

# Detection Methods for Irradiated Foods

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**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).

# Detection Methods For Irradiated Foods Current Status

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