

High-resolution mapping of DNA/RNA hypermethylation and hypomethylation process in human cancer cells, tissues and tumors under synchrotron radiation

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Changes in DNA/RNA hypermethylation and hypomethylation patterns are an important characteristic of human cancer cells, tissues and tumors. DNA/RNA hypermethylation and hypomethylation is a process by which methyl groups are added to the DNA/RNA molecule. DNA/RNA hypermethylation and hypomethylation was the initial epigenetic abnormality recognized in human cancer cells, tissues and tumors. In addition, DNA/RNA hypermethylation and hypomethylation have brought more heavy metals from human cancer cells, tissues and tumors under synchrotron radiation into the human healthy cells and caused more health in the human cells. Heavy metals are one of the most important environmental pollutants. The aim of present study is to be high-resolution mapping of DNA/RNA hypermethylation and hypomethylation process in human cancer cells, tissues and tumors under synchrotron radiation. High-resolution mapping were applied on these types of human cells, tissues and tumors for determination of heavy metals content. Analytical Ultracentrifugation, Atomic Absorption Spectroscopy (AAS), Auger Electron Diffraction (AED), Auger Electron Spectroscopy (AES), Atomic Force Microscopy (AFM), Atomic Fluorescence Spectroscopy (AFS), Atom Probe Field Ion Microscopy (APFIM), Appearance Potential Spectroscopy (APS), Angle Resolved Photoemission Spectroscopy (ARPES), Angle Resolved Ultraviolet Photoemission Spectroscopy (ARUPS), Attenuated Total Reflectance (ATR), BET Surface Area Measurement (BET) (BET from Brunauer, Emmett, Teller), Bimolecular Fluorescence Complementation (BiFC), Backscatter Kikuchi Diffraction (BKD), Bioluminescence Resonance Energy Transfer (BRET), Back Scattered Electron Diffraction (BSED), Coaxial Impact Collision Ion Scattering Spectroscopy (CAICISS), Coherent Anti-Stokes Raman Spectroscopy (CARS), Convergent Beam Electron Diffraction (CBED), Charge Collection Microscopy (CCM), Coherent Diffraction Imaging (CDI), Capillary Electrophoresis (CE), Cryo-Electron Tomography (CET), Cathodoluminescence (CL), Confocal Laser Scanning Microscopy (CLSM), Correlation Spectroscopy (COSY), Cryo-Electron Microscopy (Cryo-EM), Cryo-Scanning Electron Microscopy (Cryo-SEM), Cyclic Voltammetry (CV), Dielectric Thermal Analysis (DE(T)A), De Haas-van Alphen Effect (dHvA), Differential Interference Contrast Microscopy (DIC), Dielectric Spectroscopy (Dielectric spectroscopy), Dynamic Light Scattering (DLS), Deep-Level Transient Spectroscopy (DLTS), Dynamic Mechanical Analysis (DMA), Dual Polarisation Interferometry (DPI), Diffuse Reflection Spectroscopy (DRS), Differential Scanning Calorimetry (DSC), Differential Thermal

Analysis (DTA), Dynamic Vapour Sorption (DVS), Electron Beam Induced Current (EBIC), Elastic (Non-Rutherford) Backscattering Spectrometry (EBS), Electron Backscatter Diffraction (EBSD), Exclusive Correlation Spectroscopy (ECOSY), Electrical Capacitance Tomography (ECT), Energy-Dispersive Analysis of X-Rays (EDAX), Electrically Detected Magnetic Resonance (EDMR), Energy Dispersive X-Ray Spectroscopy (EDS or EDX), Electron Energy Loss Spectroscopy (EELS), Energy Filtered Transmission Electron Microscopy (EFTEM), Electron Induced Desorption (EID), Electrical Impedance Tomography and Electrical Resistivity Tomography (EIT and ERT), Electroluminescence (EL), Electron Crystallography, Electrophoretic Light Scattering (ELS), Electron Nuclear Double Resonance (ENDOR), Electron Probe Microanalysis (EPMA), Electron Paramagnetic Resonance Spectroscopy (EPR), Elastic Recoil Detection or Elastic Recoil Detection Analysis (ERD or ERDA), Electron Spectroscopy for Chemical Analysis (ESCA), Electron Stimulated Desorption (ESD), Environmental Scanning Electron Microscopy (ESEM), Electrospray Ionization Mass Spectrometry or Electrospray Mass Spectrometry (ESI-MS or ES-MS), Electron Spin Resonance Spectroscopy (ESR), Electrochemical Scanning Tunneling Microscopy (ESTM), Extended X-Ray Absorption Fine Structure (EXAFS), Exchange Spectroscopy (EXSY), Fluorescence Correlation Spectroscopy (FCS), Fluorescence Cross-Correlation Spectroscopy (FCCS), Field Emission Microscopy (FEM), Focused Ion Beam Microscopy (FIB), Field Ion Microscopy-Atom Probe (FIM-AP), Flow Birefringence, Fluorescence Anisotropy, Fluorescence Lifetime Imaging (FLIM), Fluorescence Microscopy, Feature-Oriented Scanning Probe Microscopy (FOSPM), Fluorescence Resonance Energy Transfer (FRET), Forward Recoil Spectrometry (FRS), Fourier Transform Ion Cyclotron Resonance or Fourier Transform Mass Spectrometry (FTICR or FT-MS), Fourier Transform Infrared Spectroscopy (FTIR), Gas Chromatography-Mass Spectrometry (GC-MS), Glow Discharge Mass Spectrometry (GDMS), Glow Discharge Optical Spectroscopy (GDOS), Grazing Incidence Small Angle X-Ray Scattering (GISAXS), Grazing Incidence X-Ray

