ANALYTICAL ACTIVITY OF THE LABORATORY FOR DETECTION OF IRRADIATED FOOD IN 2005

Wacław Stachowicz, Kazimiera Malec-Czechowska, Katarzyna Lehner, Grzegorz P. Guzik, Magdalena Laubsztejn

The activity of the Laboratory for Detection of Irradiated Foods, Institute of Nuclear Chemistry and Technology was focused in 2005 on the following topics:

- development and improvement of the methods for detection of irradiated food implemented and accredited earlier in the Laboratory,
- implementation of new standardised detection methods to be accredited in the Laboratory,
- analytical activity to fulfil the requirements of numerous firms and institutions from abroad and from the country. The purpose is to prove whether food products delivered for examination are or are not treated with ionising radiation.

In 2005, two detection methods adapted in the Laboratory have been implemented. One method is based on EPR (electron paramagnetic resonance) spectrometry, while its preparation and measuring procedures have their source in the European standard PN-EN 13708 [1]. The method is capable to detect all foods containing crystalline sugars *e.g.* dried fruits like dates, figs, resins *etc*. The second method employs photostimulated luminescence released from a sample proving its radiation treatment. The method was implemented after the installation of pulsed photostimulated luminescence (PPSL) system in the Laboratory this year. The corresponding European standard is numbered PN-EN 13751 [2]. This is a screening method but very useful for fast detection of irradiation in spices and herbs.

Actually, three detection methods have PCA (Polish Center for Accreditation) accreditation certificates and are routinely used for the examination of irradiation in food samples delivered from the clients. Two methods are based on EPR spectrometry, while the third one takes the advantage

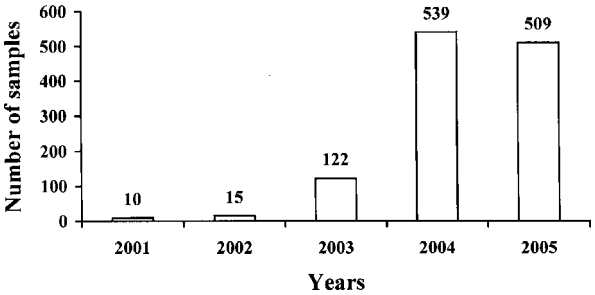

Fig.1. The number of samples analysed in the Laboratory for Detection of Irradiated Food in the period from 2001 to 2005.

of thermoluminescence effect. The methods make it possible the detection of irradiation:

- in food containing bone, *e.g.* meat, poultry and fish according to European standard PN-EN 1786 [3];
- in food containing crystalline cellulose, *e.g.* in nuts and some spices (European standard PN-EN 1787) [4];
- in food from which silicate minerals are isolated, *i.e.* in spices, herbs and their blends, dried and fresh vegetables, shrimps (European standard PN-EN 1788) [5].

The majority of 509 samples examined during the year 2005 (Fig.1) have been received from Germany and Italy, but some samples were also delivered from the United Kingdom, Denmark, and Sweden. Altogether 385 samples of various foodstuffs obtained from abroad have been examined. The number of samples delivered from the country is 124.

It has to be stressed, however, that only 4 samples have been received from private firms, while 120 were examined for the purpose of monitoring organised by the Chief Sanitary Inspector of Poland under supervision of the Ministry of Health (Fig.2).

Fig.2. The origin of the orders for the examination of food samples in 2005.

The most of samples were examined by the thermoluminescence (TL) method (European standard PN-EN 1788 [5]). It is because the most of them contained spices as an ingredient. The products received were spices and their blends and/or foodstuffs or pharmacy composites containing spices, generally as flavour ingredients. About 7% of all samples have been examined by the EPR methods (European standards PN-EN 1786 [3] and PN-EN 1787 [4]).

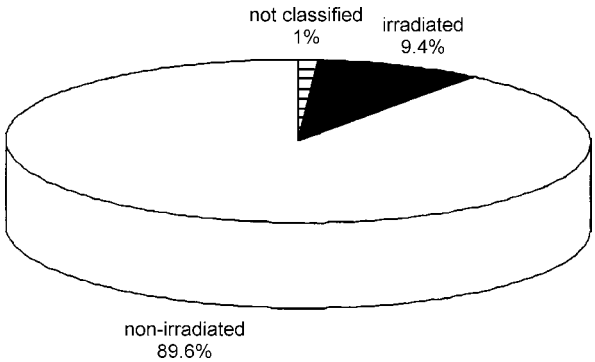

Fig.3. Classification of food samples undertaken to examination in 2005.

More and more frequently the Laboratory receives a lot of composed samples which have not been analysed earlier by the TL method in the Laboratory.

