COLLISION INDUCED DISSOCIATION ON ELEMENTARY BIO-MOLECULAR SYSTEMS

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Irradiation of tumour cells with ionizing radiation is now commonly used in cancer treatments. In particular, use of protons or heavier ions allows to deliver doses in a well define region localized in the Bragg peak region.

Physical and chemical processes which come off to DNA strand break and tumour cell's death are not yet clearly established. Some atomic or molecular elementary mechanisms have already been established: previous works of Chetioui et al. [1] and Touati et al. [2] showed that inner shell ionisation followed by Auger decays could play important role in DNA fragmentation processes and, more recently, Bouidaiffa et al. [3] showed that low energy electron beam, below the ionisation thresholds of the bio-molecules, were able to realise stand break coming from dissociative electron attachment mechanisms.

Others processes can be point out such as direct excitation and ionisation, subsequent secondary electrons emissions, radical species formed along the ion track and any combination of these processes.

In order to investigate the interaction of ionising radiation with nucleic acid bio-molecules, a collision experiment on DNA and RNA bases and small nucleosides is developed at the LCAR laboratory.
Our experimental setup combined a high energy pulsed proton beam (25-150 keV), time of flight spectrometer and electrostatic cylindrical mirror analyser to characterize the electrons and the ionic fragments produced during the fragmentation processes of the Bio-molecules. DNA/RNA components are produced in gas phase by sublimation in an oven.

With this set-up, absolute double differential cross section measurements of emitted electrons were already obtained and published on Uracil base [4]. Recently dissociation patterns of doubly charged molecules of DNA bases and their corresponding branching ratios have been obtained as shown in Figure 1 for guanine.

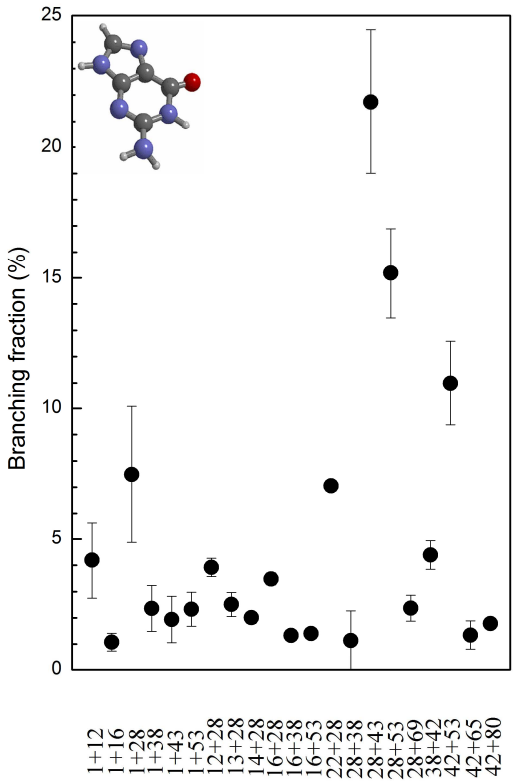

Fig. 1. Branching ratio obtained from correlation spectrum for guanine fragmentation.

These new results obtained from the fragmentation of Adenine, Cytosine, Guanine and Thymine molecules will be presented at the conference. They are showing no collision energy dependence in the range investigated.

References

[1] A. Chetioui et al., in 20th ICPEAC, edited by F. Aumayr and H. Winter (World Scientific, Vienna, 1997), p. 519.
[2] A. Touati et al., Radiation Protection Dosimetry 9, 83 (2002).
[3] B. Boudaiffa et al., Science **287**,1658 (2000)
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