PHOTOINDUCED FRONTAL POLYMERIZATION OF BIOBASED ACRYLATESù IN THE PRESENCE OF NATURAL FILLERS

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Frontal polymerization (FP) is a self-sustaining reaction where an initial trigger (such as thermal or photoinitiation) generates a localized reaction zone known as the “polymerization front.” The exothermic heat released in this zone raises the temperature sufficiently to initiate further polymerization at the interface between the polymer and unreacted monomer, often leading to planar propagation [1].

Compared to conventional polymerization methods, FP offers several advantages: (a) a simple process without the need for stirring; (b) rapid reaction rates that save time; (c) cost-effective and eco-friendly operation without continuous external energy input; (d) reduction of multiple processing steps; (e) high product uniformity and homogeneity of polymer chains, as phase separation and sedimentation are avoided by the propagating front; (f) high conversion rates; and (g) minimal to no solvent usage [2].

This study presents findings on the curing of thick samples and monomers located in dark areas using photoinduced frontal polymerization of biobased acrylic monomers. The effects of incorporating natural fillers (wood powder and cellulose powder) were explored. Characterization techniques included FT-IR, viscometry, thermal imaging, and FESEM. Additionally, process optimization was examined with respect to thermal effects, frontal velocity, monomer conversion, reaction mechanisms, formulation type, and environmental and processing conditions.

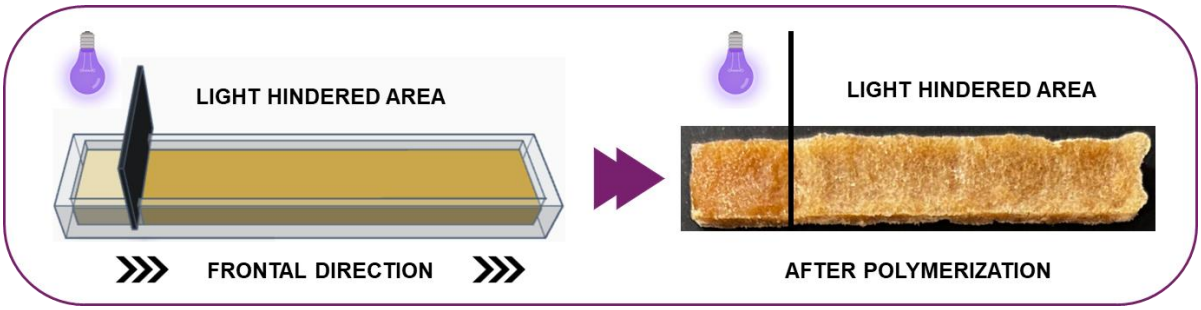


Figure 1. Irradiation process scheme and a photo of biocomposite after polymerization.

Literature

[1] Benjamin A. Suslick et al, Frontal Polymerizations: From Chemical Perspectives to Macroscopic Properties and Applications Chemical Reviews Vol 123, 2023, 3237–3298.

[2] Li, Qing et al, Advances in frontal polymerization strategy: From fundamentals to applications, Progress in Polymer Science Vol 127, 2022, 101514.

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