SYNTHESIS AND INVESTIGATION OF POLYMERS COMPOSED OF BIOBASED METHACRYLATES

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The (meth)acrylate systems are easily and promptly polymerizable materials which undergo radical chain-growth polymerization during photocross-linking forming a cross-linked network [1]. Due to this (meth)acrylate feature they are used in optical 3D printing, acrylic paints, organic glass, acrylic fiber and etc. The most widely used (meth)acrylates are petroleum-derived and, because of decreasing petroleum recourses, it became crucial to search for alternative materials such as renewable resources [2]. The biobased (meth)acrylates could be obtained from wood, vegetable oils, animal fat, and other natural feedstock.

Isoboronyl methacrylate (IBOMA) is a 71% biobased monomer coming from pine resin, having the homopolymer T_g of 150 °C, and being suitable as a hard monomer. The IBOMA monomers are produced from camphene through the reaction with (meth)acrylic acid [3]. Methacrylated fatty acids as soft monomers could be used in order to increase the elasticity of IBOMA polymers. Dodecyl methacrylate (C13-MA) and hexadecyl methacrylate (C17-MA) are obtained from fatty acids derived from triglycerides that were extracted from vegetable oils and subsequently hydrolysed [4].

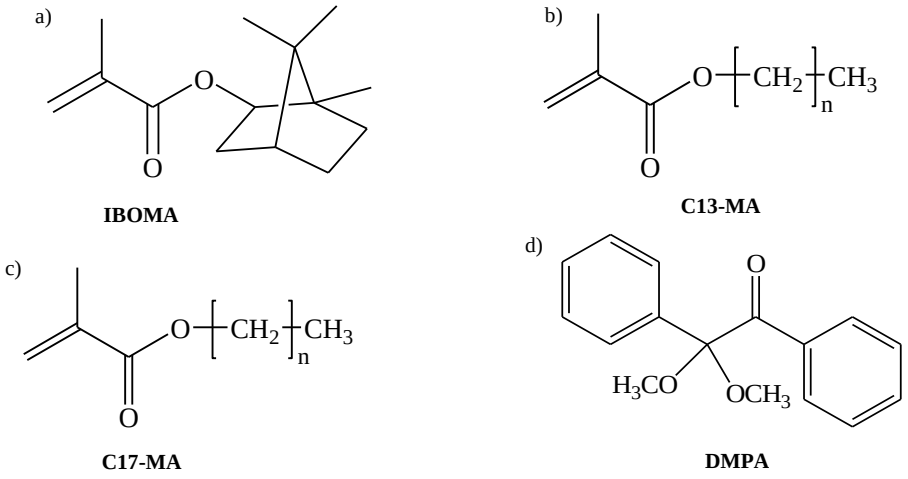

Fig. 1. Chemical structure of isoboronyl methacrylate (a), dodecyl methacrylate (b), hexadecyl methacrylate (c), and 2,2-dimethoxy-2-phenylacetophenone (d)

In this study, biobased IBOMA was photocross-linked with biobased C13-MA and C17-MA. 2,2-Dimethoxy-2-phenylacetophenone (DMPA) was used as photoinitiator. The investigation of photocross-linking kinetics was carried out with MCR302 rheometer from Anton Paar equipped with plate/plate measuring system. The insoluble fraction of the cross-linked polymers was determined by Soxhlet extraction. Mechanical testing of the cross-linked polymer specimens was performed by tensile test on a Testometric M500-50CT.

It was determined that pure IBOMA undergo the photocross-linking reaction the fastest forming a hard highly cross-linked polymer, though C13-MA and C17-MA formed gel-like soft polymers. The photocross-linking of the mixtures with higher amount of IBOMA was the faster and more cross-linked polymers with better mechanical properties were formed.

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