Free Radical Mechanisms of Radiation Damage to DNA: The role of the aqueous electron

Michael D. Sevilla and Anil Kumar
Department of Chemistry, Oakland University, Rochester, MI 48309

Radiation damage to DNA results from both roughly equal contributions of direct ionization of DNA including its first hydration layer (direct type effects) and indirect effects from attack of mainly hydroxyl radicals and aqueous electrons.[1] DNA damage from direct ionization results from formation of DNA-cation radicals (holes) and DNA-anion radicals (excess electrons) within DNA. Low energy electrons (LEE) produced during ionization have also been shown to lead to frank DNA strand breaks via dissociative electron attachment.[2] The role of the hydroxyl radical from the indirect effect has been well studied; however, the aqueous electron reactions with DNA have recently been called into questions by several workers. In this talk an overview of that status of our understanding of the effect of radiation on DNA will be given with special attention to the role and reactivity of the aqueous electron. A "new" model of the aqueous electron will be shown to account for its properties, such as, its free energy of solvation, VDE, as well as its redox potential.[3] Our work confirms that aqueous electrons will add to DNA; however, recent reports suggest interesting new pathways for subsequent reaction.[4] Supported by the NIH NCI under grant R01CA045424.

References

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