Under this new situation the Laboratory is faced today (a) how to analyse the complex samples to obtain reliable results and (b) how to treat those samples which cannot deliver reliable results and hence, will not undergo classification whether irradiated or non-irradiated according to standard PN-EN 1788 [5]. First problem finds very often its solution in the modification, if necessary, of the preparation technique leading to more effective isolation of mineral fraction and/or in an increase of the mass of a single sample to be examined.

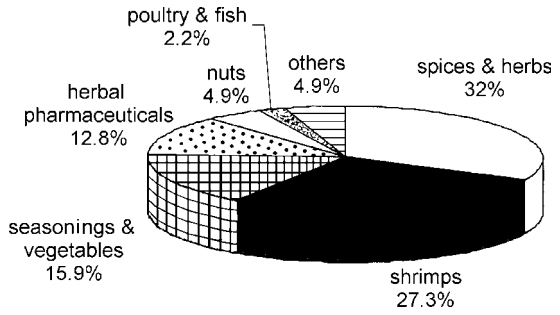

Fig.4. Assortment of foodstuffs examined in 2005.

Sometimes, however, the separation of silicate minerals remains still unsuccessful. Under such a condition, the examination of a sample is not satisfactory and thus the test report cannot include the statement whether the sample was or was not irradiated. Usually, we inform our client in advance that such situation may appear and the receiving of reliable result of the analysis may be rather problematic. This year, only 5 samples remained unclassified.

Among the 509 food samples analysed in this year, 89.6% were found unirradiated, 9.4% – irradiated, while 1% samples remained not classified (Fig.3).

The assortment of foodstuffs that were examined in 2005 (Fig.4) compiles:
- spices, herbs and their blends that may contain a small admixture of irradiated spices as a flavour ingredient (32%);
- seasonings, fresh and dried vegetables (15.9%);
- shrimps (27.3%);
- herbal pharmaceuticals, herbal extracts (12.8%);
- foods containing bone – poultry, meat and fish (2.2%);
- nuts in shell (4.9%);
- others – instant soups, red fermented rice, all purpose savoury seasoning (4.9%).

References

[1]. PN-EN 13708:2001: Foodstuffs – Detection of irradiated food containing crystalline sugar by ESR spectroscopy.
[2]. PN-EN 13751:2002: Foodstuffs – Detection of irradiated food using photostimulated luminescence.
[3]. PN-EN 1786:2000: Foodstuffs – Detection of irradiated food containing bone. Method by ESR spectroscopy.
[4]. PN-EN 1787:2001: Foodstuffs – Detection of irradiated foods containing cellulose. Method by ESR spectroscopy.
[5]. PN-EN 1788:2002 Foodstuffs – Thermoluminescence detection of irradiated food from which silicate minerals can be isolated.

PPSL – THE NEWLY INSTALLED ANALYTICAL SYSTEM FOR THE DETECTION OF IRRADIATED FOOD

Grzegorz P. Guzik, Wacław Stachowicz

The pulsed photostimulated luminescence (PPSL) system has been installed in the Laboratory for Detection of Irradiated Food at the beginning of 2005. The system, composed of two modules, was manufactured by the Scottish Universities Research and Reactor Centre – SURRC (United Kingdom) in 2004.

The PPSL system has been developed to meet the requirement of European food market that needed a relatively simple and compact device for fast control of foodstuffs whether irradiated. Indeed, two Directives of the European Parliament, 1999/2/EC and 1999/3/EC established the requirement of labelling and control of irradiated foods in all EU countries [1-3].

The method of the detection of irradiated food using photostimulated luminescence has the status of European Standard EN 13751:2003 and is recommended for the use as a control method for the detection of irradiation in foods since 2003. The corresponding Polish replica of European standard is numbered PN-EN 13751:2003 (U).

The PPSL method is today successfully used for examination of the whole spices and herbs and some other food products to detect the earlier radiation treatment in them [3,4].

Currently, the research program with the use of PPSL system in the Institute of Nuclear Chemistry and Technology (INCT) is focused on the examination of archival samples of herbs and spices stored in the Laboratory. Basil, chilli, curry, tarragon, nutmeg, mustard, clove, juniper, dill, turmeric, lovage, oregano, black pepper and white pepper, sweet pepper and cayenne pepper, parsley and rosemary have been tested so far.

Principle of the PPSL method

Mineral debris of silicates and bioinorganic composites (calcite and hydroxyapatite) are the natural contaminants of most foods, *e.g.* of spices, herbs and seasonings that belong to most frequently irradiated food products. They are mainly composed of quartz and feldspar, as proved in earlier works [1-3]. This debris stores steadily the energy of ionising radiation in charge carriers trapped at structural, interstitial or impurity sites [4]. Charge carriers which are very stable at ambient temperatures are released from mineral debris with increasing temperature – thermoluminescence (TL)