Substitution of chemical phenols by plant polyphenols for processing phenolic biomaterials

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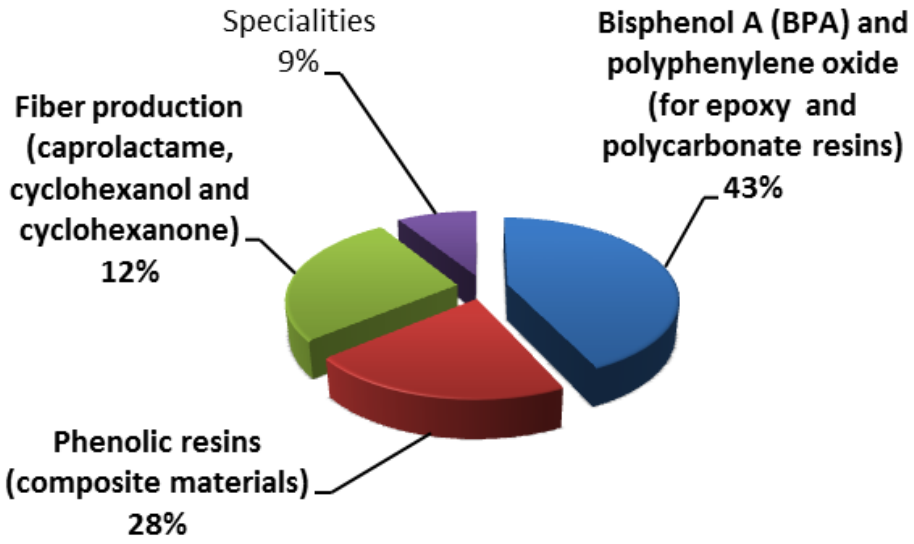
WORLD ANNUAL PRODUCTION OF PHENOL

2000 : 6 million tons
2010 : 8 million tons
2020 : 12 million tons (prediction)

Market in expansion
New production plant in Nanjing, China (INEOS and SINOPEC) : 400 000 tons (end 2013)

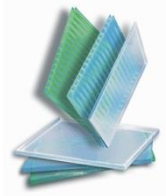
EUROPEAN PHENOL USE

2 million tons per year ; more than 80% for plastic materials and resin



APPLICATIONS

- Plastic materials : thermosetting (polycarbonate, epoxy)
- Plastic fibers : nylon (polyamide)
- Electric isolating
- Bactericid paint
- Hydrophobic coating
- Anionic detergent
- Thermic ink
- Insulating glue



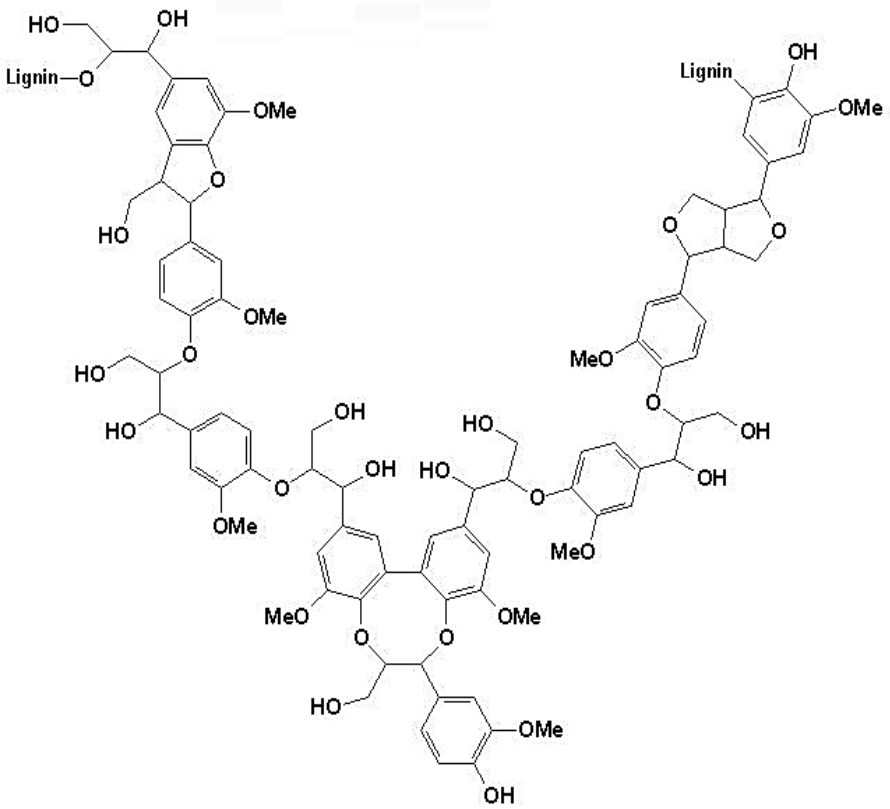



INTRODUCTION

PROBLEMATIC

Need to find quickly alternatives to petroleum-based aromatic compounds to halt the massive contamination of our environment and protect human beings from its negative impacts on health

