# DETERMINATION OF THE EFFECTIVENESS AND CONTROL OF FOOD IRRADIATION PROCESS WITH A LOW-ENERGY ELECTRON BEAM

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Currently, for food irradiation highly penetration ionizing radiation sources are used. A new approach to irradiation processing of food and agricultural products is related to the limited penetration of low energy electrons (LEEB), which can effectively reduce the number of microorganisms in food products [1]. The advantage of such a solution is that low energy electrons do not penetrate the whole volume of food products thus interacting less with food components. However, to ensure that microorganisms are effectively inactivated in food products it is necessary to determine all parameters which may influence the effectiveness of LEEB microbial decontamination process. Due to the limited penetration of electrons in treated material, it is important to define which food categories can be treated with the low energy electron beam.

In the presented study the work focused on the determination of the thickness of the layer which electrons can penetrate in different types of food products depending on the energy of electrons. Since microorganisms may inhabit different thicknesses of food [2], for the high LEEB process effectiveness it is important to select process paraments that ensure that the whole sub-surface layer inhabited by microorganisms is reachable by the electrons.

The results obtained for the selected classes of food products are supported by dosimetric data, EPR spectroscopy, analysis of the internal structure using a USB camera and density measurements. The dose measurements were performed using B3 dosimetric foil to determine the range of electrons in water which in experimental conditions ranged from 100 μm for the beam of energy 200 keV up to about 350 μm for the beam of energy 300 keV. EPR spectroscopy was used to determine the type of radicals formed as an effect of ionising radiation interaction with food components. The range of electrons in food was correlated with the EPR signal, which for heterogenous in chemical composition food samples changes with the energy of electrons, as shown for pepper sample in Fig.1. The radicals localised in cellulosic components, starch or sugars of food result in a different signal, thus giving information on the thickness of the irradiated layer.

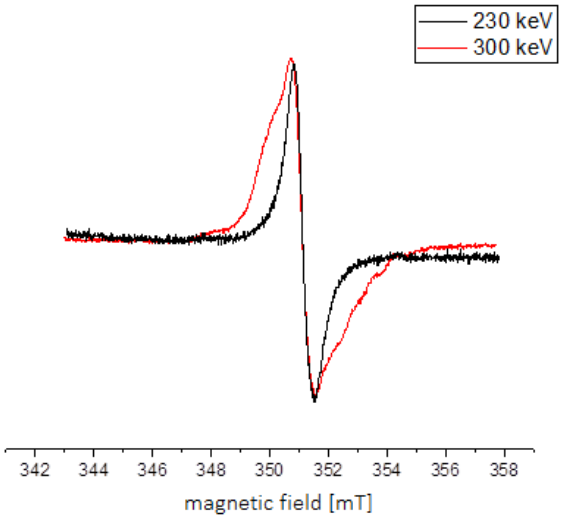


*FIG. 1. Changes of EPR signal measured for white pepper grains irradiated with the electron beam of energy 230 and 300 keV*

## REFERENCES

[1] GRYCZKA, U., KAMEYA, H., KIMURA, K., TODORIKI, S., MIGDAŁ, W., BUŁKA, S., Efficacy of low energy electron beam on microbial decontamination of spices, Rad. Phys. Chem. **170** (2020) 108662.

[2] GRYCZKA, U., MADUREIRA J., CABO VERDE S., MIGDAŁ, W., BUŁKA, S., Determination of pepper microbial contamination for low energy e-beam irradiation, Food Microbiology. **98** (2021) 103782.