SYNTHESIS AND INVESTIGATION OF NATURAL OIL-BASED SHAPE-MEMORY PHOTOPOLYMERS

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The increasing recognition of pollution and environmental challenges stemming from the utilization of petroleum-derived materials is propelling scientific investigations aimed at substituting frequently employed harmful products with bio-based alternatives [1]. Shape memory polymers are smart materials that can be deformed and fixed into a temporary shape and can recover their permanent shape after the release of the external stimulus. Due to their appealing qualities like structural flexibility, lightweight nature, affordability, ease of processing, high elastic strain, biocompatibility, and biodegradability, they are gaining significant interest in industrial, aerospace, textile, and medical applications [2].

In this study, photopolymers were synthesized by photocuring of resins containing natural oil-based monomers and other biobased comonomers, using ethyl-(2,4,6-trimethylbenzoyl)-phenylphosphinate as photoinitiator. Real-time photorheometry was used to monitor the evolution of photocuring process. The chemical structure of the photopolymers was confirmed by Fourier transform infrared spectroscopy, Soxhlet extraction and swelling test. The thermal properties of the photopolymers were investigated by dynamic mechanical thermal analysis and thermogravimetric analysis. It was determined that photocuring rate, rheological, and thermal properties of the resulting photopolymers depended on the initial composition of the resins. Samples of all synthesized photopolymers were able to obtain a new shape while heated above their glass transition temperature, maintain it after cooling below their glass transition temperature, and return to their primary shape after heating again above their glass transition temperature. These behaviors have determined these photopolymers as shape memory polymers.

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