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Multifuncionalidad, conservación y empleo rural
en el territorio del sur de Europa a través de la
extracción de la resina

Multifonctionnalité, conservation et emploi rural
dans le territoire du Sud de l'Europe au moyen de
l'extraction de la résine

Multifuncionalidade, conservação e emprego rural
no território do sul da Europa a través da
extração da resina

La industria de la colofonia y aguarrás en Europa

COFINANCIA:



SOCIOS:



ASOCIADOS:



la unión resinera española, s.a.

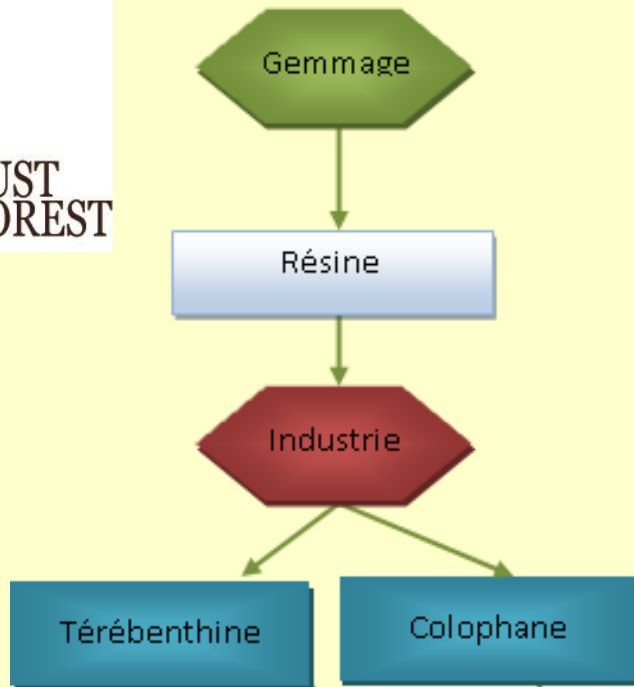


Rincón de la Vega, S.A.L.



AFLODORONORTE
Associação Florestal do Vale do Douro Norte





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Origines de la térébenthine

Essence de papeterie

- Production mondiale 120 -140 000 t / an
- Co produit de la fabrication du papier

Essence térébenthine

- Production mondiale 130 - 150 000 t / an
- Co produit de la production de colophane



Qualité de la térébenthine

Essence de papeterie

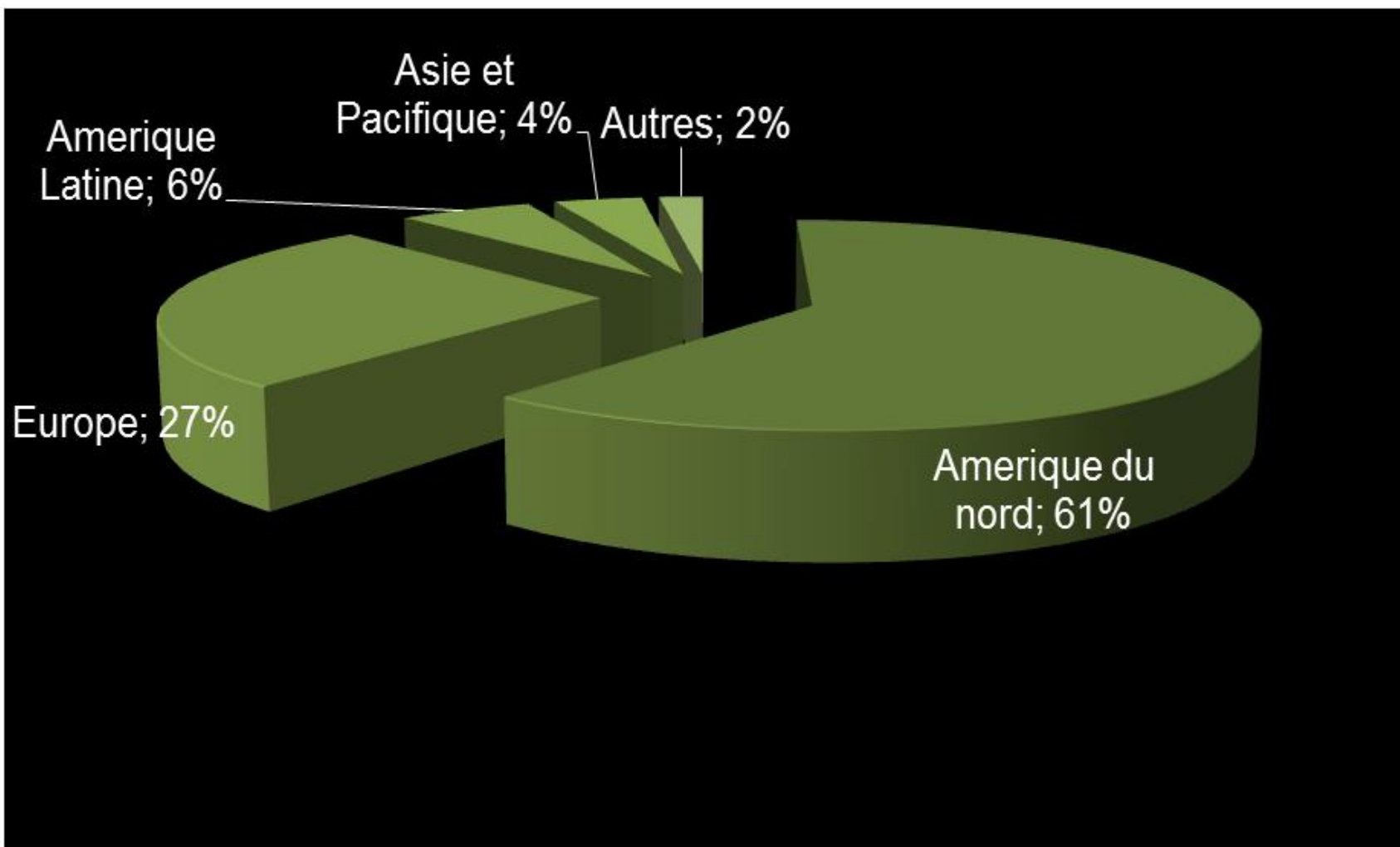
- Mise en œuvre complexe
- Désulfuration obligatoire