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Diffraction (GIXD), Grazing Incidence X-Ray Reflectivity (GIXR), Gas-Liquid Chromatography (GLC), High Angle Annular Dark-Field Imaging (HAADF), Helium Atom Scattering (HAS), High Performance Liquid Chromatography (HPLC), High Resolution Electron Energy Loss Spectroscopy (HREELS), High-Resolution Electron Microscopy (HREM), High-Resolution Transmission Electron Microscopy (HRTEM), Heavy-Ion Elastic Recoil Detection Analysis (HI-ERDA), High-Energy Proton Induced X-Ray Emission (HE-PIXE), Ion Induced Auger Electron Spectroscopy (IAES), Ion Beam Analysis (IBA), Ion Beam Induced Charge Microscopy (IBIC), Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES), Inductively Coupled Plasma Mass Spectrometry (ICP-MS), Immunofluorescence, Ion Cyclotron Resonance (ICR), Inelastic Electron Tunneling Spectroscopy (IETS), Intelligent Gravimetric Analysis (IGA), Inert Gas Fusion (IGF), Ion Induced X-Ray Analysis (IIX), Ion Neutralization Spectroscopy (INS), Inelastic Neutron Scattering, Infrared Non-Destructive Testing of Materials (IRNDT), Infrared Spectroscopy (IRS), Ion Scattering Spectroscopy (ISS), Isothermal Titration Calorimetry (ITC), Intermediate Voltage Electron Microscopy (IVEM), Low-Angle Laser Light Scattering (LALLS), Liquid Chromatography-Mass Spectrometry (LC-MS), Low-Energy Electron Diffraction (LEED), Low-Energy Electron Microscopy (LEEM), Low-Energy Ion Scattering (LEIS), Laser Induced Breakdown Spectroscopy (LIBS), Laser Optical Emission Spectroscopy (LOES), Light (Raman) Scattering (LS), Matrix-Assisted Laser Desorption/Ionization (MALDI), Molecular Beam Epitaxy (MBE), Medium Energy Ion Scattering (MEIS), Magnetic Force Microscopy (MFM), Magnetic Induction Tomography (MIT), Multiphoton Fluorescence Microscopy (MPM), Magnetic Resonance Force Microscopy (MRFM), Magnetic Resonance Imaging (MRI), Mass Spectrometry (MS), Tandem Mass Spectrometry (MS/MS), Mechanically Stimulated Gas Emission (MSGE), Mössbauer Spectroscopy, Microthermal Analysis (MTA), Neutron Activation Analysis (NAA), Nanovid Microscopy, Neutron Diffraction (ND), Neutron Depth Profiling (NDP), Near Edge X-Ray Absorption Fine Structure (NEXAFS), Nuclear Inelastic Scattering/Absorption (NIS), Nuclear Magnetic Resonance Spectroscopy (NMR), Nuclear Overhauser Effect Spectroscopy (NOESY), Nuclear Reaction Analysis (NRA), Near-Field Optical Microscopy (NSOM), Optical Beam Induced Current (OBIC), Optically Detected Magnetic Resonance (ODNMR), Optical Emission Spectroscopy (OES), Osmometry (Osmometry), Positron Annihilation Spectroscopy (PAS), Photoacoustic Spectroscopy, Photoacoustic Tomography or Photoacoustic Computed Tomography (PAT or PACT), Photoemission of Adsorbed Xenon (PAX), Photocurrent Spectroscopy (PC or PCS), Phase Contrast Microscopy, Photoelectron Diffraction (PhD), Photodesorption (PD), Potentiodynamic Electrochemical Impedance Spectroscopy (PDEIS), Photothermal Deflection Spectroscopy (PDS), Photoelectron Diffraction (PED), Parallel Electron Energy Loss Spectroscopy (PEELS), Photoemission Electron Microscopy or Photoelectron Emission Microscopy (PEEM), Photoelectron Spectroscopy (PES), Photon-Induced Near-Field Electron Microscopy (PINEM), Particle (or Proton) Induced Gamma-Ray Spectroscopy (PIGE), Particle (or Proton) Induced X-Ray Spectroscopy (PIXE), Photoluminescence (PL), Porosimetry, Powder Diffraction, Photothermal Microspectroscopy (PTMS), Photothermal Spectroscopy (PTS), Quasielastic Neutron Scattering (QENS), Raman Spectroscopy (Raman), Resonant Anomalous X-Ray Scattering (RAXRS), Rutherford Backscattering Spectrometry (RBS), Reflection Electron Microscopy (REM), Reflectance Difference Spectroscopy (RDS), Reflection High Energy Electron Diffraction (RHEED), Resonance Ionization Mass Spectrometry (RIMS), Resonant Inelastic X-Ray Scattering (RIXS),

