

Abstract

Improvement of Thermal Characteristics of Plasticized PVC via a Complex of Eco-Friendly Additives [†]

Polina Alexandrovna Kruchinina *  and Irina N. Vikhareva 

Nanotechnology Research & Education Centre, South Ural State University, Chelyabinsk 454080, Russia; vikharevain@susu.ru

* Correspondence: asp2025kpa6@susu.ru

[†] Presented at the 3rd International Online Conference on Polymer Science, 19–21 November 2025; Available online: <https://sciforum.net/event/IOCPS2025>.

Keywords: polyvinyl chloride; plasticizer; thermal stability; environmental friendliness; hierarchical microstructured materials; thermolysis

Enhancing the thermal stability of plasticized PVC (Bashkir Soda Company Caustic JSC, Sterlitamak, Russia) is a critically important task for expanding its areas of practical application. The development of eco-friendly modifying additives shows promising growth in this field. Titanium phosphates meet the requirements of green chemistry, and their use in hierarchical microstructured materials contributes to improving the characteristics of the material. Complex esters of adipic acid are widely used as alternative PVC plasticizers that promote increased thermal stability. This study investigates the combined effect of titanium phosphates and diphenoxyethyladipate (obtained in the laboratory) on the thermal characteristics of PVC. The thermal stability of PVC compositions was studied using Thermogravimetric Analysis (TGA) and Differential Scanning Calorimetry (DSC) in an oxidative environment (air). The obtained results show an improvement in the thermal characteristics of the compositions compared to the base PVC compound plasticized with dioctyl phthalate (JSC Kamtex-Khimprom, Perm, Russia). The key evaluation parameters for the composition are as follows: initial mass loss temperature; coke residue; temperature of maximum decomposition rate (T_{max} DTG); and temperature of maximum heat flow (T_{max} DSC) during the main stage of thermolysis. Increasing the DFEA (diphenoxyethyladipate) content in PVC composition from 16 to 49 parts by weight resulted in improved thermal characteristics. The initial temperature of the sample mass loss indicated a shift in the degradation process towards higher temperatures. The shift in the maximum of the first stage of PVC composition degradation—dehydrochlorination—confirmed a reduction in the rate of thermal degradation of the material. Analysis of the DSC data confirmed an increase in the thermal stability of the composition, expressed as an increase in the T_{max} DSC value. A PVC composition with improved thermoanalytical characteristics using eco-friendly additives was developed.



Academic Editor: Alessandro Pegoretti

Published: 14 November 2025

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Author Contributions: Conceptualization, I.N.V.; methodology, I.N.V.; software, P.A.K.; validation, P.A.K.; formal analysis, I.N.V.; investigation, P.A.K.; resources, I.N.V.; data curation, P.A.K.; writing—original draft preparation, P.A.K.; writing—review and editing, I.N.V.; visualization, P.A.K.; supervision, I.N.V.; project administration, I.N.V.; funding acquisition, I.N.V. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Ministry of Science and Higher Education of the Russian Federation (grant FENU 2024-0005).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was not required for this study in accordance with national legislation and institutional requirements.

Data Availability Statement: Dataset available on request from the authors due to privacy.

Conflicts of Interest: The authors declare no conflicts of interest.

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