Essence térébenthine

- Directement utilisable
- 95 % de la térébenthine valorisable

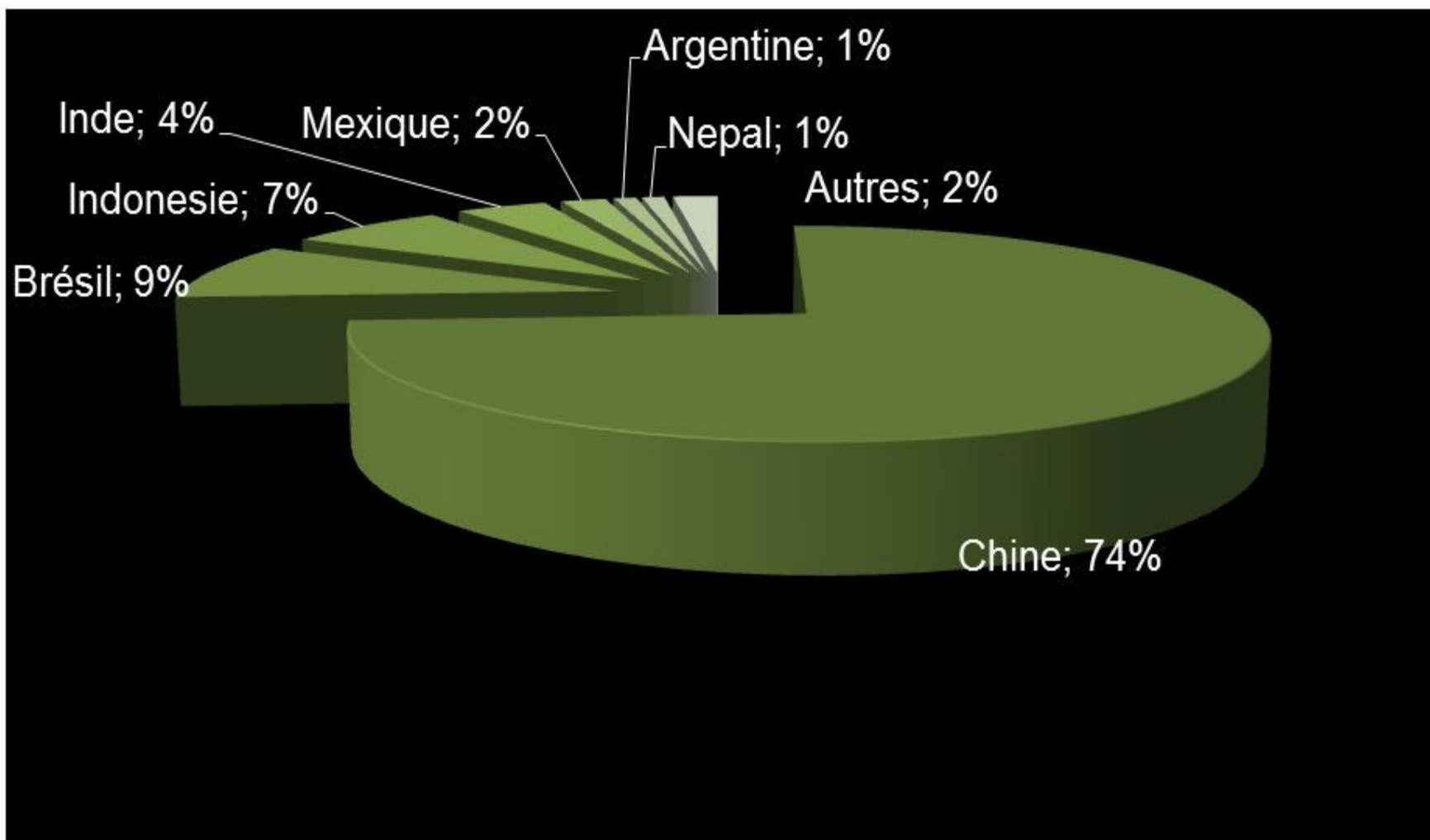


Essence de papeterie





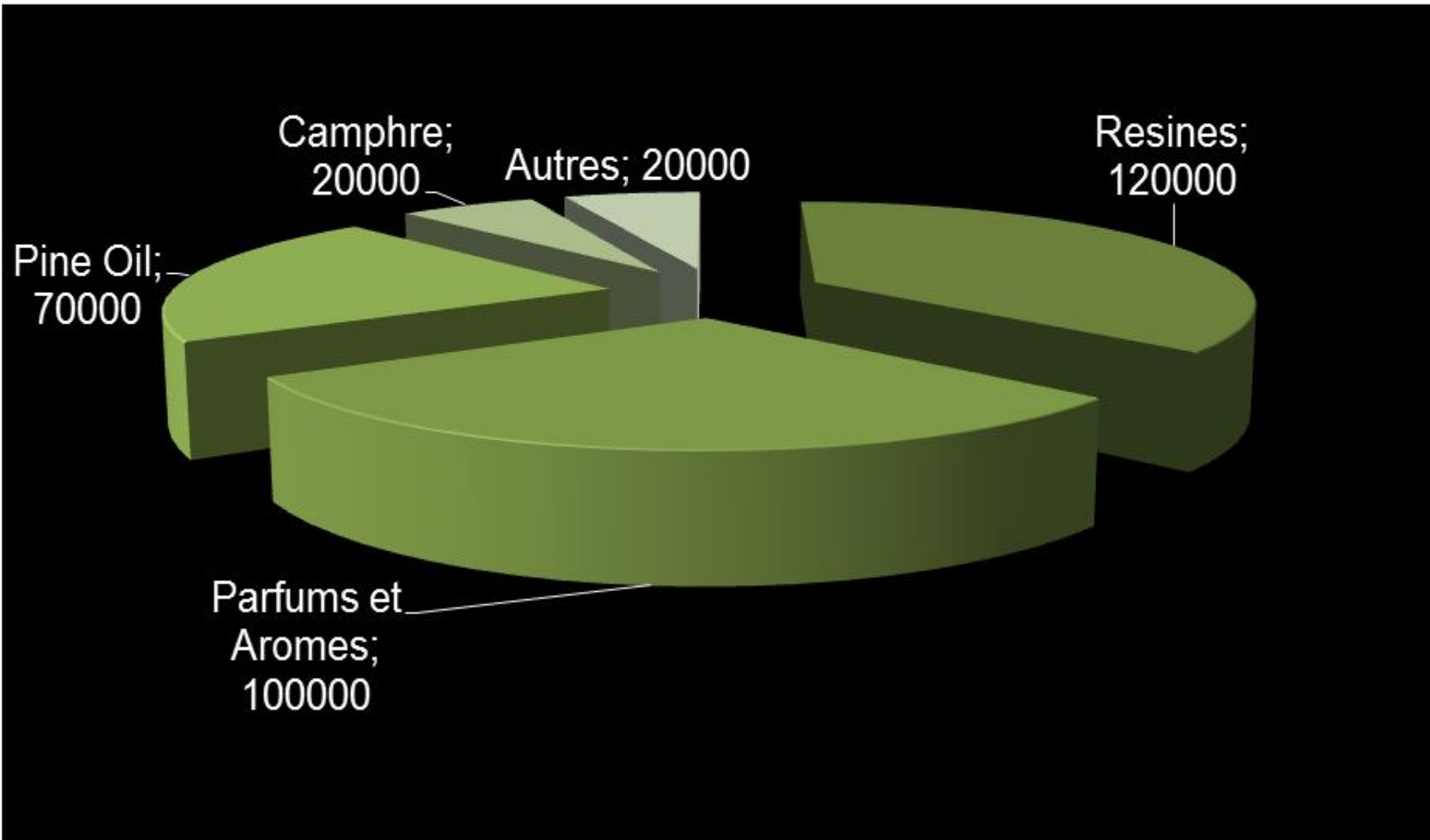
Essence de térébenthine





USAGES PRINCIPAUX

(Tonnes de terpènes)





USAGES PRINCIPAUX

Resines

- Produites principalement à partir d'essence de papeterie
- Adhésifs, chewing gum, pneumatiques

