Characterization of Condensed Tannin Extracts from Pinus pinaster Bark

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In recent years, an increased interest in the research for natural and cheap alternatives to synthetic phenolic petroleum-based adhesives for wood has been taking place. Tannins are naturally occurring polyphenols, which main characteristic is their ability to bind and precipitate proteins. They are also able to condense with formaldehyde or even self-condense without the need of any external reticulation agent, having therefore, properties of adhesion. The condensed tannins are widely spread in the plant tissues of a great variety of species. Condensed tannins, complex polymers or oligomers of flavanoid units, namely flavan-3-ols and flavan-3,4-diols can be found in significant quantities in the bark of several species of trees, namely of the Pinus genre. Pinus pinaster is the main forest specie in Portugal, and its bark is specially rich in condensed tannins. Therefore, the bark of Pinus Pinaster can be an interesting source of polyphenolic natural compounds, and can be used successfully in the total or partial replacement of conventional synthetic resins (phenol-formaldehyde or urea-formaldehyde) for the wood agglomerate industry. In this kind of application some problems remain to be solved in order to obtain a Pine extract of commercial value: high reactivity of the phloroglucinolic polymers of procyanidin and high viscosities and low solubilities of the extracts solutions at usual solid contents (at least 40 %). So, in order to obtain a commercially viable extract, it is necessary to optimize the extraction procedure by the characterization of the phenolic and carbohydrate content of the extracts, which have been reported to affect largely the performance of tannin based adhesives. The average molecular weight and sugar content of several aqueous/organic pine bark extracts was determined by Vapor Pressure Osmometry (VPO) and Thin Layer Chromatography (TLC) respectively and the phenolic components were separated and identified by TLC. These results were compared with the obtained with commercially available tannin extracts (wattle, quebracho, tara, chestnut and gambir). The pine bark extracts were also introduced in methilol-urea pre-polymers with promising results.