DNA Based Radiological Dosimetry Technology

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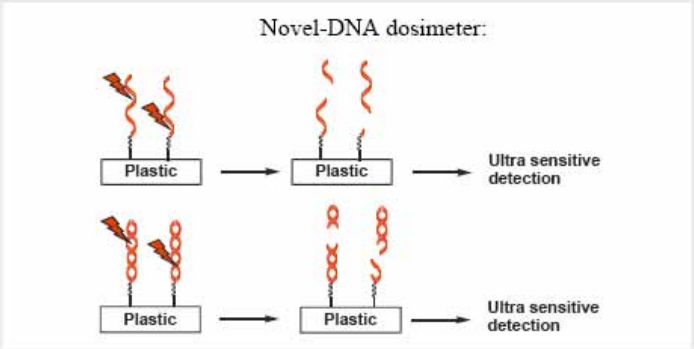
Abstract

The purpose of this project is to develop a personal and wearable dosimeter using a highly-innovative approach based on the specific recognition of DNA damage with a polymer hybrid. Our biosensor will be sensitive to breaks in nucleic acid macromolecules and relevant to mixed-field radiation. The dosimeter proposed will be small, field deployable and will sense damages for all radiation types at the DNA level.

The generalized concept for the novel-based radiological dosimeter:

- Single or double stranded oligonucleotide is immobilized on surface.
- Single stranded has higher cross-section for fragmentation.
- Double stranded is more biological relevant.
- Radiation induces fragmentation.
- Ultra-sensitive detection of fragments provides radiation dose.



Successful efforts have been made towards a proof-of-concept personal wearable DNA-based dosimeter that is appropriate for mixed-field radiation. The covalent immobilization of oligonucleotides on large areas of plastic

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surfaces has been demonstrated and corroborated spectroscopically. The surface concentration of DNA was determined to be 8 x 1010 molecules/cm2 from a Ce(IV) catalyzed hydrolysis study of a fluorescently labelled oligonucleotide. Current efforts are being directed at studying radiation induced fragmentation of DNA followed by its ultra-sensitive detection via a novel method. In addition, proof-of-concept wearable personal devices and a detection platform are presently being fabricated.