Pine oil

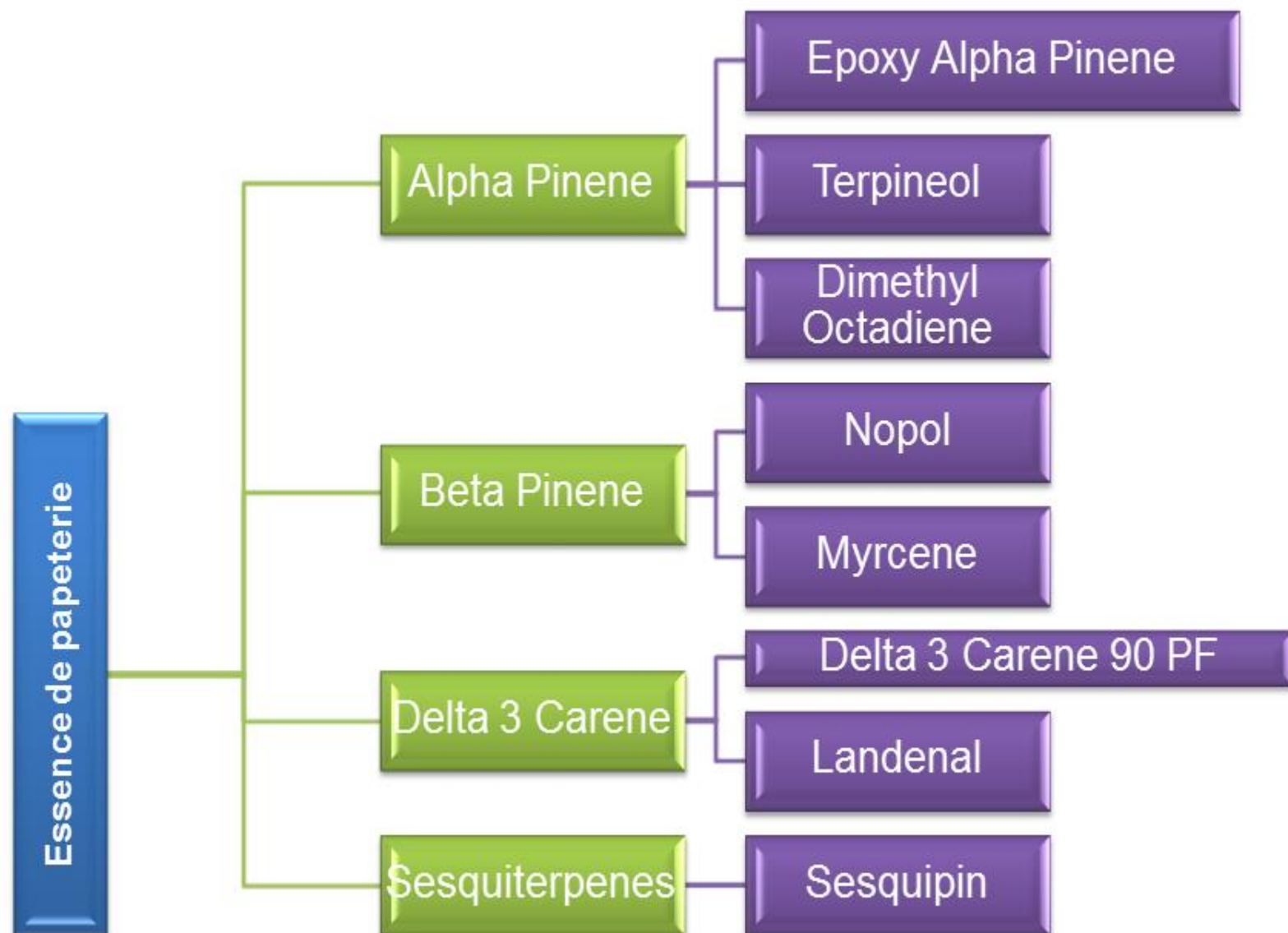
- A partir d'essence papeterie (US) ou de térébenthine (China)
- Détergents

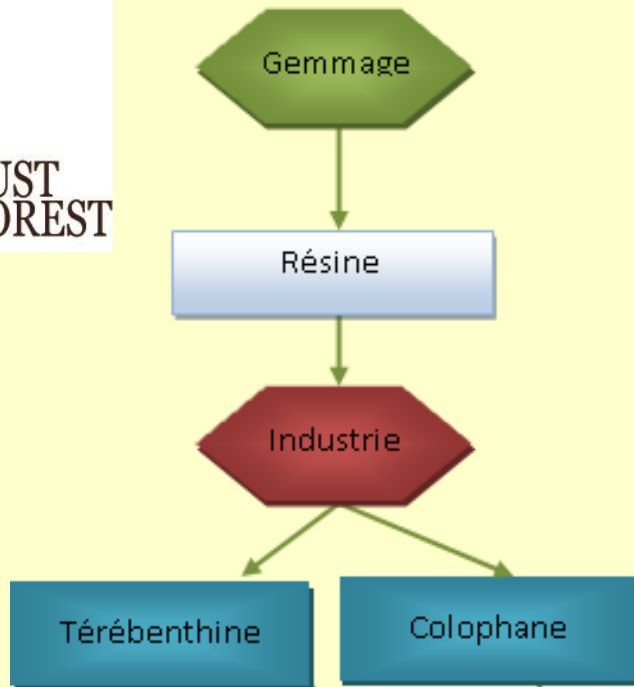
Camphre

- Produit avec alpha pinene de térébenthine
- Désinfectant, Temples en Inde



Parfums





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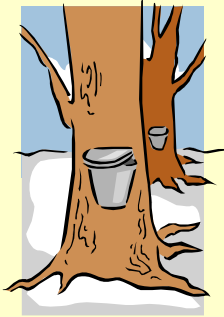


What is Rosin?

