

Book reviews

Practical NIR Spectroscopy. By B. G. Osborne, T. Fearn & P. H. Hindle. Longmans, UK, 1993. 227pp. ISBN 0582-099463. Price: £65.00

Vibrational spectroscopy has long been used by the chemist as an important method for *qualitative* analysis. Thus, for example, in functional group identification of organic molecules infrared spectroscopy plays a very active role. The first near infrared (NIR) spectra—of solar emission—were recorded by Herschel as long ago as 1800 and the first NIR spectra of organic liquids were obtained in 1881. However, this method, as a means of qualitative analysis, has been rather neglected, largely as it is very difficult to make positive assignments, for complex molecules, of bands which generally result from combinations and overtones of fundamental vibrations—often those making hydrogen atoms.

In recent years the use of vibrational spectroscopy as a method for *quantitative* analysis has been actively developed. One of the main reasons for this upsurge has been the development of data handling systems which can store spectral data and perform the often rather complicated mathematical manipulations necessary for quantitative analysis. It is in this field that NIR spectroscopy has come into its own. The low absorptivities of NIR absorption means that long pathlengths may be used; in some systems transmission through intact samples is possible, in others measurements by diffuse reflectance from the surfaces of opaque materials may be made. Sampling is rarely a problem since most optical materials and water have low absorptivity in this region; thus spectra of samples in glass vessels and spectra of aqueous solution may be recorded. These advantages are shared by another vibrational spectroscopic technique namely FT-Raman, although it is fair to say that so far NIR spectroscopy has been more widely used in quantitative analysis than has Raman spectroscopy.

The food industry has a long history of using NIR spectroscopy. Thus it is no surprise that NIR has now become one of the most widely used methods for food and beverage analysis. This book is, therefore, timely. It is also well written and logically set out. It covers fundamental principles. Thus, the origin of NIR bands is given a detailed treatment both in terms of how radiation interacts with matter to produce absorption bands and of which vibrations give rise to which absorption. There is an extremely useful chapter on NIR instrumentality. This will be of much use to those

carrying out experiments in the area; thus we have information on spectrometers, sources, various types of cell, fibre optics and sample preparation. The last chapter of the book returns to the theme of experimentation. Here many practical aspects of NIR analysis are covered, such as design of calibration experiments, standardisation of experiments and analytical quality assurance. Sandwiched between these two essentially practical chapters are two sections giving an outline (where mathematics is kept to a sensible minimum) of calibration methods, and one chapter, which is perhaps the central part of the whole book, discussing application of NIR spectroscopy in food and beverage analysis.

In conclusion I can recommend this book to those working in the food industry, and to those with an interest in vibrational spectroscopy who wish to learn more about its role in quantitative analysis.

M. J. Almond

Enzymes in Food Processing, Third edition. Edited by T. Nagodawithana & G. Reed. Academic Press Inc., London, 1993. xxiv + 480 pp. ISBN 0-12-513630-7.

This is the Third Edition of the book, previous editions appearing in 1967 and 1975. According to the preface it has been completely rewritten because of the extensive changes in the way enzymes are used and the availability of new enzymes. Chapters on enzyme functionality and the effect of environmental parameters have been expanded and chapters on genetic modifications of enzymes and the uses of enzymes in fish processing have been included.

The book can be divided into three main sections, which are as follows:

- (1) General characteristics of enzymes with chapters on; Environmental effects on enzyme activity; Modern methods of enzyme expression and design; and Immobilised enzymes. These chapters present the basic concepts required to understand enzyme usage in food processing.
- (2) Chapters dealing with specific types of enzymes. These are: Carbohydrases; Proteases; Lipases; Oxidoreductases. Some applications of oxidoreductases. The last chapter is quite short and perhaps could have been combined with the previous one.
- (3) Chapters covering applications of enzymes in different commodity sectors. These are: Milling

and baking; Starches, sugars and syrups; Dairy products; Pectic enzymes in juice manufacture; Enzymes associated with savoury flavour enhancement; Wine; Enzymes in brewing; Fish processing.

