ACRYLATED GLYCEROL-BASED PHOTOCROSS-LINKED POLYMERS

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The availability of petroleum-based resources has decreased significantly with the increase of worldwide demand for energy. Indeed, the depletion of fossil reserves associated with serious ecological problems related to greenhouse gas emissions forced researchers to develop new polymeric materials based on renewable and sustainable sources. Glycerol, as a by-product of the biodiesel production process, is a highly available commercial compound in recent times [1] and can be chemically transformed into high added-value chemical products [2]. Photopolymerization is nowadays a high-performance technology for the synthesis of polymer materials in various industrial fields such as coatings, dental resins, automotive, holographic data storage, stereolithography, etc. [3]. Several advantages over the thermally-induced polymerization process make photopolymerization an eco-friendly technology with time, money and energy savings, waste reduction, absence of solvent, etc. [4].

After considering the advantages of glycerol and photopolymerization, it was decided to synthesize novel acrylated glycerol-based photocross-linked polymers. In this study, the cross-linked polymers were obtained by photopolymerization of 2,3-dihydroxypropylmethacrylate (GM), glycerol dimethacrylate (mixture of isomers) (GDM), and glycerol trimethacrylate (GTM), using ethyl (2,4,6-trimethylbenzoyl) phenyl phosphinate as photoinitiator (TPOL). The chemical structure of polymers was confirmed by FT-IR spectroscopy. The amount of insoluble polymer fraction was determined by Soxhlet extraction. The reaction process was studied by the real-time photorheometry. The obtained polymers were characterized by differential scanning calorimetry, thermogravimetry, and mechanical testing.

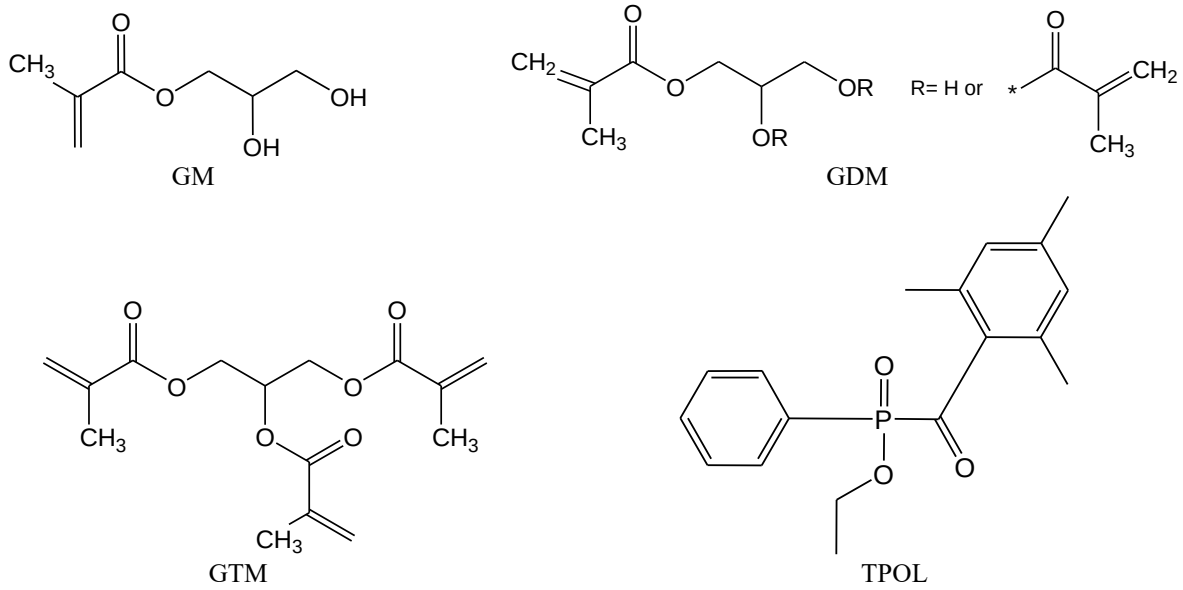

Fig. 1. Chemical structure of monomers and photoinitiator used in this study.

The addition of photoinitiator into the compositions reduced reaction duration and improved the rheological, thermal, and mechanical properties of the resulting polymers due to the increased cross-linking density. The rheological properties of polymers were improved by increase of the amount of acrylgroup in the compositions.

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