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Valorizing suberin and other cork side-products in sustainable thermosets

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PURPOSE OF THE ABSTRACT

In an attempt to adhere to the circular economy beliefs by valorizing wastes and creating biobased materials, cork has been extensively studied.
Indeed it is the perfect canditate, its main application being for the cork stoppers manufacturing [1], which leaves a lot of cork powder residues and does not use virgin cork.
Moreover, cork is a very interesting material since it has low conductivity and therefore good insulation properties thanks to its closed cell structure. It also has the advantage of being hydrophobic and fire resistant thanks to suberin, a polyester with long chain aliphatics, which is its main component at about 40%w.[2]
Depolymerized suberin, which can be extracted via a saponification reaction from those « useless » cork residues is also an extremely interesting product. It is mostly monomers such as ?-hydroxyacids and ?,?-dicarboxylic acids.[2]
In addition of its hydrophobicity it has been shown to portray antimicrobial properties [3] as well as antimutagenic effects acting in a desmutagenic manner. [4] It has therefore been used to create novel Suberin NPs which were also able to immobilize essential oil derivatives, such as TCN and improve their antimicrobial and anticancer properties.[5]
In this work, the depolymerized suberin was used with ELO (epoxidized linseed oil) to form biobased non toxic epoxy resins, replacing toxic and petroleum based conventional epoxy resin reactants such as DGEBA.[6]
The resulting resin has the tremendous advantage of being non toxic and is relatively flexible.[6]
Mechanical analysis shows that crosslinked chains of ELO/suberin films present a large temperature range of relaxation which can be interesting for industrial applications. Final properties can be fine-tuned according to ratios and time-temperature program used.[6]
The cork powder or granules left over from the cork stoppers industry were also used as fillers for composites used with Poly(furfuryl alcohol) or with the biobased resin previously stated.[7]
The use of cork in composites, with PFA as matrix for example, permits to have a filled thermoset with improved thermal and mechanical properties.[7]

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

Cork | suberin | Biopolymers | epoxy resin

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