Partial ionization cross sections for positive fragments produced by electron impact on uracil

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Partial ionization cross sections for positive fragments produced by electron impact on uracil

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Synopsis Fragmentation of uracil in the gas phase has been studied using low-energy electron impact. Positive ions have been detected using a reflectron time-of-flight mass spectrometer. Mass spectra have been measured as a function of electron impact from 0 to 100 eV, and ion yield curves most of the positively charged fragments have been extracted.

We have measured mass spectra of positive ions for electron impact on uracil, with electron energies ranging from 0 to 100 eV in steps of 0.5 eV. Ions have been collected and detected using a reflectron time-of-flight mass spectrometer. Details about the experiment and the data analysis can be found in [1-3], which present results obtained for electron impact on cytosine, thymine and adenine.

A beam of uracil is generated by a resistively heated oven mounted in an expansion chamber, and the forward section of the beam effusing from a capillary in the oven passes through a skimmer into the collision chamber, where the beam is crossed by a pulsed electron beam. Positively charged fragments are mass resolved and detected using a reflectron time-of-flight mass spectrometer. LabView based data acquisition techniques are used to accumulate time-of-flight spectra as a function of electron impact energy.

Ion yield curves for most fragment ions of uracil have been obtained by fitting groups of adjacent peaks in the mass spectra with sequences of normalized Gaussians.

Tests of the electron beam current have shown that the current is constant down to 15 eV and decreases to about 60% at 8 eV. Because all ion yield curves are generated from a single dataset, and assuming that the detection efficiency of the reflectron mass spectrometer is mass independent, above 15 eV the yields of all fragments are on the same relative scale and are comparable. The ion yield curves have been normalized by comparing the sum of the ion yields to the average of calculated total ionization cross sections. Appearance energies have been determined for most ions.

Mass spectra, ion yield curves and appearance energies will be presented at the conference and will be compared with other research on uracil (see [4-6] and references therein).

The experiment also involves the implementation and development of a new source design using a 50 micron straight nozzle with argon gas acting as the buffer gas [4]. The new design will improve beam collimation and will enable formation of small nucleobase-water clusters when water vapour is introduced into the source. Other future plans include an investigation of electron impact on fluorouracil.

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