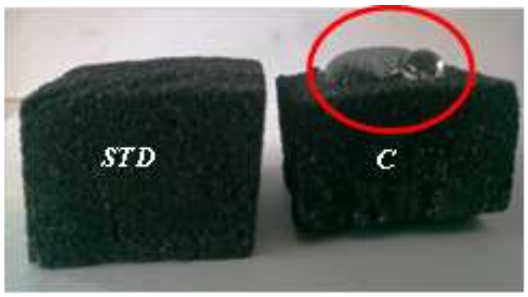
WOGRAFAN



Water impervious oil-grafted tannin foams

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Context —
Since a few years, new biosourced cellular materials have been developed using condensed tannins extracted from the bark of trees. This type of foam is among the most innovative foams proposed in the last years. In particular, Tannin-furanic foams, based on the co-reaction of bark-derived condensed tannins and thermosets furanic polymers, have been prepared, characterized and extensively studied in the LERMAB laboratory. The low thermal conductivity, the self-extinguishing and high fire resistance of these foams lets envisage the development of several industrial uses with a number of companies in very different fields of application showing a considerable interest. Unfortunately, one of the characteristics of these foams is the absorption of water in the foam itself. Another problem of these foams is their rather sensitive surface friability that is a definite drawback to some of their utilizations.

Objectives —
The project is to graft one or several hydrophobic chain on polyphenols and to use these hydrophobic polyphenols in the previously developed formulations of tannin-furanic foams. The long, water-repellant fatty chains grafted onto the polyphenol will improve the water repellency of the basic tannin materials to further improve water resistance of these materials.

Approaches —
Two approaches can be envisaged, namely the use of oil-pre-grafted tannins for the preparation of the foams or even, although, perhaps, more difficult, the grafting of hydrophobic side chains on the hydroxyl groups in existing foams.

Key results —

1. The chemical modification of tannins is now well under control. The characterization of this modification can be done by MALDI-tof mass spectroscopy.
2. From the results obtained, it is clear that incorporating some oil-grafted tannins leads to tannin-furanic foams that are less friable. In their role of exterior-type plasticizers, oil-grafted tannins can markedly decrease the friability of tannin-furanic foams. Furthermore, these grafted tannins, contrary to classical exterior-type plasticizers, do not cause foam shrinkage. This is because the hardening of the foam is very rapid and not shifted in time in relation to foam expansion.
3. Furthermore, incorporation of oil-grafted tannins leads to tannin-furanic foams, which are less hydrophilic, practically hydrophobic. The wetting behavior of the foam was assessed from both static contact angles using the sessile drop method and water adsorption. Increased macroscopic hydrophobicity of the foam is evidenced by both techniques for the modified tannin foam. This is a very interesting effect that can be clearly seen with the addition of only small amounts, such as 8% of grafted tannins, to a standard foam formulation.

Main conclusions including key points of discussion —

This subject is above all for an applied purpose and should allow to produce innovative renewable materials. But this study is also fundamental because she allows to study also the chemical reactivity of tannins and of polyphenol in general

Perspectives —

It would be interesting to modify the proportion of grafted tannins and also the proportion of fatty chains grafted onto the tannin to see the effect on the resulted foams, but for that it will be then necessary to develop the formulation to compensate the lower reactivity of the grafted tannin.

Valorization :

Oral communication:

Hubert Chapuis, Sébastien Orlandini, Géraldine Rangel, Christine Gérardin "Chemical hydrophobic modifications of polyphenol molecules: flavonoids and condensed tannins" IPB, Bogor, Indonésie, 16/09/2015.

Article:

Géraldine Rangel, Hubert Chapuis, Maria-Cecilia Basso, Antonio Pizzi, Clara Delgado-Sanchez, Vanessa Fierro, Alain Celzard, Christine Gerardin-Charbonnier « Improving Water Repellence and Friability of Tannin-Furanic Foams by Oil-Grafted Flavonoid Tannins" (2016) **Bioresources**, 11(3) 7754-7768.