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Applications of Terahertz Spectroscopy to the Analysis of DNA[1]

CHRISTOPHER LEMON, Ohio Northern University, Department of Physics, JOE KNAB, YUNFEN HE, ANDREA MARKELZ, SUNY at Buffalo, Department of Physics, JANET MORROW, SUNY at Buffalo, Department of Chemistry — Terahertz spectroscopy is a unique analytical method that investigates collective, low-energy vibrational modes of molecules. This technique is especially useful for the characterization of biological molecules, which have a large number of normal modes in the far infrared region. However, terahertz spectroscopy as applied to biological molecules is in its infancy. Proteins have been largely studied, but DNA has not been extensively explored. Only a few solid-state studies have been conducted on the nitrogenous bases and deoxyribonucleosides. In order to be more biologically relevant, a series of experiments on deoxribonucleotides has been performed in the solution state. The mononucleotides were studied in both pellet and solution forms in order to draw comparisons between the two states. These observations are similar to those obtained from a series of ab initio calculations. Since this technique can be applied to detect binding events, the well-characterized biotin and avidin system was studied. Spectra of biotin, avidin, and the complex were obtained. Based on absorbance and refractive index changes, it can be concluded that binding of biotin and avidin has occurred to form the complex. As a result, terahertz spectroscopy is a viable tool for detecting binding events.

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