- ***Substitution of chemical phenol by natural polyphenols***

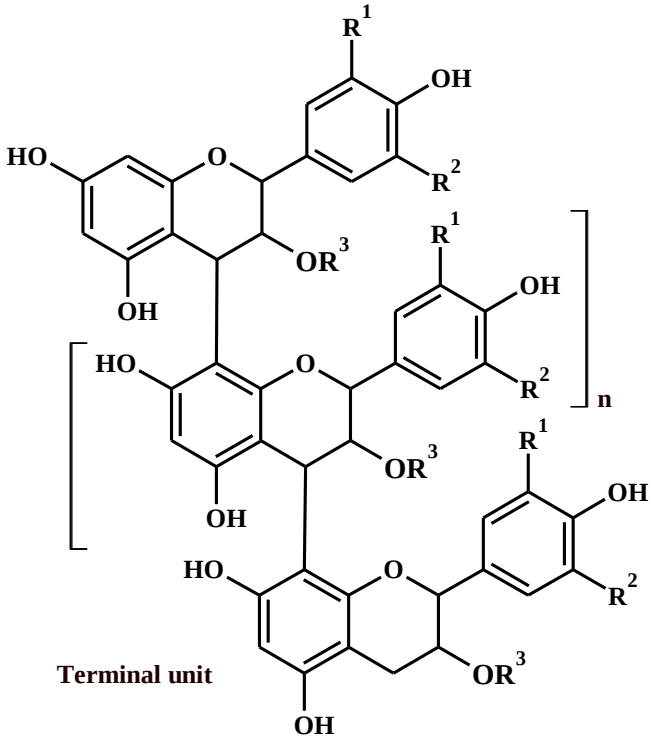


Lignin

Extension units

R^1, R^2 = OH or H

R^3 = H, Gal



Condensed tannins

RESEARCH WORKS

RESSOURCES

Agro-industrial wastes (wine and cider making, fruit juice)

Winemaking Biomass	seeds	pomaces	stems
Annual output	80 000-140 000 t	700 000 t	300 000 t
Tannins (% DM weight)	6 -16%	0,04 - 1,2%	3%

