The Oxypropylation of Olive Stone and the Use of the Ensuing Polyols for the Synthesis of Novel Polyesters and Polyurethanes Based on Renewable Resources

Marina Matos[1,2], *Filomena Barreiro*[2], *Alessandro Gandini*[1]

1. CICECO and Chemistry Department, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal
2. LSRE, Polytechnic Institute of Bragança, Campus de Santa Apolónia Ap. 1134, 5301-857 Bragança, Portugal
marina.matos@ua.pt, agandini@ua.pt, barreiro@ipb.pt

The development of polyols by the oxypropylation of abundant and renewable vegetable and animal resources constitutes an original approach to the exploitation of the biomass. Cellulose, starch, chitosan, chitin, different types of lignins, cork and more complex structures like sugar beet pulp, are among the documented examples[(1)]. All these systems displayed a similar pattern in terms of the grafting of short poly(propylene oxide) (POP) chains from the OH groups of the substrate, albeit of course each situation required a specific set of optimized experimental conditions to transform the natural solid into a viscous polyol. The transformation of these polyols into polyurethanes is the only operation which has been studied to date as a form of their exploitation into polymer materials.

In a similar vein, we have undertaken a study of the oxypropylation of olive stone, a by-product of the olive oil production, which, like many other biomass residues, is presently burnt for energy recovery. The purpose of this investigation was of course the search of a more useful and promising way to exploit this abundant and renewable Mediterranean natural material. A preliminary report on some aspects of this work has already been published[(2)], and the purpose of this communication is to provide an up-to-date account of its progress.

On the one hand, a detailed relationship was obtained between the reaction parameters applied to the oxypropylation of olive stone and the structure and physical properties of the ensuing polyols, and this for different particle sizes of the substrate. The characterization involved FTIR and NMR spectra, viscosity and OH index, as well as the proportion of POP homopolymer formed in these reactions.

On the other hand, a choice of more promising polyols was selected for chemical modifications involving first ester and urethane formations with aliphatic and aromatic monofunctional reagents. The conversion of part or all of the OH groups of the polyols into much less polar moieties brought about significant changes in the properties of the ensuing materials, which were thoroughly characterized. Thereafter, difunctional reagents were employed to transform the polyols into polyester and polyurethane networks, whose properties were again assessed as a function of the type of reaction (different modes of esterification and condensation with diisocyanates), the specific structure of the reagent (aliphatic vs. aromatic) and the extent of OH conversion (stoichiometry).

Acknowledges

Financial support from **FCT** (project PTDC/CTM/71491/2006) is acknowledged.

References

(1) Gandini, A., Belgacem, N. M., 2008. Monomers Polymers and Composites from Renewable Resources. Amsterdam: Elsevier.

(2) Matos, M., Barreiro, Maria F., Gandini, A., 2010. Olive Stone as a Renewable Source of Biopolyols. Industrial Crops and Products 32, 7-12.