

Nanoscale AFM/CSM-Coupled Raman/Fluorescence Studies on Water Soluble Cationic Oxotitanium(IV) meso-Tetrakis(1-Methyl-Pyridium-4-yl) Prophyrin Bound with DNA

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The importance of an accumulation of fundamental knowledge on binding of water-soluble cationic (metallo) porphyrins with DNA has been increasingly recognized for medical, biological and photophysical applications of porphyrins, and Raman/Fluorescence spectroscopy is useful for studying the binding patterns of water-soluble cationic (metallo) porphyrins with DNA with regard to photophysical properties [1]. However, the conventional Raman/Fluorescence techniques require large volume of sample solution and their strong laser power can damage the sample [2]. In order to solve these problems, we have developed the nanoscale AFM-correlated confocal scanning microscope(CSM)-coupled Raman/fluorescence spectroscopic techniques, investigating the fluorescence properties and binding patterns of water soluble cationic oxotitanium (IV) meso-tetrakis (1-methylpyridium-4-yl) porphyrin (O=TiIV(TMPyP)4+) with double stranded poly[d(A-T)2], poly[d(G-C)2] polynucleotides and calf thymus DNA. In contrast to the Raman/fluorescence spectra of free O=TiIV(TMPyP)4+ in phosphate buffer solution, those of O=TiIV(TMPyP)4+ complexed with various polynucleotides were observed to highly resolved depending on base pairs. These base pair dependency of the Raman/fluorescence were correlated with the morphology of nucleotides, demonstrating that the photophysical processes of O=TiIV(TMPyP)4+ in DNA are affected by binding of A-T base pair not only with Ti-O but also with porphyrin ring. In conclusion, the AFM-correlated CSM-coupled Raman/fluorescence techniques provide more detailed information on binding pattern of porphyrin with DNA with regard to photophysical properties as compared with the conventional Raman/fluorescence spectroscopic techniques.

References

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