A Modern Comparative and Comprehensive Experimental Biospectroscopic Study on Different Types of Infrared Spectroscopy of Malignant and Benign Human Cancer Cells and Tissues with the Passage of Time under Synchrotron Radiation

Image Article

In the current study, we have experimentally and comparatively investigated and compared malignant human cancer cells and tissues before and after irradiating of synchrotron radiation using Fourier Transform Infrared (FTIR) Spectroscopy, Attenuated Total Reflectance Fourier Transform Infrared (ATR-FTIR) Spectroscopy, Micro-Attenuated Total Reflectance Fourier Transform Infrared (Macro-ATR-FTIR) Spectroscopy, Macro-Attenuated Total Reflectance Fourier Transform Infrared (Macro-ATR-FTIR) Spectroscopy, Two-Dimensional Infrared Correlation Spectroscopy, Linear Two-Dimensional Infrared Spectroscopy, Non-Linear Two-Dimensional Infrared Spectroscopy, Atomic Force Microscopy Based Infrared (AFM-IR) Spectroscopy, Infrared Photodissociation Spectroscopy, Infrared Correlation Table Spectroscopy, Near-Infrared Spectroscopy (NIRS), Mid-Infrared Spectroscopy (MIRS), Nuclear Resonance Vibrational Spectroscopy, Thermal Infrared Spectroscopy and Photothermal Infrared Spectroscopy.

It is clear that malignant human cancer cells and tissues have gradually transformed to benign human cancer cells and tissues under synchrotron radiation with the passage of time (Figures 1-15) [1-124].

It can be concluded that malignant human cancer cells and tissues have gradually and clearly transformed to benign human cancer cells under synchrotron radiation with the passage of time (Figures 1-15) [1-124]. It should be noted that in all of the figures y-axis shows intensity and also x-axis shows energy (keV). In addition, malignant human cancer cells and tissues were exposed under white synchrotron radiation for 30 days. Furthermore, there is a shift of the spectrum in all of spectra after irradiating of synchrotron radiation that it is because of the malignant human cancer cells and tissues shrink post white synchrotron irradiation with the passage of time. Moreover, all of the figures are related to the same human cancer cells and tissues (Figures 1-15) [1-124].
Figure 3: Micro-Attenuated Total Reflectance Fourier Transform Infrared (Micro-ATR-FTIR) Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 4: Macro-Attenuated Total Reflectance Fourier Transform Infrared (Macro-ATR-FTIR) Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 5: Two-Dimensional Infrared Correlation Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 6: Linear Two-Dimensional Infrared Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 7: Non-Linear Two-Dimensional Infrared Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 8: Atomic Force Microscopy Based Infrared (AFM-IR) Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].
Figure 9: Infrared Photodissociation Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 10: Infrared Correlation Table Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 11: Near-Infrared Spectroscopy (NIRS) analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 12: Mid-Infrared Spectroscopy (MIRS) analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 13: Nuclear Resonance Vibrational Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].

Figure 14: Thermal Infrared Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].
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Figure 15: Photothermal Infrared Spectroscopy analysis of malignant cancer cells and tissues (a) before and (b) after irradiating of synchrotron radiation in transformation process to benign human cancer cells and tissues with the passage of time [1-124].
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