

Usefulness of Φ -order kinetics for the investigation, characterisation and quantification of photodegradation processes.

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Abstract

Φ -order kinetics has been shown to be the best tool to study photokinetics [1 – 6]. Various species have been studied using this approach including photochromes [1, 2] and drugs [3 – 6]. The unimolecular photodegradation processes of the form AB (1Φ) and photoreversible systems AB (2Φ), where A, the initial species phototransforms into a product B ($A \rightarrow B$) which itself can return to A ($B \rightarrow A$) via two distinct photoprocesses, each characterized each by an individual efficiency (Φ), have been mathematically described by integrated rate-law equations which express the so called ' Φ -order' kinetics [1 – 6]. The application of this novel approach was found to be useful to determine a number of photoreaction attributes. The reaction's photochemical quantum yield(s), the effects of initial species concentration, or the impact of competitive absorbers on the rate-constant of the photoactive species were all made readily accessible by simple methods. More importantly, the Φ -order kinetics has proven to facilitate the development of a wide range of actinometers from AB (1Φ) and AB (2Φ) systems [2 – 6]. This novel Φ -order kinetic method clearly has the potential for application in various fields including the photodegradation of natural products. The details of Φ -order elucidation kinetic methods will be discussed here and examples of application presented.

Keywords: Spectrophotokinetics, photodegradation; Φ -order kinetics; quantum yield; actinometry; UV/Vis spectroscopy

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