New process observed in collisions between highly charged protonated protein and Xe8+, Xe5+, He2+ ions

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Synopsis Electron multicapture processes have been studied in collisions between cytochrome C protein and highly charged Xe and He projectile at keV kinetic energy range. In competition with single and double electron capture, a new and unexpected channel attributed to deprotonation process of the protein has been observed.

Studies of processes in ions-ions collisions are not common in the keV energy range. We have investigated the interaction between highly charged Xe^{8+}, Xe^{5+} or He^{2+} projectiles and trapped highly protonated cytochrome C (Cyt-C) using a new set-up developed at the KVI laboratory [1]. Single electron capture SEC and double electron capture DEC processes have been studied versus the charge q of the protein Cyt-C^{q+} (q=15-19). Typical mass spectra are shown on figure 1 for collisions between Xe^{8+} and Cyt-C^{q+}. At first sight, collisions between selected charge state of Cyt-C and projectile involve very few processes. As an example for the trapped Cyt-C^{18+} parent ion (figure 1d) the expected Cyt-C^{19+} and Cyt-C^{20+} peaks are mainly attributed to the single (SEC) and double electron capture (DEC) processes. The unexpected Cyt-C^{17+} peak is attributed tentatively to a deprotonation (DP) process of the Cyt-C parent ions. This new and unexpected channel has never been observed for other smaller biological molecules. This DP process increases from Cyt-C^{15+} to Cyt-C^{19+}. A tentative explanation is based on the fast decreasing of proton affinities versus the charge of Cyt-C. During the collision process; the electric field of the projectile is high enough to eject the proton from the Cyt-C. Higher mass resolution spectra and kinetic energy dependence would be necessary to confirm this mechanism.

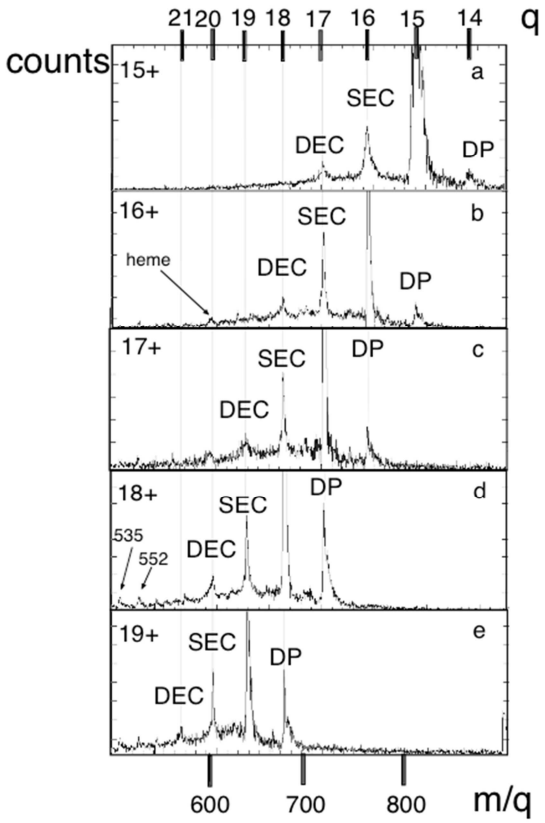

Figure 1. Mass spectra of Xe^{8+} + Cyt-C^{q+} (q=15-19). SEC, DEC and DP processes are observed.

References

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