Irradiated samples indicate only a small increase of the PPSL signal, whereas with unirradiated ones the increase of the signal is significant.

**Application and limitations of measures**

The method of detection of irradiated food by means of PPSL has been positively tested in interlaboratory tests for samples of shellfish (*e.g.* prawns), herbs, spices and seasoning [9-11].

PPSL sensitivity depends on the quantity and type of minerals present in the individual sample. Signals of the intensity below the lower threshold ($T_1$) are generally associated with unirradiated material, but sometimes can be also derived from low sensitivity irradiated materials. In general, calibrated PPSL measurements are recommended for shellfish with low mineral contents and „clean" spices (*e.g.* nutmeg, white and black pepper) to avoid false negative results [9,14]. According to our experience, for the examination of any sample delivered from our clients the calibrated PPSL measurement should be always adapted.

Multicomponent food products like curry powder, for example, and blended seasonings may contain the debris of minerals of low PPSL sensitivities, in which case calibrated PPSL may also provide unclear results. In such a case it is necessary to turn to TL measurements.

Food products classified in the course of our investigation as such that may provide unclear results of PPSL measurements are: garlic powder, carrot pepper (leaves), sweet pepper (powder), black pepper (grains), black pepper (ground), clove (whole), dried dill (powder).

The presence of salt in a product given for examination intensifies so much the PPSL signal intensity that its contribution dominates to an extent which masks effectively signals from any irradiated ingredient. The dominance of the luminescence from crystalline salts in a product makes the signals from irradiated components undetectable. An admixture to a product of the following salts makes the examination of by PPSL method not rational: sodium chloride (domestic salt), natrium sorbitan, sodium benzoate, monosodium glutamate, Arabic gum.

It has to be strongly stressed that the examination of samples containing the above ingredients may also cause the damage of photomultiplier and is prohibited.

Sometimes hydration of a product leading to full dilution of salt and its elimination followed by drying and PPSL measurement can both identify and rectify this situation.

**Conclusions**

The PPSL method can be successfully used for the detection of irradiation in pure spices, herbs and seasonings as well as in most of multicomponent blends of spices, herbs and seasonings [6,14,15].

Screening by means of the PPSL apparatus is easy, effective and first and above all inexpensive. The method provides the fastest way to gain final results whether food product is irradiated. By comparison with the TL method, preparation of samples is simple, much quicker and takes not longer than one hour instead of few days by the TL method. However, in ambiguous results of PPSL, the validated TL method should be always used [16].

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# DETECTION OF IRRADIATION IN CUTICLES OF COMMERCIAL SHRIMPS

**Katarzyna Lehner, Wacław Stachowicz**

The detection of stable EPR (electron paramagnetic resonance) signal produced by the action of ionising radiation in crustacea has been reported by several authors elsewhere [1,2]. The signal ob-

served was identical with that used for detection of irradiation in bone and eggshell by the EPR method. This signal is specific for hydroxyapatite that appears in some extent in exoskeletons of shrimps and crabs. However, the results of model studies on these products were not reliable enough. For that reason, crustacea are not quoted until now in European Standard EN 1786 among food products that can be examined by EPR method to prove their irradiation [3]. The most reliable results have been obtained with lobsters [4]. The results of the examination of various crustacea species indicated that the EPR signal is more or less influenced by the variety, origin and age of crabs.

Nowadays, the Laboratory for Detection of Irradiated Food has more and more orders for detection of irradiation in shrimps. Part of them are delivered in cuticles. A method adapted to accomplish the detection of irradiation in shrimps is a thermoluminescence measure. However, the analytical procedure is much time-consuming and needs several days to receive the final result.

The aim of present study was to prove, whether the EPR examination of cuticles taken from shrimps could be used as a screening method for the detection of irradiation in this product. The earlier results obtained with irradiated cuticles of shrimps only seem promising [5].

In a model study commercial shrimps were irradiated in a $^{60}Co$ source with doses of 1, 3 and 7 kGy. The technological dose recommended for microbial decontamination of shrimps is between 3 and 7 kGy.

Cuticles taken from the shrimp body were cleaned, dried and subsequently crushed to small pieces to be measured by the EPR method. The resultant spectra recorded with cuticles irradiated with 3 and 7 kGy are shown in Fig.1. The positions of coefficient g (spectroscopic splitting factor), specific for irradiated hydroxyapatite, are marked with arrows. The signal is a singlet of axial symmetry with $g_x$=2.0035, $g_y$=1.9973 and $g_z$=2.0017, respectively.

The positions of all three g's in the magnetic field are easily distinguished in the spectrum of cuticle irradiated with 7 kGy (Fig.1b). However, in the spectrum of cuticle irradiated with 3 kGy the positions of $g_z$ and $g_x$ are not very well defined although the experienced EPR operator can establish them with a precision which could be perhaps satisfactory enough for identification of radiation treatment (Fig.1a).

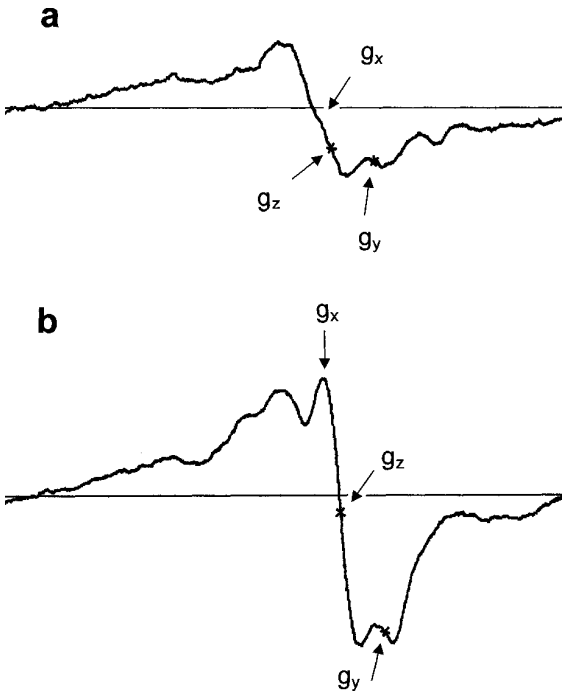


Fig.1. The EPR spectra (first derivatives) recorded with cuticles taken from shrimps irradiated with 3 kGy (a) and 7 kGy (b). The positions of g values specific for irradiated hydroxyapatite are marked with arrows: $g_x$=2.0035, $g_y$=1.9973, $g_z$=2.0017.

In conclusion, it can be postulated that the EPR measurement of cuticles of shrimps can be adapted in the Laboratory as preliminary, screening test proving the irradiation of shrimp. It has to be stressed, however, that the lack of a specific, hydroxyapatite born EPR signal in the spectrum cannot suggest that sample was not irradiated.

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# DSC STUDIES OF RETROGRADATION AND AMYLOSE-LIPID TRANSITION TAKING PLACE IN GAMMA-IRRADIATED WHEAT STARCH

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The course of gelatinisation and retrogradation occurring during heating of starch and flour suspensions depend on the structure of starch granules. In the case of wheat flour, retrogradation depends additionally on the presence of lipids. In fact, binding of lipids to the polysaccharide chains was found to resist recrystallisation of starch gels.

Our previous studies have shown that degradation resulting from gamma irradiation induces a decrease in order of starch granules [1,2] and