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Composite Materials from Epoxidized Linseed Oil and Lignin

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Abstract : the last decades, studies about the use of polymeric materials of plant origin, considering environmental concerns, have captured the interest of researchers because these represent an alternative to petroleum-derived materials. Vegetable oils are one of the preferred alternatives for petroleum-based raw materials having long aliphatic chains similar to hydrocarbons which means that can be processed using conventional chemistry. Epoxidized vegetable oils (EVO) are among the most interesting products derived from oil both for their high reactivity (epoxy group) and for the potential to react with compounds from various classes. As in the case of epoxy resins starting from petrochemical raw materials, those obtained from EVO can be crosslinked with different agents to build polymeric networks and can also be reinforced with various additives to improve their thermal and mechanical performances. Among the multitude of known EVO, the most common in industrial practice are epoxidized linseed oils (ELO) and epoxidized soybean oils (ESO), the first with an iodine index over 180, the second having a lower iodine index but being cheaper. On the other hand, lignin (Ln) is the second natural organic material as a spread, whose use has long been hampered because of the high costs associated with its isolation and purification. In this context, our goal was to obtain new composite materials with satisfactory intermediate properties in terms of stiffness and elasticity using the characteristics of ELO and Ln and choosing the proper curing procedure. In the present study linseed oil (LO) epoxidation was performed using peracetic acid generated in situ. The obtained bio-based epoxy resin derived from linseed oil was used further to produce the new composites byloading Ln in various mass ratios. The resulted ELO-Ln blends were subjected to a dual-curing protocol, namely photochemical and thermal. The new ELO-Ln composites were investigated by FTIR spectrometry, thermal stability, water affinity, and morphology. The positive effect of lignin regarding the thermal stability of the composites could be proved. The results highlight again the still largely unexplored potential of lignin in industrial applications.

Keywords : composite materials, dual curing, epoxidized linseed oil, lignin
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