Synthetic Intermediate Research Report

on project achievement in the period December 11th, 2014 - December 15th, 2015

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In this work surface-enhanced Raman spectra of genomic DNAs extracted from leaf tissues of different grapevine varieties, respectively, have been analyzed in the wavenumber range 300-1800 cm^{-1}. Also, structural changes induced in genomic DNAs upon femtosecond IR laser pulses irradiation are discussed in detail for several genomic DNAs.

The main marker bands were identified, and their corresponding assignments were indicated. Particularly, stretching, deformation and scissoring vibrations were put into evidence in deoxyribose and dC, dT, dA, dG DNA residues, respectively.

The present SERS spectra, corresponding to genomic DNAs extracted from leaf tissues of different grapevine varieties, show well resolved, accurate bands, providing thus a high molecular structural information content. Besides, we highlight the absence of some very intense SERS bands in selected spectra of irradiated DNA samples. Loss of essential structural organization, including alteration of DNA double helix might be found in these cases. The observed variety dependent sensitivity of nucleic acids to laser treatment might be correlated with the structural differences of genomic DNAs under study (e.g. biopolymer sequence, base pairs content and number).

The most structural responsive investigated system to femtosecond IR laser pulses irradiation process was identified.

Particularly, both C2'-*endo*-anti and C3'-*endo*-anti conformations have been detected in our nucleic acids systems. As a general observation, we have identified the wavenumber range being mostly due to dG, dA, dC and dT residues, which seems to suffer some changes upon irradiation process. This finding could reflect modified base-stacking interactions in DNA.

The detected spectral shifts were mainly attributed to certain DNA components. Nucleic acids residues, which seem to be less affected by IR laser pulses irradiation were indicated. Also, changes in conformational properties of DNA are to be observed after femtosecond laser pulses treatment.

For Principal Component Analysis (PCA), SERS spectra were collected from DNA samples extracted from eight grapevine varieties of different provenance. The most accurate grouping of the eight sets of spectral data was achieved, when the original spectra were processed using the following algorithms: baseline correction, multiplicative scattering correction (MSC) and area normalization. In addition, using unbiased computational resources by means of PCA, two different tomato cultivars were discriminated.

Based on this work, specific plant DNA-ligand interactions or accurate local structure of DNA in the proximity of a metallic surface, might be further investigated using surface-enhanced Raman spectroscopy, due to band assignments described in terms of a specific DNA atom or functional group.

Further on cancer research could benefit from ultra-fast lasers technology. Research teams might be planning to study how intense impact have femtosecond laser pulses on tumoral DNA and on cancerous cells, respectively, minimizing the risk of disease being caused.

Reference

C. M. Muntean, N. Leopold, C. Tripon, A. Coste, A. Halmagyi (2015) “Surface-Enhanced Raman Spectroscopy of genomic DNA from *in vitro* grown tomato (*Lycopersicon esculentum* Mill.) cultivars before and after plant cryopreservation”, Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, Vol. 144, 107-114.

In addition to this synthetic intermediate research report, full length research report (38 pages) is submitted to the beneficiary.

Project manager,

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