31ª REUNIÃO ANUAL DA SBQ-SUL
A QUÍMICA COMO PROPULSORA DE NOVOS ECOSSISTEMAS DE INOVAÇÃO
19 A 21 DE NOVEMBRO
Campus Toledo
Unioeste

Área: ANA

Spectroscopic and Chromatographic Analysis of Polyvinyl Chloride Degradation Under UV Radiation

Laura S. Souza (IC)[1], Rafaella V. Comunello (PG)[1], Daniele G. Muller (PQ)[1], Felipe Kessler (PQ)[1], Daiane Dias (PQ)[1], Eliézer Q. Oreste (PQ)[1]

lauradssouzafurg@gmail.com; eliezerquadro@gmail.com

[1]Laboratório de Eletroespectro Analítica (LEEA), Escola de Química e Alimentos (EQA), Universidade Federal do Rio Grande (FURG).

Keywords: Characterization, Polymer, Photodegradation, Polyvinyl chloride.

Highlights

The PVC was exposed to UV radiation and analyzed by fluorescence, FTIR and GPC. Dehydrochlorination and oxidized were observed, highlighting the need for stabilization and recycling.

Resumo/Abstract

Polyvinyl chloride (PVC) is one of the most used synthetic polymers on a global scale, mainly due to its versatility, low cost and durability (1). However, it has a high environmental impact and toxicity, as its degradation is slow and results in the release of harmful compounds. Ultraviolet radiation (UV) acts as one of the main agents of PVC degradation, promoting photodegradation processes that begin with dehydrochlorination, responsible for the release of HCl and the formation of conjugated polyene sequences (2). In subsequent steps, the oxidation of these structures occurs, with the generation of functional groups such as aldehydes, ketones and carbonyls, which significantly modify the physical-chemical properties of the material (3).

The present study aimed to evaluate these structural transformations using fluorescence spectroscopy and Fourier Transform Infrared (FTIR) spectroscopy on PVC powder samples irradiated for different periods (15 min to 5 h). The results showed an initial increase in fluorescence, associated with the formation of polyenes, followed by a decrease at longer exposure times, indicating conversion to oxidized species with lower emission intensity. FTIR analyses complemented the spectroscopy results, showing progressive intensification of carbonyl bands (1720–1745 cm^{-1}) and reduction of C–H and C–Cl absorptions, confirming the progression of photodegradation.

Additionally, the samples were analyzed by Gel Permeation Chromatography (GPC) to assess polydispersity, defined as the ratio of the weight-average molar mass (Mw) to the number-average molar mass (Mn). It was observed that polymers exposed for longer periods exhibited higher polydispersity, indicating increased molecular chain scission during degradation.

The results highlight the importance of spectroscopic and chromatographic techniques in elucidating PVC degradation mechanisms and characterizing structural changes induced by UV radiation. Further studies are being conducted using Immobilized Microparticle Voltammetry (VIMP) to complement the analysis of chemical alterations.

Agradecimentos/Acknowledgments

FURG, EQA, PPGQTA, LEEA, CAPES, FAPERGS, Governo do Estado do Rio Grande do Sul, CNPq and Banco Mundial.

Referência:

(1) ON PLASTICS. Plásticos GON 2025, 1, 10–15.
(2) JUNAID, M. et al. Sci. Total Environ. 2024, 927, 172213. Acta Facultatis Medicae Naissensis 2022, 39, 75-88.
(3) ROMÃO, W.; SPINACÉ, M. A. S.; DE PAOLI, M.-A. Polímeros 2009, 19, 121–132.