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New Platform of Biobased Aromatic Building Blocks for Polymers

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Abstract : Recent years have witnessed an increasing demand on renewable resource-derived polymers owing to increasing environmental concern and restricted availability of petrochemical resources. Thus, a great deal of attention was paid to renewable resources-derived polymers and to thermosetting materials especially, since they are crosslinked polymers and thus cannot be recycled. Also, most of thermosetting materials contain aromatic monomers, able to confer high mechanical and thermal properties to the network. Therefore, the access to biobased, non-harmful, and available aromatic monomers is one of the main challenges of the years to come. Starting from phenols available in large volumes from renewable resources, our team designed platforms of chemicals usable for the synthesis of various polymers. One of these phenols, vanillin, which is readily available from lignin, was more specifically studied. Various aromatic building blocks bearing polymerizable functions were synthesized: epoxy, amine, acid, carbonate, alcohol etc. These vanillin-based monomers can potentially lead to numerous polymers. The example of epoxy thermosets was taken, as there is also the problematic of bisphenol A substitution for these polymers. Materials were prepared from the biobased epoxy monomers obtained from vanillin. Their thermo-mechanical properties were investigated and the effect of the monomer structure was discussed. The properties of the materials prepared were found to be comparable to the current industrial reference, indicating a potential replacement of petrosourced, bisphenol A-based epoxy thermosets by biosourced, vanillin-based ones. The tunability of the final properties was achieved through the choice of monomer and through a well-controlled oligomerization reaction of these monomers. This follows the same strategy than the one currently used in industry, which supports the potential of these vanillin-derived epoxy thermosets as substitutes of their petro-based counterparts.

Keywords : lignin, vanillin, epoxy, amine, carbonate
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