

Detection Methods for Irradiated Foods

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and A.S. Bawa

ABSTRACT: Proper control of irradiation processing of food is very critical to facilitate international trade of irradiated foods and to enhance consumer confidence, consumer choice, and safety. Analytical detection of radiation-processing of food is very important to implement quality control at all levels. An ideal detection method should measure a specific radiation effect, which is proportional to the dose and should not be affected by processing parameters and storage conditions or the length of time between irradiation processing and analysis. The detection of irradiated foods is mainly based on radiolysis of lipids, modification of amino acids, modification of DNA, modification of carbohydrates, formation of free radicals, release of hydrogen gas, alterations in microbial load, measurement of biological difference, and other physical methods.

Introduction

Irradiation has recently become one of the successful techniques to preserve food with minimum interruption to the functional, nutritional, and sensory properties of food products. This processing of food involves controlled application of energy from ionizing radiations such as gamma rays, X-rays, and electron beam for food preservation. Irradiation preserves the food by disrupting the biological processes that lead to decay of food quality. Radiation interacts with water and other biological molecules in a food system and produces various radiolytic products, which generally act as oxidizing agents and can cause several changes in the molecular structure of organic matter. Radiations also damage DNA molecules effectively, so living cells such as in microorganisms, insects, and gametes are prevented from reproduction, resulting in a preservative effect. Irradiation, like other processing techniques, results in physicochemical changes in food products.

The nature and extent of these changes depend on the kind of food subjected to irradiation and the irradiation dose. Irradiation involves exposing the food, either prepackaged or in bulk, to a predetermined level of ionization radiation. Almost 40 countries, including India, have approved the use of irradiation for over 100 food items, but in some countries it is prohibited. Table 1 shows the current uses of food irradiation by processing industries and institutional catering worldwide (Farkas 1988; Kilcast 1995). In recent years, the volume and number of irradiated food products introduced in the market have grown steadily. As a result, consumers and legislative authorities demand clear labeling of irradiated foods. Presently, the labels of irradiated food products indicate the treatment and purpose of irradiation.

The food irradiation policies vary from country to country. The U.S. Food and Drug Administration (FDA) regulates all aspects of irradiation, such as irradiation dose, product type, and labeling requirements. Foods permitted for irradiation under FDA's

regulations are shown in Table 2 (Morehouse 2002). The U.S. Dept. of Agriculture (USDA) is responsible for the inspection and monitoring of irradiated meat and poultry products, as well as for the enforcement of FDA regulations related to these products. Since 1986, it has become mandatory that all irradiated products must carry the internationally accepted radiation symbol "radura." The development of analytical methods for correct identification of irradiated samples from nonirradiated samples has thus become important for upholding regulatory controls, checking compliance against labeling requirements, facilitating international trade, and reinforcing consumer confidence. Regulatory authorities in all countries are interested in having reliable methods to detect irradiated foods as well as estimation of dose.

Prior to 1980, limited work was carried out for the development of reliable detection methods for irradiated foods. After 1980, extensive research was undertaken which resulted in the development of a range of test methods that can be used to reliably determine the irradiation status of a wide variety of foods. During 1996, the European Committee for Standardization (CEN) adopted 5 European standards for detection of irradiation process in food commodities, EN-1784 to EN-1788, and in 2004 5 more validated standard methods, EN-13783, EN-1384, EN-14596, EN-13708, and EN-13751 came in to existence (Stewart 2001) (EN 13708:2001, 13551:2002, 13783:2001, 13784:2001, 14569:2004, 1784:2003, 1785:2003, 1786:1996, 1787:2000, 1788:2001, and 14569:2004). The methods used for the detection of irradiated foods are based on physical, chemical, biological, and microbiological changes in food products during irradiation, although these changes are minimal.

Physical methods

The physical methods measure the effects of the radiation-generated radicals or trapped electrons in the solids. These methods may either leave free radicals and electrons unchanged or stimulate some of the electrons and measure their absorbed radiation energy. They are practically involved with the radiation-generated defects by dissolution of the solid substances.

MS 2008-0218 Submitted 4/28/2008, Accepted 8/20/2008. Authors are with Defence Food Research Laboratory, Mysore, Karnataka 570 011, India. Direct inquiries to author Chauhan (E-mail: Sulaxana.chauhan@yahoo.co.in).

