Photoacoustic Spectroscopy Applied to the Study of Protoporphyrin IX Induced in Mice

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We used Photoacoustic Spectroscopy (PAS) to study protoporphyrin IX (PpIX) in mice skin induced from δ-aminolevulinic acid (ALA) administrated by intraperitoneal route to CD 1 female mice. From obtained PAS spectra and by using the Phase-Resolved Method we estimated that PpIX in skin was preferentially concentrated near to the inner side of the basal membrane. It was also obtained the total attenuation coefficient (μ_t) of the mouse skin as a function of wavelength. The obtained μ_t values, in particular at 630 nm agree with the literature values for similar samples. Also it was estimated in a first approximation the degradation time of PpIX when is irradiated at its maximun optical absorption wavelength.

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In the photodynamic therapy (PDT), porphyrins are currently used as photosensitizers of cancerous tumors, thus, is important to measure their distribution in tissues, mainly in relation to the possible side effects after their injection into patients.[1] Among these porphyrins stands out the protoporphyrin IX (PpIX) which is induced by δ-aminolevulinic acid (ALA) being accumulated in high concentrations in cancerous cells and in low concentrations in normal cells.[1,2] It is important to measure the distribution of PpIX in tissues and to study the products of its photobleaching in order to find possible collateral effects and optimize the PDT. Photothermal (PT) techniques could be useful for this kind of studies in tissues.

Among the PT techniques, Photoacoustic Spectroscopy (PAS) is ideally suited for measuring the absorption spectrum of opaque materials,[3] as it depends on thermal as well as optical properties of the sample, and provides different information from reflectance measurements.[4,5] It involves the measurements of heat produced as an excite species relaxes by a nonradiative path. The exciting light is chopped at a suitable frequency and the resulting modulated heat flow is detected as pressure fluctuations by using a microphone and a lock-in amplifier. As the exciting light is scanned in wavelength, a similar spectrum of the optical absorption spectrum is obtained in which the response is proportional to both the absorption cross section and the thermal diffusivity of the sample.[3] PAS has been used in skin studies including stratum corneum maturation, sunscreen effectiveness, and in a study of both water content and tetracycline disappearance. [6]

The purpose of this work is to determine, from mice exposed to ALA, the PpIX accumulation in skin also to calculate the degradation time of PpIX *in vitro*, when irradiated at its maximum optical absorption wavelenght, and to obtain the total attenuation coefficient in mouse skin as a function of the wavelength radiation. In all these studies were used PAS.

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