fertiliser legislation (*COM(71)1500 fin*).
11. Fertilisers—proposed methods of analysis *111/10388/67*.
12. Sampling of fertilisers: *227/111/71*.