***Rosin is a solid form
of natural resin
obtained from conifers
and mainly pine trees***



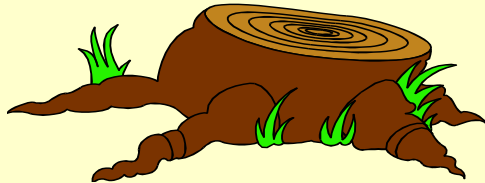
Rosin Sources



- ***GUM:***
Tapping the Oleoresin of Living Pine Trees



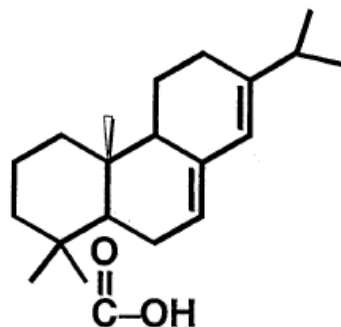
- ***Tall Oil Rosin (TOR):***
By-product of Kraft Pulping Process



- ***Stumpwood:*** *Extraction/Special Processing of Oleoresin from Stumps*

Rosin composition

Rosin is mainly composed (>90%) of resin acids with similar basic structures

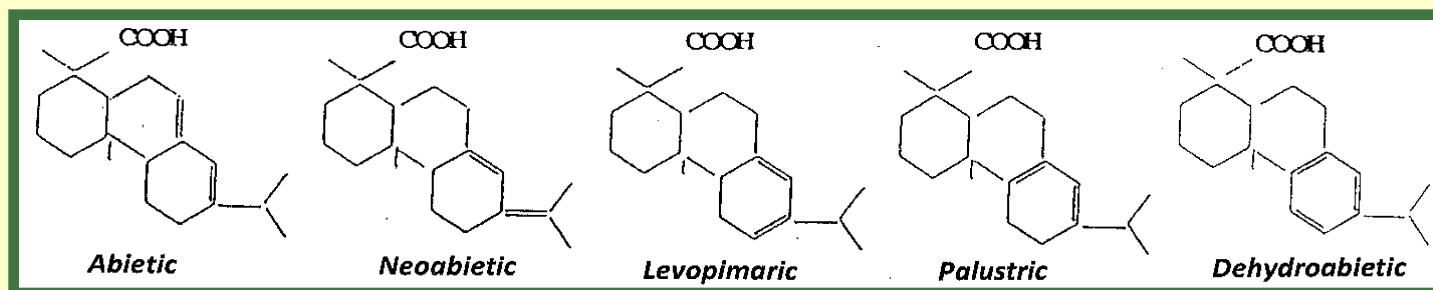


Abietic Acid

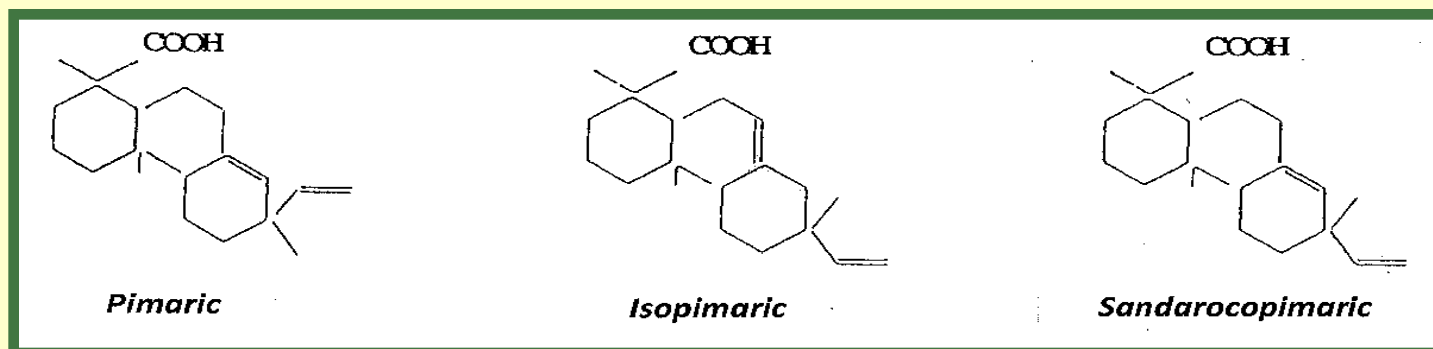
- $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}-\text{OH} \end{array}$ Carboxylic Acid
- = Unsaturation
- Ring Size & Structure

Two common families of resin acids:

● ***Abietane skeletal class:***



● ***Pimarane skeletal class:***



Rosin, as natural resin, has a variable composition depending on:

- ***Origin of the Rosin (sources)***
- ***Types of the trees (species)***
- ***Location of the trees (geographical area)***

*Typical composition of resin acids in rosin by **SOURCES***

<i>Resin Acid</i> <i>(% of acid fraction)</i>	<i>Gum</i> <i>rosin</i>	<i>Tall Oil</i> <i>rosin</i>	<i>Wood</i> <i>rosin</i>
<i>Abietic</i>	<i>32-37</i>	<i>40-45</i>	<i>25-35</i>
<i>Palustric/Levopimaric</i>	<i>18-23</i>	<i>5-10</i>	<i>5-10</i>
<i>Neoabietic</i>	<i>15-20</i>	<i>1-6</i>	<i>5-15</i>
<i>Dehydroabietic</i>	<i>8-10</i>	<i>27-32</i>	<i>20-25</i>
<i>Pimaric</i>	<i>7-12</i>	<i>5-10</i>	<i>3-5</i>
<i>Isopimaric</i>	<i>6-11</i>	<i>4-9</i>	<i>2-6</i>
<i>Sandarcopimaric</i>	<i>1-3</i>	<i><2</i>	<i>1-3</i>

