LED-Driven Free Radical Photopolymerization of Bio-Based Monomers Using Schiff Base Photocatalysts

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Abstract

The search for alternatives to non-renewable monomers has increased due to fossil fuel emissions and plastic waste, promoting the use of materials from renewable sources. Photochemical processes offer advantages over thermal methods, such as lower temperatures, faster reactions, and control over material properties[1,2]. Herein, methacrylate monomers were synthesized from sesamol (from sesame oil) and piperonyl alcohol (from black pepper), following literature procedures[1] and evaluated in free radical photopolymerization (FRP). The three-component system was investigated containing a photocatalyst (PC), di-tert-butyl-diphenyl iodonium hexafluorophosphate (Iod), and ethyl 4-(dimethylamino)benzoate (EDB) under UV and visible irradiation. A newly synthesized **Salophen^{Me}** photocatalyst was obtained by condensation of 4,5-dimethyl-1,2 phenylenediamine with 2-phenylsalicylaldehyde and characterized by spectroscopic techniques[2]. Formulations were prepared with 0.5 g of sesamol methacrylate (**SMA**) or piperonyl methacrylate (**PipMA**), 0.2 wt% of PC, and 2 wt% of Iod and EDB as additives, whereas FRP was monitored by FTIR (C=C, ~1636 cm^{-1}). Conversions of ~45–70% were obtained under LED irradiation (365, 405, and 455 nm), with **SMA** reaching ~45–50% and **PipMA** ~60–70% at 1200s. **PipMA** showed faster kinetics at short irradiation times (600 s). Control systems (Iod/EDB) exhibited lower or no conversions, confirming the key role of the photocatalyst under mild conditions.

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