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标题: Terahertz spectroscopy of dry, hydrated, and thermally denatured biological macromolecules

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摘要: Terahertz time-domain spectroscopy (THz-TDS) is an effective technique to probe the intermolecular and collective vibrational modes of biological macromolecules at THz frequencies. To date, the vast majority of spectroscopic studies have been performed on dehydrated biomolecular samples. Given the fact that all biochemical processes occur in aqueous environments and water is required for proper protein folding and function, we hypothesize that valuable information can be gained from spectroscopic studies performed on hydrated biomolecules in their native conformation. In this study, we used a THz-TDS system that exploits photoconductive techniques for THz pulse generation and freespace electro-optical sampling approaches for detection. We used the THz spectrometer to measure the time-dependent electric field of THz waves upon interaction with water, phosphate buffered saline (PBS), and collagen gels. By comparing these waveforms with references, we simultaneously determined each sample's index of refraction (n) and absorption coefficients ($\mu(a)$) as a function of frequency. Our data show that the properties we measure for the water, PBS and collagen are comparable to those reported in the literature. In the future, we plan to examine the effect that both temperature and pH have on the optical properties of other biological macromolecules. Studies will also be performed to compare our results to those generated using molecular dynamics simulations.

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