Principal resin acids of gum rosin by species

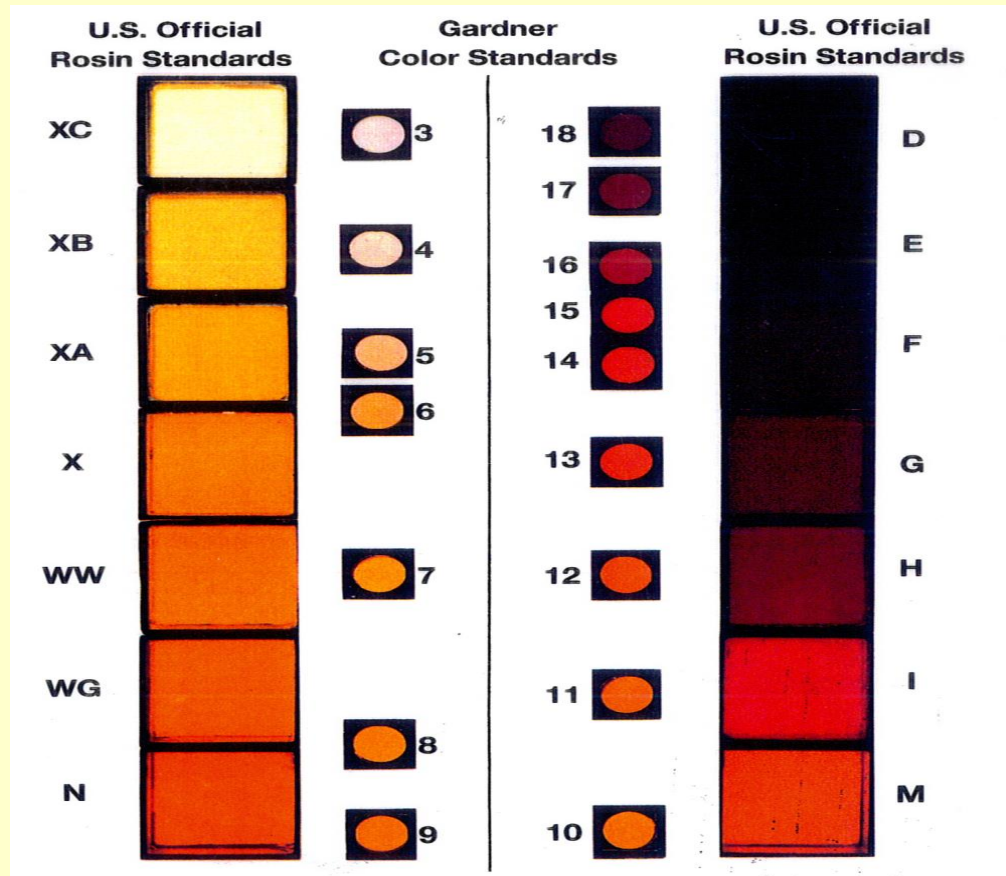
Species (origin)	<i>P. pinaster</i> (France)	<i>P. halepensis</i> (Greece)	<i>P. sylvestris</i> (Russia)	<i>P. massoniana</i> (China)	<i>P. elliotti</i> (Brazil)	<i>P. merkusii</i> (Indonesia)
Resin acid (%)						
Abietic	35	45	35	39	37	28
Isopimaric	10	11	7	2	17	16
Neoabietic	15	13	15	16	16	5
Palustric/ Levopimaric	20	23	23	25	15	27
Dehydroabietic	9	5	10	7	5	4
Pimaric	10		9	10	5	
Communic					4	
Mercusic						11

*Principal resin acids of gum rosin from *P. pinaster* by geographical area*

<i>P. pinaster</i> tree location Resin acid (%)	<i>P. pinaster</i> France	<i>P. Pinaster</i> Portugal	<i>P. Pinaster</i> Spain	<i>P. pinaster</i> USA
Abietic	35	34	26	14
Isopimaric	10	7	5	12
Neoabietic	15	19	27	18
Palustric/ Levopimaric	20	21	22	39
Dehydroabietic	9	9	6	4
Pimaric	10	8	9	8
Sandarocopimaric	2	2	2	2

Rosin is not an homogenous substance

<i>Typical physical and chemical properties of rosin by sources</i>	<i>Gum rosin</i>	<i>Tall Oil rosin</i>	<i>Wood rosin</i>
<i>Acid number</i>	<i>164</i>	<i>167</i>	<i>166</i>
<i>Saponification index</i>	<i>172</i>	<i>174</i>	<i>172</i>
<i>Unsaponifiable matter</i>	<i>8%</i>	<i>7%</i>	<i>6%</i>
<i>Fatty acids</i>	<i>-</i>	<i><5</i>	<i>-</i>
<i>Color, U.S. rosin grade</i>	<i>WW</i>	<i>WG</i>	<i>WG</i>
<i>Softening point (R&B)</i>	<i>76 °C</i>	<i>77 °C</i>	<i>76 °C</i>
<i>Refractive index</i>	<i>1.541</i>	<i>1.540</i>	<i>1.545</i>
<i>Density</i>	<i>1.07</i>	<i>1.07</i>	<i>1.07</i>



