

Electron Magnetic Resonance study of the Structure and Thermal Stability of Radiation-Induced Free Radicals in Trehalose Single Crystals, M. A. Tarpan, G. Scheir, H. De Cooman, H. Vrielinck, F. Callens, *7th European Federation of EPR (EFEPR) Groups Meeting and Closing Meeting of COST P15*, Antwerp, Belgium, **6 - 11 September 2009**

Radiation-induced radicals in sugars have recently gained considerable interest with respect to both fundamental and applied research. A number of studies are available that focus on the dosimetric characteristics of sugar systems. Other studies, like ours, aim to understand the identity and the structural properties of the involved radicals, and the radical reactions in which the primary or secondary products can be linked to the stable radicals.

We present here experimental results obtained on radiation-induced radicals in trehalose single crystals. A major purpose of this study is to check if the cleavage of the glycosidic bond and carbonyl formation are common radiation-induced processes produced by irradiation in disaccharides. Recently, the chemical structures of three dominant radicals obtained after room temperature (RT) irradiation in sucrose single crystals, were identified by De Cooman et al.¹⁻³ All three radicals have a broken glycosidic bond and a carbonyl group. Trehalose was selected as the object of this study because of its close structural similarity with sucrose : it is a disaccharide composed of two α -D-glucosyl units linked by a glycosidic oxygen bridge between their two anomeric carbon atoms, C1 and C1'.

After RT irradiation of trehalose single crystals three dominant radicals are present. One radical species is characterized by a rather isotropic triplet due to the interaction of the unpaired electron with two almost equivalent protons in β positions. The other two radical species exhibit only proton hyperfine couplings smaller than 20 MHz and therefore are characterized by a broad EPR singlet. In addition to these radicals, two other less dominant species characterized by a doublet structure are present. Storing the irradiated trehalose crystal at RT for three months or heating it to 40° for three days, changes the EPR spectrum completely, the dominant species now being characterized by a doublet of doublets.

References

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