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Leo M.L. Nollet, Fidel Toldra



Detection Methods For Irradiated Foods Current Status:

Detection Methods for Irradiated Foods Cecil H. McMurray,1996 This book draws together known methods for detecting irradiated foods and will act as an authoritative guide to analytical scientists and food chemists interested in this subject

Safety Analysis of Foods of Animal Origin Leo M.L. Nollet,Fidel Toldra,2016-04-19 We cannot control how every chef packer and food handler might safeguard or compromise the purity of our food but thanks to the tools developed through physics and nanotech and the scientific rigor of modern chemistry food industry and government safety regulators should never need to plead ignorance when it comes to safety assurance Written by world renowned scientists and experts in their fields of research this book examines the tools available for the analysis of safety parameters in food of animal origin It covers safety aspects of biological agents and products of different organisms and methods to control the presence of bacteria viruses or parasites It also discusses adulteration foreign compounds irradiation and genetically modified organisms It reviews sample preparation clean up methods and detection methods The book concludes with a brief summary of guidelines for the presence of these parameters for different end products

Food Irradiation Research and Technology Christopher H. Sommers,Xuetong Fan,2008-02-28 The benefits of food irradiation to the public health have been described extensively by organizations such as the Centers for Disease Control and Prevention in the U S and the World Health Organization The American Medical Association and the American Dietetic Association have both endorsed the irradiation process Yet the potential health benefits of irradiation are unknown to many consumers and food industry representatives who are wary of irradiated foods due to myth information from consumer advocate groups Food Irradiation Research and Technology presents the latest scientific findings of researchers at the leading edge of food irradiation In this book experts from industry government and academia define the basic principles of irradiation and the public health benefits of irradiation describe advances in irradiation technology detection technology and radiation dosimetry review the regulations pertaining to food irradiation and the toxicological safety data provide food industry representatives and public health officials with effective methodologies to educate consumers and counteract misinformation review recent advances in the irradiation of meat and poultry fruits and vegetables seafood and the use of irradiation as a phytosanitary treatment Food Irradiation Research and Technology appeals to a broad readership industry food scientists involved in the processing of meat and fish fruits and vegetables food microbiologists and radiation processing specialists government and industry representatives involved in the import and export of food commodities and industry local and state officials involved in educational efforts regarding food irradiation Food scientists and technologists share a responsibility to ensure that educational materials provided to the public regarding food safety and processing technologies are based on sound science and fact not on misconceptions Food Irradiation Research and Technology meets that goal

[Analytical Detection Methods for Irradiated Foods](#) ,1991 *Detection Methods for Irradiated Foods - Review of Current Developments* T. Hayashi,1992 *Proceedings*

of the International Symposium on Luminescence and Its Applications ,2000 **Canadian Journal of Physiology and Pharmacology** ,2001 Journal of the Chemical Society of Pakistan Chemical Society of Pakistan,2007 *Journal of AOAC International* ,1994 **Radiation Processing for Safe, Shelf-Stable and Ready-To-Eat Food** International Atomic Energy Agency,2003 The increasingly busy lifestyles of populations in many countries have driven the demand for safe convenient and ready to eat food Traditional food processes such as drying canning or refrigeration offer a partial solution to this demand as the sensory quality of such food may be significantly affected or the products may be contaminated by bacteria during preparation For developing countries safe shelf stable food without the need for refrigeration would offer advantages Irradiation offers a potential to enhance microbiological safety and quality of food through shelf life extension A Coordinated Research Project CRP on the Development of Safe Shelf Stable and Ready to Eat Food through Radiation Processing therefore was implemented by the Joint FAO IAEA Division of Nuclear Techniques in Food and Agriculture to evaluate the role if irradiation for such food This publication presents the encouraging research results reported at the final research coordination meeting on this CRP Annual Report. Scottish Crop Research Institute Scottish Crop Research Institute,1996 *Energy Research Abstracts* ,1993 Semiannual with semiannual and annual indexes References to all scientific and technical literature coming from DOE its laboratories energy centers and contractors Includes all works deriving from DOE other related government sponsored information and foreign nonnuclear information Arranged under 39 categories e g Biomedical sciences basic studies Biomedical sciences applied studies Health and safety and Fusion energy Entry gives bibliographical information and abstract Corporate author subject report number indexes **Nuclear Science Information of Japan. Oral Presentation** ,2002 **Nutrition Abstracts and Reviews** ,2001 Chemistry and Industry ,1997 *Advances in Microbial Food Safety* Vijay K. Juneja,John P. Cherry,American Chemical Society. Meeting,2006 A timely scientific examination and definitive explanation of current food safety technologies used in preventing finding detecting removing destroying predicting behavior for better management of food borne pathogens topics of immense interest today because of consumer preference for high quality fresh minimally processed foods that offer consumer convenience in availability and preparation In this book leading researchers and practitioners in food safety present a thorough and cutting edge examination and explanation of the various technologies at the forefront aimed at improving the safety and quality of our food supply Topics include genomic and proteomic approaches diagnostic techniques based on molecular immunological biosensor based methods quorum sensing pre and post slaughter interventions thermal treatments for muscle foods and sous vide products emerging non thermal processing technologies such as food irradiation radio frequency pulsed electric field and hyrostatic pressure processing as well as predicting the behavior and fate of microbial pathogens as related to risk assessment modeling thermal inactivation regulatory perspectives and performance standards and prevention of the use of food as a weapon of terrorism Proceedings of the Symposium on Irradiation Technology for

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