Interaction mechanism of low energy electron and biomolecules

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Among all electron-molecule collisions, low energy electron (LEE, especially below 10eV) interactions with biomolecules have attracted great attention because of the potential of medical treatment. LEE can essentially create DNA damage by attaching temporarily to DNA components, forming transient negative ion (TNI) state of DNA subunits (e.g., nucleobases, sugar, or phosphate group). Generally, this process is known as dissociative electron attachment (DEA). LEE-induced DNA damage is closely related to serious diseases like cancer and genetic disease, but on the contrary LEE event can also apply to medical cure. To better understand these phenomena at the molecular level, we have investigated experimental studies with DNA model biomolecules. Surprisingly, the damaging yield caused by DEA is a considerable amount compared to those resulted from high energy quanta collisions. Furthermore, LEEs as well as ions and radicals have thought one of key elements on the newest plasma medicine. In this talk, we will present some experimental tools to produce biological data and show some recent results related to LEE collisions on the condensed DNA film. All experiments were carried out under ultra-high vacuum condition to avoid electron energy loss before reaching the target. The samples after LEE collision were analyzed by high-performance liquid chromatography-tandem mass spectrometry and gel-electrophoresis in order to quantitative and qualitative analyses. And finally, we have suggested the possible mechanisms of DNA damage by LEE collision and surrounding molecules.

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