



Photochemical Reactions in the Irradiated Poly (*para*- substituted styrene) in Solid Films and in Solutions

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Abstract

In the last few years, much attention has been focused on research to prepare new generation of Poly (*para* – substituted styrene), and to study the irradiation, thermal and plasticization effects on stability of these new polymers. The photodegradation of irradiated solid films was studied by using UV – Visible, Fluorescence, FT - IR and TLC spectroscopic techniques. Irradiated pure and blended Poly (*para* – substituted styrene) solid films showed a gradual increase in the absorption intensity of the main band with the increase in the amount of blended plasticizers and increase in the irradiation time as well as the formation of new bands at longer wavelengths. The fluorescence spectra of irradiated polymers in solid films and in solutions of different polarity, showed a deformation in the fluorescence main band and the appearance of new bands at longer wavelengths, indicating the distraction of polymer chains and the formation of new photo products through the formation of free radical reactions. The FT – IR spectra of irradiated pure and blended solid films, showed an increase or decrease of the polymer vibration frequencies, as well as a changes in numerous inferred bands intensities. The increase in the intensities of the analyzed ranges is attributed to the formation of carbonyl, hydroxyl, and aliphatic ketones and to the increase in the number of polyene structures that resulted from hydrogen abstraction during photodegradation reactions. The analysis of the Fourier-transform infrared spectra of the irradiated and nonirradiated samples showed a noticeable formation of a new broad band centered at (1,727 cm^{-1} , C=O), assigned to the growth of aliphatic ketones formerly from the reaction of reactive alkoxy radicals. Its intensity was found to increase with the increase in irradiation time and also with the increase in the amount of added Terephthalate and phthalates plasticizer, indicating an increase in the efficiency of the photo degradation process. The analysis of fragments that resulted from the photo irradiation samples of PSP in solution, using electrospray ionization-ion trap (ESI). Where the separation and determination of the fragments which resulted from degraded polymer were studied by LC–ESI-MS in positive mode, and gave the best specificity and sensitivity for their detection. The positive ion (ESI-MS) spectra showed five main peaks of the total ion chromatogram (TIC). All the compounds that were resulted from the photodegradation of the irradiate polymer solution gave the protonated molecules $[M + H^+]$ after ionization in the electro spray source. The fragmentation ions showed the formation of monomer, dimer and oxygenated organic compounds. Some kinetics work was applied to the

results on fluorescence intensity of the excimeric emission to evaluate the quenching efficiencies and photo quenching rate constant by applying Al Ani – Hawi equation. Electrophilic substitution such as (Cl, and Br) in the *para* position of the polymer backbone should less stability towards UV – Irradiation, whereas, nucleophilic substitution such as (- H, - CH₃, -OCH₃, -OC₂H₅, -C₆H₅, α – CH₃, α –OCH₃, Phenyl and – C (CH₃)₄ should higher stability towards irradiation of plasticization. Among the *para*-substituted polystyrene, Poly (4-fluorostyrene) should a very high stability towards irradiation and plasticization that all polymers used in these studies. It is even more stable than polystyrene, The mechanism of the photodegradation of these irradiated polymers was found to started from abstraction of α – hydrogen atom from the phenyl group followed by a random chain scission in the polymer backbone. Proposed mechanism for the photodegradation of *para*-substituted styrene in solid films and in solution was based on the decrease or increase in the functional groups that appears from the FT – IR spectra of irradiated solid films.



Biography:

Al Ani has completed his PhD at the age of 26 years from Southampton University - England , UK, and postdoctoral studies from Texas University, Austin, Texas - USA .He was a visiting professor at Liverpool University at the Inorganic and industrial department, Liverpool – England, UK.. He has a professor post at Baghdad University, Department of Physical Chemistry – Iraq, a professor of physical chemistry at Oran University of science and technology – Algeria, also at the Hashemite University – Jordan. He was dean of Faculty of Pharmacy (2014 – 2017) at Jadara University, Jordan. Currently, he is Head of the Pharmaceutical since department at Jadara University – Irbid, Jordan. He has published more than 48 original articles in international journals, and attended more than 19 international conferences around the world.

**Speaker Publications:**

1. "Irradiation Effect on Photodegradation of Pure and Plasticized Poly (4-Methylstyrene) in Solid Films"; Materials Sciences and Applications / 2014 / 5(5).
2. "Kinetic Study of the Effect of Plasticization on Photodegradation of Polystyrene Solid Films Materials Science and Applications/ 2015/ Vol 6 (7).
3. "Irradiation Effect on Stability of Plasticized Poly(Fluorostyrene) Isomers in Solution"; International Journal of Photochemistry/ Vol 2014, 2014.

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