BIO-BASED MONOMERS FOR UV-CURABLE COATINGS: ALLYLATION OF FERULIC ACID AND INVESTIGATION OF PHOTOCURED THIOL-ENE NETWORK

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Ferulic acid (FA) is an unsaturated hydroxycinnamic acid that can be isolated from lignin. It has three different functional groups; a phenol, a cinnamoyl double bond, and a carboxylic acid-group. In this work, [1] the biorenewable FA was allylated to result in a library of mono- or diallylated monomers, either having the inherent cinnamoyl double bond intact (A2FA) or saturated through hydrogenolysis (h-A2FA). All reactions proved to be very selective resulting in high yield without side reaction. The monomers were photo-chemically cured with trimethylolpropane tris(3-mercaptopropionate) (TRIS) into crosslinked films in the presence of a photoinitiator (Irgacue 819). The reactivity of the FA-derived monomers toward TRIS was investigated in detail by photorheology. FT-IR spectroscopy revealed details on the relative reaction rates for the different alkene groups, C=C double bond at 1640 cm^{-1}. Cinnamoyl and allyl ether group had different reactivity evaluated by means of FT-IR. The thermo-mechanical properties of the crosslinked films were fully characterized by means of dynamic mechanical analysis (DMTA) and thermal calorimetry (DSC). It was demonstrated that the glass transition temperature of the final crosslinked network could be controlled by the addition of a monoallylated monomer. By increasing the content of the monoallylated compound, it was possible to observe a linear decrease of the Tg values of the crosslinked films.

[1] Pezzana, L.; Mousa, M.; Malmström, E.; Johansson, M.; Sangermano, M. Bio-based monomers for UV-curable coatings: allylation of ferulic acid and investigation of photocured thiol-ene network. Prog. Org. Coatings 2021, 150, doi:10.1016/j.porgcoat.2020.105986.