Electron ionization and low energy electron attachment to molecules of biological interest

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Electron ionization and low energy electron attachment to molecules of biological interest

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Synopsis Ethylenediaminetetraacetic acid (EDTA) and 2-amino-2-(hydroxymethyl)-1,3-propanediol (TRIS) were investigated by electron impact ionization and low energy electron attachment. Both compounds are components of biological buffers and often are used as DNA stabilizers in irradiation studies. hus it is of a great importance to understand their potential interactions with radiation. Our results revealed that at least one of them, EDTA, may influence the experimental outcomes by O^- and OH^- production upon electron attachment.

Understanding the interactions of various types of radiation with the constituent cellular molecules (DNA in particular) underlay new DNA damage models formulation. Such models should be able to predict not only the patterns of ionizations but also the spectra of damage complexity that different types of radiation can induce in DNA.

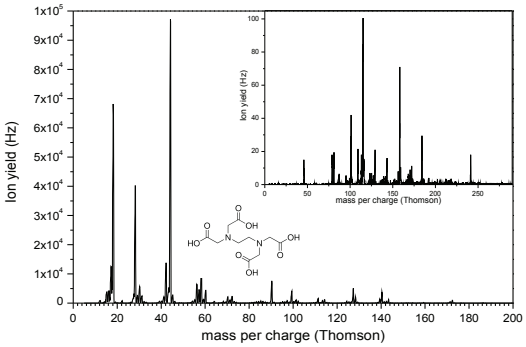

Figure 1. Positive ion mass spectrum of EDTA obtained at 70 eV incident electron energy and negative ions formed upon DEA at 0 eV electron energy (insert)

Hence knowledge of the relationship between the amount of energy deposited within a given region of the DNA helix and the type and severity of the damage that is produced is required [1]. In irradiation studies extracted plasmid DNA is being used that requires stabilisation, e.g. is suspended in EDTA solution. Therefore, the accurate determination of the influence of DNA stabilizers on the experimental outcomes is of great importance [2]. We have investigated by means of 70 eV electron impact and low energy (0-20 eV) electron attachment two most popular compounds used in DNA irradiation studies; EDTA often used as stabilizer [3] and TRIS used as OH radical scavenger [4], since it has already been noticed that EDTA may impact irradiation outcome [5].

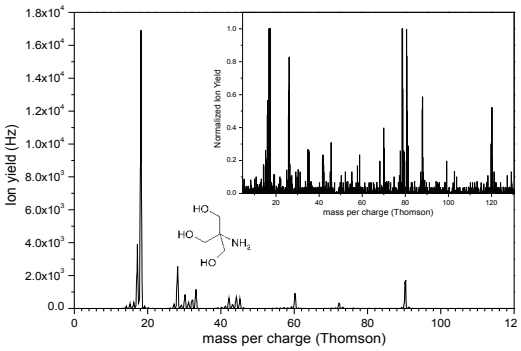

Figure 2. Positive ion mass spectrum obtained at 70 eV incident electron energy and negative ions formed upon DEA over the electron energy range 0-18 eV (insert) of TRIS

Our results indicate that upon LEE attachment as well as at 70 eV electron irradiations vast quantities of charged OH and O are being produced from both compounds. We also derived most probable dissociation channels throughout thermochemical calculations.

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