Typical physical and chemical properties of gum rosin

<i>Typical physical and chemical properties of rosin by sources</i>	<i>Clear types</i>	<i>Middle types</i>	<i>Dark Types</i>
<i>Acid number</i>	<i>165-171</i>	<i>160-170</i>	<i>155-163</i>
<i>Saponification index</i>	<i>171-177</i>	<i>170-176</i>	<i>165-174</i>
<i>Unsaponifiable matter</i>	<i>4.3%-5.5%</i>	<i>5.3%-8%</i>	<i>7%-10%</i>
<i>Color, U.S. rosin grade</i>	<i>XC-WW</i>	<i>WG-I</i>	<i>H-D</i>
<i>Softening point (R&B)</i>	<i>76 °C</i>	<i>77 °C</i>	<i>76 °C</i>
<i>Ashes</i>	<i>0.041-0.02%</i>	<i>0.041-0.02%</i>	<i>0.01-0.17%</i>
<i>Refractive index</i>	<i>1.541</i>	<i>1.540</i>	<i>1.545</i>
<i>Density</i>	<i>1.07</i>	<i>1.07</i>	<i>1.07</i>

Why Rosin Derivatives?

Not suitable rosin properties:

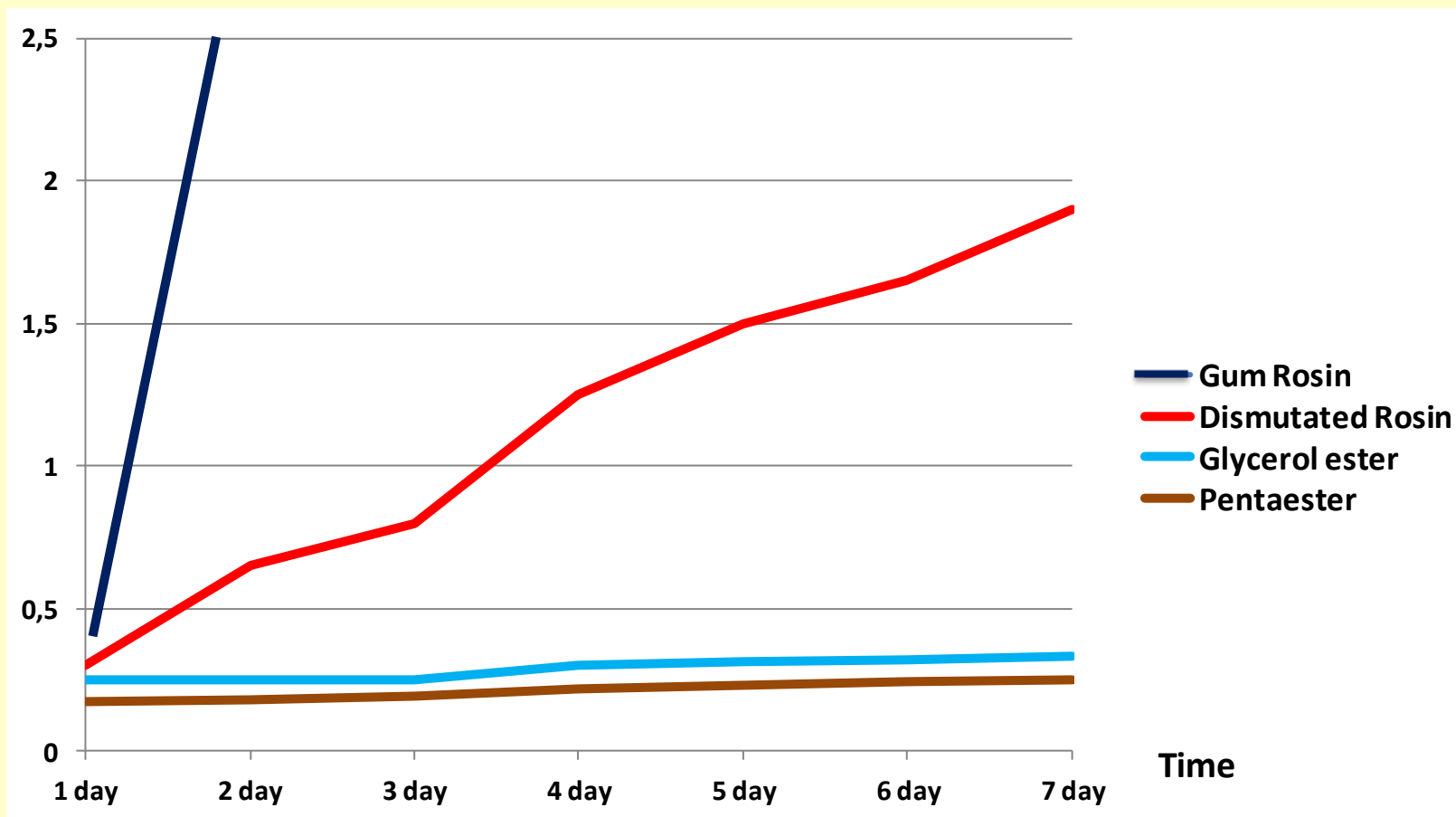
- ***Low softening point (70 - 80°C)***
- ***Oxidation trend***
- ***High acidity ($I_a = 155 - 170$)***
- ***Crystallization trend***
- ***Low viscosity***
- ***Quite dark color***
- ***High solvent retention***
- ***Other***