The book is well written and presented, with a simple but eye-catching blue cover. Most of the chapters have several sections and each chapter is well referenced. I spotted very few typographical errors, although some non-standard abbreviations have crept in (p. 245, hr; p. 347, sec). The book layout and the way in which it covers specific enzymes, followed by a commodity approach inevitably leads to overlap. For example, information covered in the chapter on carbohydrases also appears in the chapters on pectic enzymes in fruit and vegetable juice manufacture, milling and baking, wine-making, and dairying. The same can be said for most of the other enzymes. However, there is little cross-referencing between these different sections or chapters. This is to some extent compensated by a very comprehensive index, which is useful when looking for specific information. For example, searching for information on the use of lactoperoxidase for controlling microbial activity in milk, I found two references, but it was interesting that neither of these were in the dairying section. I was also interested in low-lactose milks and found described on p. 141, a potential novel application, using lactase enzymes in sterilised milks. In fact this is now a commercial reality in the UK, with such products, produced by adding a sterile enzyme to milk after UHT treatment, being available for cats.

There were a few minor omissions. I found hardly any information on the use of enzymes in combination with membranes in continuous enzyme reactors, for hydrolysis of carbohydrates or proteins, although there was a very brief mention of such reactors in the lipase section. I was also surprised to see no mention of heat resistant lipases and proteases in the dairy section; the latter, in particular can cause problems during storage of UHT products.

I enjoyed reading and reviewing this book and am sure that it will become a much-consulted reference work on all aspects of enzymes in foods.

Mike Lewis

Instrumentation and Sensors in the Food Industry.
Edited by E. Kress Rogers. Butterworth Heinemann, 1993. xxxi + 780 pp. ISBN 0 7506 1153 7.

This is a very comprehensive book, which covers on-line, at line and remote (laboratory) measurements. It is divided into three main sections, preceded by an overview which provides a brief review of the subject area, and discussion of the constraints placed by foods and cleaning regimes together with the challenges faced by designers of instrumentation for food quality assurance. The contents are described to give an impression of the breadth of coverage provided.

Part 1 deals with In-line Measurement for the control of food processing operations. There are chapters on: Principles of colour measurement of food; Colour measurement of foods by colour reflectance; Sorting by colour in the food industry; Compositional analysis using Near Infrared Absorption Spectroscopy; Practical aspects of infrared thermometry; Microwave measurements of product variables; Ultrasound propagation in foods and ambient gases: principles and applications; Ultrasonic instrumentation in the food industry

Part 2 deals with Instrumental Techniques in the Quality Control Laboratory. There are chapters on: Rheological measurements; Modern methods in texture measurement; Water activity and its measurement in food; Instrumental methods in the Chemical quality control laboratory; Impedance tests for microbial Assay; Impedance Microbiology in food quality control.

Part 3 deals with New Sensors for Applications in the food Industry. There are only two chapters in this section. The first is entitled 'The marker concept: frying oil monitor and meat freshness sensor'. The second is on Chemosensors, Biosensors and Immunosensors. This is a long chapter which is further subdivided, with references at the end of each subdivision. The emphasis in this section is on new ideas and concepts, with an eye to future developments in food quality assurance procedures.

The Appendices cover a glossary of terms, which is extremely useful. I think this could have been given more prominence, maybe even its own chapter. Units and dimensions, conversions and some physical properties are also covered. The index, which is 66 pages long, is one of the most comprehensive that I have seen in any book. This adds to its value as an extremely useful reference source: one which provides an up-to-date picture of the state of the art, in an area which is subject to many interesting new developments. Most of the chapters discuss methods from the very simple to the highly sophisticated, for example in the chemical analysis, from simple moisture, fat and nitrogen determinations, through to different types of chromatography and mass spectrometry. Unfortunately, I suspect that some of the instruments described, in this and other chapters, would be outside the budgets of many laboratory managers, although this in no way detracts from their value in the text. The only disappointment was the omission of any detailed discussion on temperature measurement, apart from infrared thermometry. This is a fundamental parameter in many aspects of food control and safety. In the preface, it is mentioned that there are a new range of instruments well beyond the measurement of pressure, temperature, level and flow rate; however these four important control parameters were not discussed in any detail and in my opinion would have merited a chapter.

This book will be of immense interest and value to all those engaged in measuring physical, chemical, biochemical and microbial properties of foods and improving the safety and quality of processed foods.

Mike Lewis