

Book Review

Biophysical Methods in Food Research. Edited by H. W.-S. Chan. (Critical Reports on Applied Chemistry, Vol. 5.) Blackwell Scientific Publications, Oxford, 1984. viii + 204 pp. Price: £19.50.

According to the editor's introduction, this book reviews some of the recent developments in physical techniques which can be applied to the study of food products and raw materials. Emphasis is placed on those techniques which, despite their great potential, have yet to find extensive application. The book consists of four chapters, each written by a specialist, dealing with thermoanalytical, optical, spectroscopic and rheological methods.

The chapter on thermoanalysis (by D. J. Wright) concentrates on differential thermal analysis (DTA) and scanning calorimetry (DSC). The author states that thermogravimetry, thermomechanical analysis and dilatometry are of lesser importance, a claim with which some might take issue. He treats DTA and DSC in a rather conventional manner, describing what *has* been done, rather than what *might* be done. No mention is made of the use of the techniques in the isothermal mode to study the kinetics, e.g. of crystallization from amorphous systems.

This reviewer got the impression that thermoanalytical methods serve mainly as fingerprinting techniques. For instance, what is the point of calculating the total ΔH for several overlapping thermal transitions? The figures of thermograms are inconsistent, with endotherms being

shown upwards in some cases, and downwards in others. Both calories and joules are used as units of energy. Although examples from food research are cited, they tend to be run-of-the-mill applications of DTA and DSC.

The second chapter, on optical methods (V. J. Morris), begins with five pages of symbols which set the tone of what is to follow. The author reviews the basic theory of scattering, linear and circular birefringence and dichroism in a concise and competent manner, which makes easy and interesting reading. All these methods require optically transparent samples, so that their direct relevance to food research is somewhat questionable. Accordingly the examples are drawn from conformational transitions in dilute solutions of biopolymers. It is doubtful whether polyisocyanates in CCl_4 qualify as biopolymers. The third chapter (by P. S. Belton) deals with some specialised aspects of NMR and with photoacoustic spectroscopy (PAS). Few examples from food research are given because 'of the novelty of PAS and the rapid development of NMR'. The description and treatment of NMR and its applications, including imaging, for systems of potential interest to food scientists are hardly new. The description of the 'states' of water in complex systems hardly reflects current thinking among those engaged in the debate on so-called 'bound' water. On the other hand PAS is shown to offer exciting new possibilities, both for the analysis of volatile substances, and for the characterisation of condensed phases.

The last chapter, devoted to rheology (by S. B. Ross-Murphy), should be compulsory reading for all aspiring food scientists. The theories describing responses to mechanical deformation are clearly presented, commercially available instrumentation is critically discussed and many applications to *real* systems, solid, semi-solid and liquid, are described in detail.

One might or might not agree with the author's view that the usefulness of rheological investigations is mainly limited by a general ignorance of the phase behaviour of food systems in terms of the phase rule. Surely the phase rule deals with the coexistence of equilibrium phases in multicomponent systems, whereas in the preparation of processed foods the attainment of equilibrium should be avoided. Thus, margarine, ice cream, mayonnaise, etc., rely for their desirable attributes on the avoidance of equilibrium during processing. The same is true for the simpler starch/water system where the amorphous (non-equilibrium) fraction is of utmost importance.

All the same, the author has done a splendid job of explaining the important aspects of rheological measurements in food research. It is easily the best and clearest presentation of the subject that this reviewer has ever read. Dr Ross-Murphy has resisted the temptation of showing off his prowess by an excess of the obscure mathematics to which rheology so easily lends itself.

In summary, this is a useful book, even though its relevance to food research is in places contrived. The rheology chapter is a gem.

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