Monitoring of the Photodegradation Process of Beta-Carotene by Thermal Lens, Optical Absorption and Emission Spectroscopy

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In this work, the photodegradation process induced by ultraviolet radiation of beta-carotene (vitamin A) at the concentrations of 100, 10 and 1 mg/ml is studied. The process has been analyzed by using the techniques of thermal lens, ultraviolet-visible and fluorescence spectroscopy. For the case of ultraviolet radiation with a wavelength of 366 nm, the sample with the highest concentration exhibits a characteristic absorbance at 450 nm along with an additional absorption band at 280 nm. This last effect is related to the photodegradation process of vitamin A, where the intensity increases with the time of exposure to ultraviolet radiation. After 60 minutes of exposure, the band shows no evolution and the effect due to irradiation is permanent. Similar results have been obtained for the samples with lower concentration. On the other hand, for an excitation at 450 nm; the emission spectra show bands around 515 nm and 590 nm at the first stage, which decrease in intensity for longer times. For an excitation at 480 nm and samples with lower concentration, similar results have been observed, which exhibit shorter stabilization times. Thermal lens measurements of the photodegradation process induced by ultraviolet radiation at wavelength 366 nm, show that the value of the thermal signal decreases until reaching its stability. This indicates that there are changes in the processes of absorption in the sample, which could be used to determine the temporal evolution of the thermal properties of the sample. The results of this work could be highly useful to determine the effects of ultraviolet radiation on vitamin A and enable the identification of products which arise after the process of photodegradation.