Pomace, fruit marcs

Sawmill co-products and forest biomass

Barks

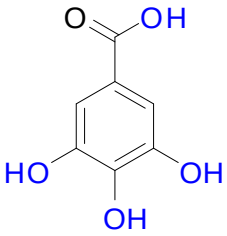
Pine needles, leaves

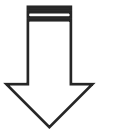
Conifers (36%)
France

French Forest
16 000 000 Ha
2,5 billions m^3

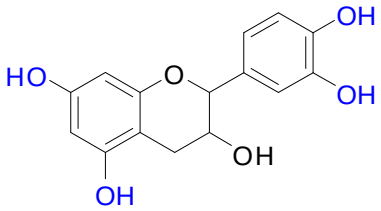
- **From phenolic models**

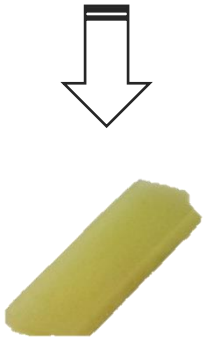
Gallic acid





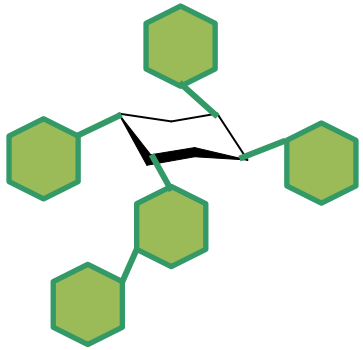
Catechin

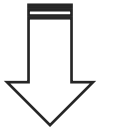




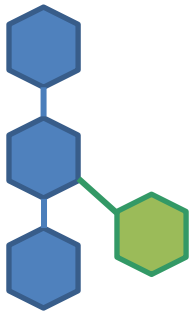
- **From commercial extracts**

Hydrolysable tannins





Condensed tannins



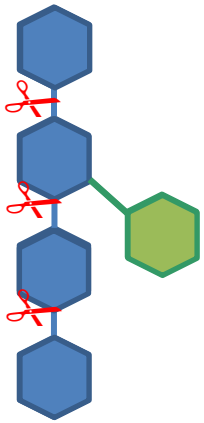
GOAL

DEPOLYMERIZATION : a key step

⇨ to get an homegeneous raw material or fine chemicals

⇨ to get the same synthons from different tannin sources

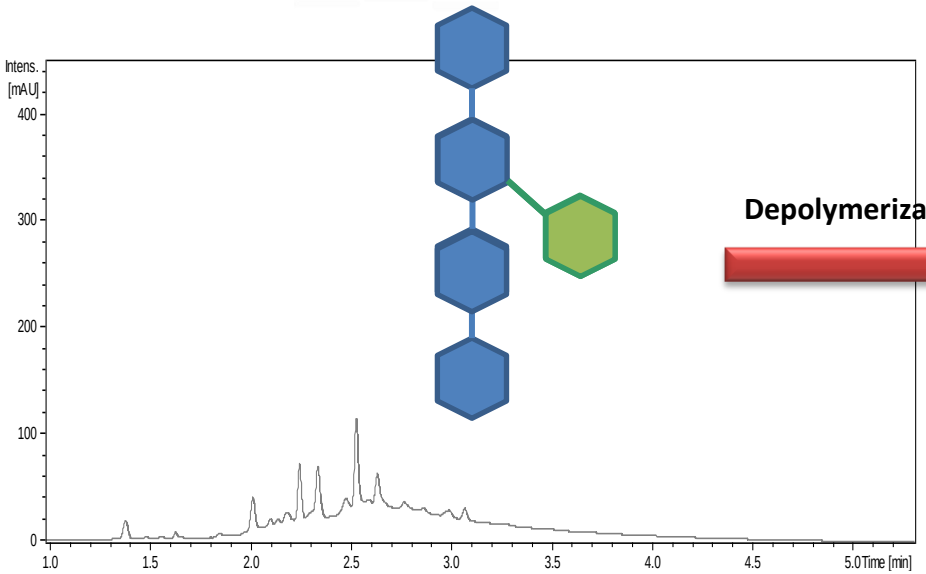
⇨ to suppress one step (simulatenous extraction/depolymerization)



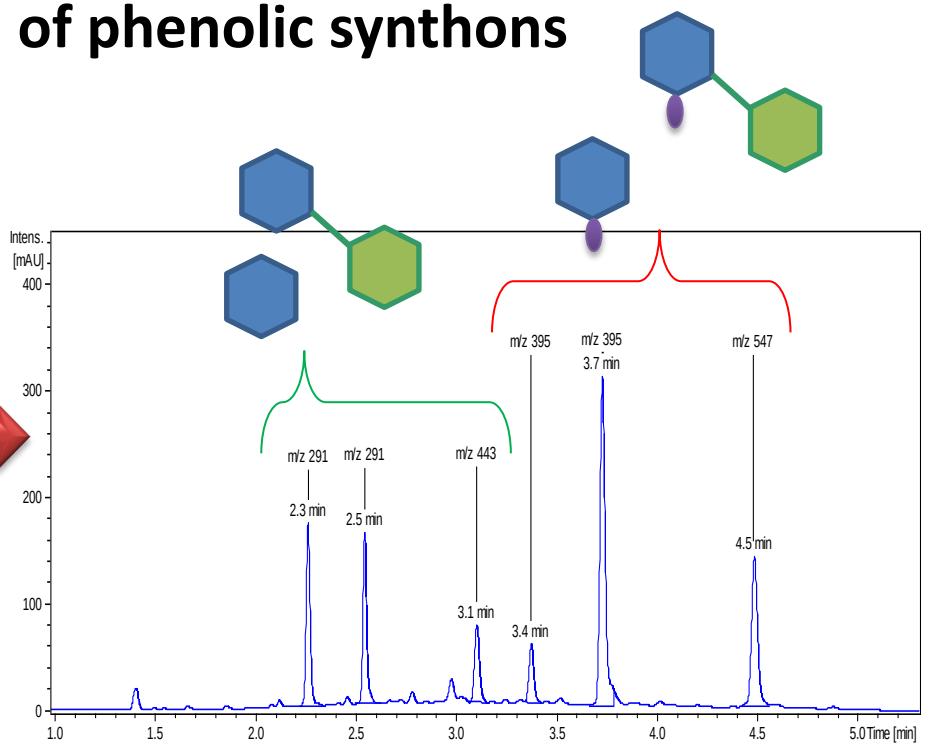
Depolymerization

Large scale process for production of biobased phenols

⇨ DEPOLYMERIZATION : obtention of phenolic synthons



Depolymerization



RESEARCH WORKS → RESULTS

Functionnalization

Curing

Epoxy resins
(thermosetting)

Perspectives

- **Materials** :

thermoplastic ; polyester, polyamide, vinylester,… and composite

- **Fine chemistry** :

  Medicinal, cosmetic
  Lubricant
  Surfactant

Thank you for your attention !

Co-workers

Lucas Suc

Guillaume Billerach