Biological tissue quality assessment by using light scattering goniometry and oblique incidence reflectometry

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Recent years showed a considerable interest in monitoring food quality due to an increased recognition of the risk of encountering a biological, chemical, or physical agent in the food due to adulteration or spoilage with potential adverse health effects. Notably, the biochemical composition and concentration of cells and tissues get altered due to denaturation and enzymatic degradation at different time scales resulting in a change in their light scattering properties. Thus, proper determination and interpretation of time dependent light scattering properties of biological tissues would provide valuable information for discriminating between healthy and damaged food products or for monitoring changes in their biophysical properties due to the microbial infection, stimuli, etc. [1,2].

In this contribution, we report the design and fabrication of a compact and efficient optical metrology system with the combined capability to perform both scattering and reflectance measurements to determine the scattering, absorption, and reduced scattering coefficients (μ_s, μ_a and μ_s' respectively), phase function, $P(\theta)$, and anisotropy factor, g of biological tissues at broadband (396–625 nm) incident wavelengths. Preliminary results including look-up tables which contain the measured scattering properties as a function of time dependent degree of spoilage of different food products (e.g., vegetables and fruits) will be presented. Significant differences in the values of scattering parameters were observed for healthy and rotten tissues at different measurement wavelengths. This study will be useful in the development of portable devices for efficient food quality assessment.

References

[1] Mishchenko, M. I., Hovenier, J. W. and Travis, L. D., eds., 2000: *Light Scattering by Nonspherical Particles: Theory, Measurements, and Applications*. Academic Press, San Diego.
[2] Jacques, S. L., 2013: Optical properties of biological tissues: a review. *Phys. Med. Biol.* **58**, R37.

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