Resonance Raman Spectroscopy (RR Spectroscopy), Selected Area Diffraction (SAD), Selected Area Electron Diffraction (SAED), Scanning Auger Microscopy (SAM), Small Angle Neutron Scattering (SANS), Small Angle X-Ray Scattering (SAXS), Surface Composition by Analysis of Neutral Species and Ion-Impact Radiation (SCANIIR), Scanning Confocal Electron Microscopy (SCEM), Spectroscopic Ellipsometry (SE), Size Exclusion Chromatography (SEC), Surface Enhanced Infrared Absorption Spectroscopy (SEIRA), Scanning Electron Microscopy (SEM), Surface Enhanced Raman Spectroscopy (SERS), Surface Enhanced Resonance Raman Spectroscopy (SERRS), Surface Extended X-Ray Absorption Fine Structure (SEXAFS), Scanning Ion-Conductance Microscopy (SICM), Solid Immersion Lens (SIL), Solid Immersion Mirror (SIM), Secondary Ion Mass Spectrometry (SIMS), Sputtered Neutral Species Mass Spectrometry (SNMS), Scanning Near-Field Optical Microscopy (SNOM), Single Photon Emission Computed Tomography (SPECT), Scanning Probe Microscopy (SPM), Selected-Reaction-Monitoring Capillary-Electrophoresis Mass-Spectrometry (SRM-CE/MS), Solid-State Nuclear Magnetic Resonance (SSNMR), Stark Spectroscopy, Stimulated Emission Depletion Microscopy (STED), Scanning Transmission Electron Microscopy (STEM), Scanning Tunneling Microscopy (STM), Scanning Tunneling Spectroscopy (STS), Surface X-Ray Diffraction (SXRD), Thermoacoustic Tomography or Thermoacoustic Computed Tomography (TAT or TACT), Transmission Electron Microscope/Microscopy (TEM), Thermogravimetric Analysis (TGA), Transmitting Ion Kinetic Analysis (TIKA), Thermal Ionization Mass Spectrometry (TIMS), Total Internal Reflection Fluorescence Microscopy (TIRFM), Photothermal Lens Spectroscopy (TLS), Thermomechanical Analysis (TMA), Time-of-Flight Mass Spectrometry (TOF-MS), Two-Photon Excitation Microscopy, Total Reflection X-Ray Fluorescence Analysis (TXRF), Ultrasound Attenuation Spectroscopy, Ultrasonic Testing, UV-Photoelectron Spectroscopy (UPS), Ultra Small-Angle Neutron Scattering (USANS), Ultra Small-Angle X-Ray Scattering (USAXS), Ultraviolet-Visible Spectroscopy (UV-Vis), Video-Enhanced Differential Interference Contrast Microscopy (VEDIC), Voltammetry, Wide Angle X-Ray Scattering (WAXS), Wavelength Dispersive X-Ray Spectroscopy (WDX or WDS), X-Ray Induced Auger Electron Spectroscopy (XAES), Near Edge X-Ray Absorption Fine Structure (XANES or NEXAFS), X-Ray Absorption Spectroscopy (XAS), X-Ray Crystal Truncation Rod Scattering (X-CTR), X-Ray Crystallography, X-Ray Diffuse Scattering (XDS), X-Ray Photoelectron Emission Microscopy (XPEEM), X-Ray Photoelectron Spectroscopy (XPS), X-Ray Diffraction (XRD), X-Ray Resonant Exchange Scattering (XRES), X-Ray Fluorescence Analysis (XRF), X-Ray Reflectivity (XRR), X-Ray Raman Scattering (XRS), X-Ray Standing Wave Technique (XSW) and so on was used for analysis of heavy metals in human cancer cells, tissues and tumors samples [1-212]. The results of this research showed that DNA/RNA hypermethylation and hypomethylation process in human cancer cells, tissues and tumors under synchrotron radiation can concentrate heavy metals in their different parts. Therefore, they can be used for human cancer cells, tissues and tumors diagnosis and treatment process and trend.

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