Effect of photo acoustic imaging and application of acoustic detectors.

Dan wade*

Department of biomedical imaging, University of Michigan, United states

Introduction

The photo acoustic effect or opt acoustic effect is the formation of sound waves following light absorption in a material sample. In order to obtain this effect the light intensity must vary, either periodically modulated light or as a single flash. The photo acoustic effect is quantified by measuring the formed sound pressure changes with appropriate detectors, such as microphones or piezoelectric sensors. The time variation of the electric output current or voltage from these detectors is the photo acoustic signal. These measurements are useful to determine certain properties of the studied sample. In photo acoustic spectroscopy, the photo acoustic signal is used to obtain the actual absorption of light in either opaque or transparent objects. It is useful for substances in extremely low concentrations, because very strong pulses of light from a laser can be used to increase sensitivity and very narrow wavelengths can be used for specificity. Furthermore, photo acoustic measurements serve as a valuable research tool in the study of the heat evolved in photochemical reaction, particularly in the study of photosynthesis [1].

The main physical picture, in this case, envisions the original temperature pulsations as origins of propagating temperature waves which travel in the condensed phase, ultimately reaching the surrounding gaseous phase. The resulting temperature pulsations in the gaseous phase are the prime cause of the pressure changes there. The amplitude of the traveling thermal wave decreases strongly exponentially along its propagation direction, but if its propagation distance in the condensed phase is not too long, its amplitude near the gaseous phase is sufficient to create detectable pressure changes. This property of the thermal wave confers unique features to the detection of light absorption by the photo acoustic method. The temperature and pressure changes involved are minute, compared to everyday scale – typical order of magnitude for the temperature changes, using ordinary light intensities, are about micro- to mill degrees and for the resulting pressure changes is about nano- to microbars [2].

Another application of the photo acoustic effect is its ability to estimate the chemical energies stored in various steps of a photochemical reaction. Following light absorption photo physical and photochemical conversions occur, which store part of the light energy as chemical energy. Energy storage leads to less heat evolution. The resulting smaller photo acoustic signal thus gives a quantitative estimate of the extent of the energy storage. For transient species this requires the measurement of the signal in the relevant time scale and the capability to extract from the temporal part of the signal the time-dependent heat evolution, by proper convolution. There are numerous examples for this application. A similar application is the study of the conversion of light energy to electrical energy in solar cells. A special example is the application of the photo acoustic effect in photosynthesis research [3].

The main physical picture, in this case, envisions the original temperature pulsations as origins of propagating temperature waves thermal waves, which travel in the condensed phase, ultimately reaching the surrounding gaseous phase. The resulting temperature pulsations in the gaseous phase are the prime cause of the pressure changes there. The amplitude of the traveling thermal wave decreases strongly exponentially along its propagation direction, but if its propagation distance in the condensed phase is not too long, its amplitude near the gaseous phase is sufficient to create detectable pressure changes. This property of the thermal wave confers unique features to the detection of light absorption by the photo acoustic method. The temperature and pressure changes involved are minute, compared to everyday scale – typical order of magnitude for the temperature changes, using ordinary light intensities, are about micro- to mill degrees and for the resulting pressure changes is about nano- to microbars [4,5].

Reference

1. Mauzerall DC, Gunner MR, Zhang JW. Volume contraction on photoexcitation of the reaction center from Rhodobacter sphaeroides R-26: internal probe of dielectrics. Biophys. J.1995;68(1):275-80.
2. Schulenberg PJ, Rohr M, Gärtner W, et al. Photoinduced volume changes associated with the early transformations of bacteriorhodopsin: a laser-induced optoacoustic spectroscopy study. Biophys. J. 1994;66(3):838-43.
3. Egerev SV, Lyamshev LM, Puchenkov OV. Laser dynamic optoacoustic diagnostics of condensed media. Sov phys uspekhi.1990;33(9):739.
4. Small JR. Deconvolution analysis for pulsed-laser photoacoustic. In Methods in enzymology.1992 210;505-521. Academic Press.
5. Harren FJ, Cotti G, Oomens J, et al. Photoacoustic spectroscopy in trace gas monitoring. Encyclopedia of analytical chemistry.2000;3:2203-26.

***Correspondence to:** Kathleen Daisy, Department of biomedical imaging, University of Michigan, United states. E-mail: danwade@umich.edu

***Received:** 26-Oct-2022, Manuscript No. AABIB-22- 82354; **Editor assigned:** 28-Oct-2022, PreQC No.AABIB-22- 82354 (PQ); **Reviewed:** 11-Nov-2022, QC No AABIB-22-82354; **Revised:** 15-Nov-2022, Manuscript No. AABIB-22- 82354; **Published:** 22-Nov-2022, DOI:10.35841/aabib-6.11.154*

***Citation:** Wade D. Effect of photo acoustic imaging and application of acoustic detectors. J Biomed Imag Bioeng. 2022;6(11):154*

Citation: *Wade D. Effect of photo acoustic imaging and application of acoustic detectors. J Biomed Imag Bioeng. 2022;6(11):154*