

SPIN DENSITY DISTRIBUTION IN FOODSTUFF AFTER IRRADIATION OR HEAT TREATMENT STUDIED BY EPR IMAGING

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Free radicals are usually very unstable species which react quickly with other molecules, so that they can hardly be detected in liquid solution. In solid state, on the contrary, their half life is considerably longer and their presence has been widely demonstrated for years by EPR spectroscopy.

In foodstuffs, free radicals are known to be generated by various treatments commonly used in the industry, such as heat treatment or decontamination (sterilization) with ionising radiations. EPR spectroscopy is now recognized internationally as a gold standard method to detect radiation-processed food containing bones, cellulose or crystalline sugar¹.

In this report, we go a step further than standard EPR spectroscopy and investigate the possibilities offered by development of EPR imaging to delineated free radical distribution within biological samples (e.a. foodstuffs).

Several representative samples of commercial foodstuff from various origins (vegetal & animal) were selected because they are known to be treated by heat or ionising radiation during their industrial processing: frog leg, coffee bean, etc. Frog legs were freeze-dried to remove water before imaging; other samples were directly investigated. Imaging was performed on a Bruker Elexsys E540 system operating at 9 GHz (100 kHz modulation frequency), equipped with a Super High Sensitivity Probe.

In irradiated frog legs (15 kGy), the main bones (calcaneum & astragalus), whose width does not exceed 1-1.5 mm, are very well delineated with a rather homogenous signal distribution. Smaller structures such as tarsal and part of the metatarsal bones are clearly visible, but not resolved. Roasted coffee bean presents a single band EPR signal, whereas this signal is absent from green coffee. Intensity distribution is not homogenous within the bean, the strongest signal arising from the centre. Analogous situation can be observed in other vegetal material.

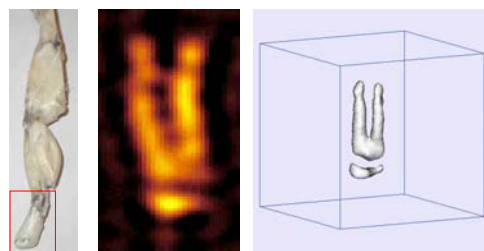


Fig 1: **A** Frog hind leg **B** 2D view of distal part (red square) **C** 3D view

EPR imaging could be used together with conventional spectroscopy where a regional distribution of radicals is needed, particularly in irradiated samples. The method offers unique capabilities to monitor the fate of these free radicals in biological samples.

References

1. European Committee for Standardisation, analytical methods EN1786, EN 1787 & EN13708