METHODS IN FOOD ANALYSIS

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Florida: CRC Press, 2014. 250 pp.
ISBN 9781482231953

Increasing demands on high-quality and safe foods production coupled with needs for innovations in food production in terms of e.g. novel foods, functional foods or foods for people with special dietary needs development, create press also to analytical methods development, applicable for food quality, originality and composition assessment and verification. As is stated by the book editors, measurement of food quality parameters, either physical, chemical, microbiological or sensorial, is necessary to characterize both existing and newly developed food products, to avoid possible adulteration/contamination and thus control their quality at every stage of production/distribution or storage at industrial and laboratory scales. Of course, plenty of different parameters can be taken for the purposes described above, applicable generally or specifically to certain food types. The editors decided to focus on selected parameters of fruits and vegetables, muscle foods, meat and fish products, seafood and edible oils.

The book is divided into seven main chapters, each dealing with the determination of qualitative/quantitative parameters in specific food matrices. The chapters were written by author teams from research groups in India, South Korea, Tunisia, Spain, Portugal and Poland, on the basis of recent information (according to the literary sources cited) in the respective field, offering thus the readers sufficient background information to the problems.

First chapter describes the methods applicable for characterization of textural and rheological properties of fruits and vegetables, which are aspects important both for consumers (in terms of the quality and acceptability) and producers (from the aspects of food and equipment design, handling systems, products flow and heat transfer optimization, new product development or quality control). Authors present the methods for rheology characterization via methods based on viscosity and viscoelasticity measurement (shear stress/shear strain concept), and for textural characterization based on deformation measurement. Last sub-chapter reviews the application of the presented methods to selected food products including fruit juices, jams, purées, fruit pastes or pulps, and discuss the aspects of rheology, texture and food quality.

The second chapter is devoted to pigments and colour characterization of muscle foods, as one of the most important sensorial property influencing significantly the consumers' decision-making process. The authors point on factors influencing colour of muscle-based foods and its changes, discuss the aspects of pigments composition and their concentration in muscle foods of selected animals, as well as factors with key importance on their changes, including species, breed, age, muscle type and sex of the animals. As meat colour is, according to the authors, most significantly affected by the concentration of myoglobin, a part of this chapter also introduces the chemistry of myoglobin and its derivative from their formation/transformation and stability points of view. Last subchapter presents the routine methods for colour evaluation based either on visual evaluation, based on traditional reflectance measurement, instrumental colour measurement and the most modern computer vision analysis.

In the third chapter, methods of analysis and quantification of lipids in fruits and vegetables are reviewed. Methods applicable to vegetable oil extraction from the matrix are presented, followed by the methods applicable to analysis of different fractions of oils. Presented are the methods on the basis of chromatography (TLC, GC, HPLC), spectroscopy (mass spectrometry, Raman spectroscopy, NMR) and electrophoretic methods.

Forth chapter deals with methods for measurement of textural properties of meat and fish, with specific focus on properties of their derivative products – restructured meat or sausages. Shearing tests, as the most frequently used in food texture analysis, are presented, including Warner-Bratzler, razor blade, Volodkewich, back extrusion methods or bulk analysis and their modifications, applicable for meat, fish and poultry food texture characterization. In addition to shearing methods, also methods based on penetration and compression measurement are reviewed. Besides these, also rather innovative methods based on tensile strength evaluation or non-destructive "finger" methods and their application are introduced.

Fifth chapter summarises the information regarding the methods applicable for identification and quantification of pigment compounds present in fruit and vegetables. The authors performed also brief survey of the relevant extraction techniques often used for these purposes, with particular accent on carotenoids and chlorophyls, anthocyanins and betalains as the most abundant natural pigments in fruit and vegetables. Both chromatographic methods (involving HPLC, open-column chromatography, TLC, supercritical fluid chromatography and capillary electrophoresis) as the most frequently used, and alternative non-chromatographic – mostly spectroscopic (Vis, NIR, reflectance, fluorescence) methods are reviewed.

Sixth chapter deals with the most representative methods of lipid extraction, total fat quantification and characterization of fatty acid profile and oxidative stability in meat and seafood. In the chapter, also main roles and structure of lipids are presented, strengthening the role of fatty acids in human health and nutrition. In details, an overview of most commonly used lipid extraction methods is presented, coupled with particular method description, together with advantages and disadvantages of their application to meat and seafood analysis. Methods are generally divided to liquid-liquid and solid-liquid based ones. Besides them, also modern non-organic solvent-based extraction methods, e.g. supercritical fluid extraction or microwave-assisted extraction are presented. As regards methods of analysis, classical analytical methods, providing mostly the information on average molecular weight, degree of unsaturation, acidity, free fatty acids content, saponification values or measure of oxidative determination together with detailed application protocols are presented. In addition, more instrumental methods for analysis offering detailed qualitative/quantitative information especially on triacylglycerols and fatty acids on the basis of TLC, GC or HPLC are summarized. Regarding the last mentioned method, detailed information is provided on the most suitable columns and separation conditions according to the type of analysed sample.

The last chapter presents the applications of vibrational and electronic spectroscopic techniques coupled with chemometrics in studies of edible oils. The edible oils quality can be effectively characterized by monitoring the spectra in UV, visible (Vis) and near infrared (NIR) and mid infrared (MIR) regions, or by fluorescence and Raman spectroscopy. Qualitative and quantitative multivariate methods of spectral analysis are presented. As follows from the presented information, processing of the spectral data allows the prediction of oil properties, as well as calibration and discrimination based on the spectral measurement.

In general, the book represents a good overview of the existing state of art in the methods of analysis of concerned foods. Although it is not an encyclopaedia, it will be valuable for university students at undergraduate and postgraduate levels in food science and technology, as an ideal reference source. Readers from R&D laboratories working in this field would, of course, need more detailed information on the topic, which the book with a limited size cannot offer.

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