Synthesis and characterization of polybenzoxazine thermoset via solventless method

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ABSTRACT

In spite of the advancement of science and technology, there is an undeniable fact that the growing global energy crisis and current environmental issues due to the utilization of fossil resources to synthesis polymeric materials. Hence, the expanding interest has been initiated for a change from fossil feedstock to sustainable and renewable resources. In this study, bio-based polybenzoxazine and conventional petroleum-based polybenzoxazine was synthesized from eugenol (renewable alcohol derivative) and phenol (non-renewable alcohol derivative) respectively by Mannich-like condensation reaction using eco-friendly solventless approach to investigate their chemical and thermal properties. The functional groups and thermal behavior of eugenol-based polybenzoxazine (EbP) and phenol-based polybenzoxazine (PbP) were characterized using Fourier-transform infrared spectroscopy (FTIR) and thermogravimetric analysis (TGA). Based on the results, PbP is more reactive due to the higher degree of substitution and intermolecular hydrogen bonding according to the peak at 1612.02 cm^{-1}. The thermal stability of PbP is higher compared to EbP due to the high degree of crosslinking as the percentage of weight loss of EbP is higher. However, the findings also show that bio-based polybenzoxazine can be synthesized via solventless method and has momentous impacts for the design of new fully bio-based polybenzoxazine with sustainable, competitive and superior performance than conventional petroleum-based polybenzoxazine.

KEYWORDS

Global energy crisis; Renewable resources; Fourier-transform infrared spectroscopy (FTIR); Thermogravimetric analysis (TGA)

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