Oxydation test

(21 Kg. of pressure of O₂ for 7 days)

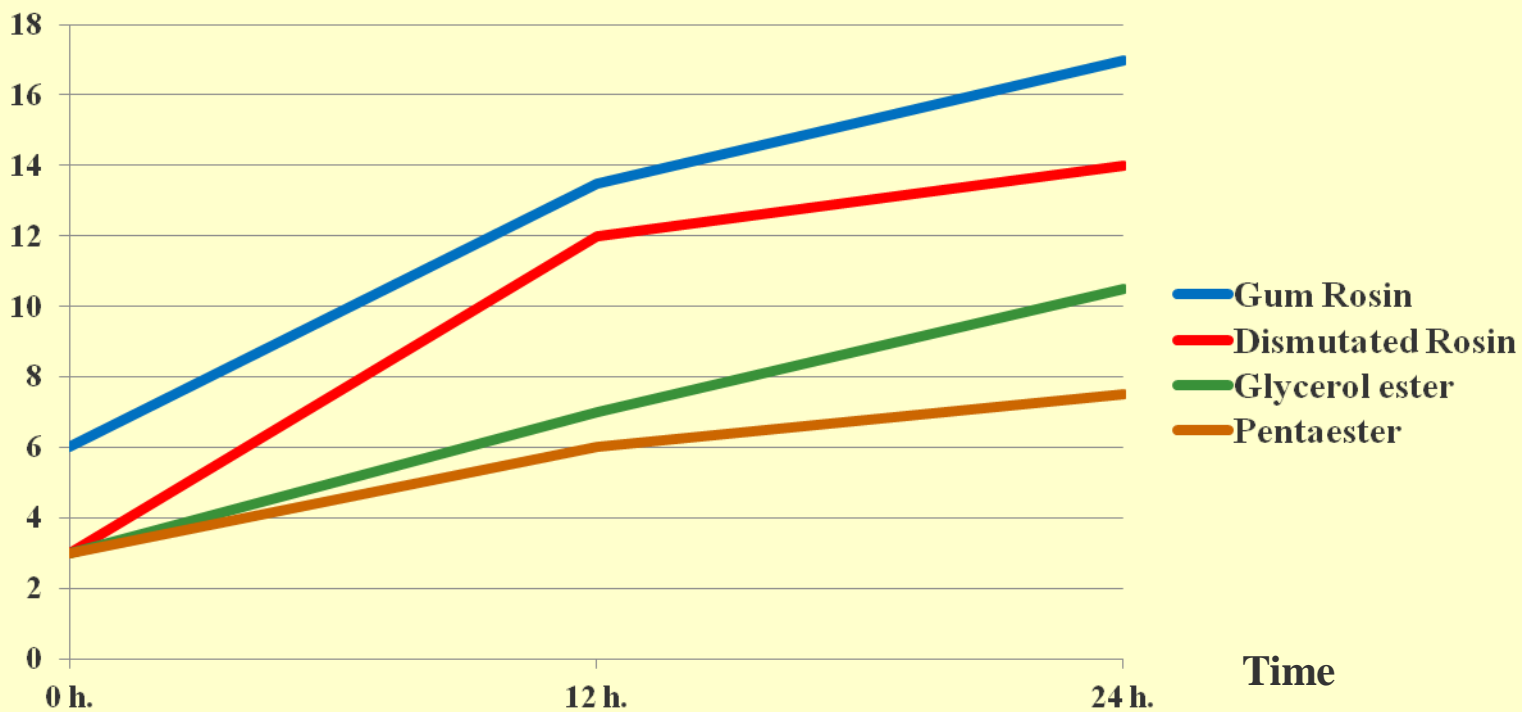
% Weight Increase



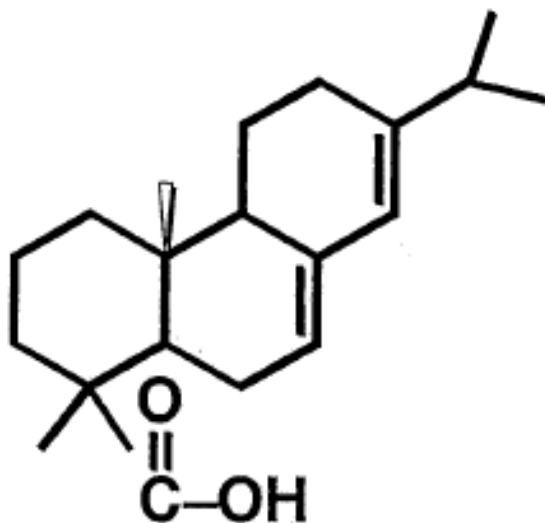
Heat stability test

(Color evolution at 170 °C)

Color Gardner



Rosin Chemistry



Abietic Acid

- $\text{C}=\text{O}$ Carboxylic Acid
- = Unsaturation
- Ring Size & Structure

Rosin Reactivity

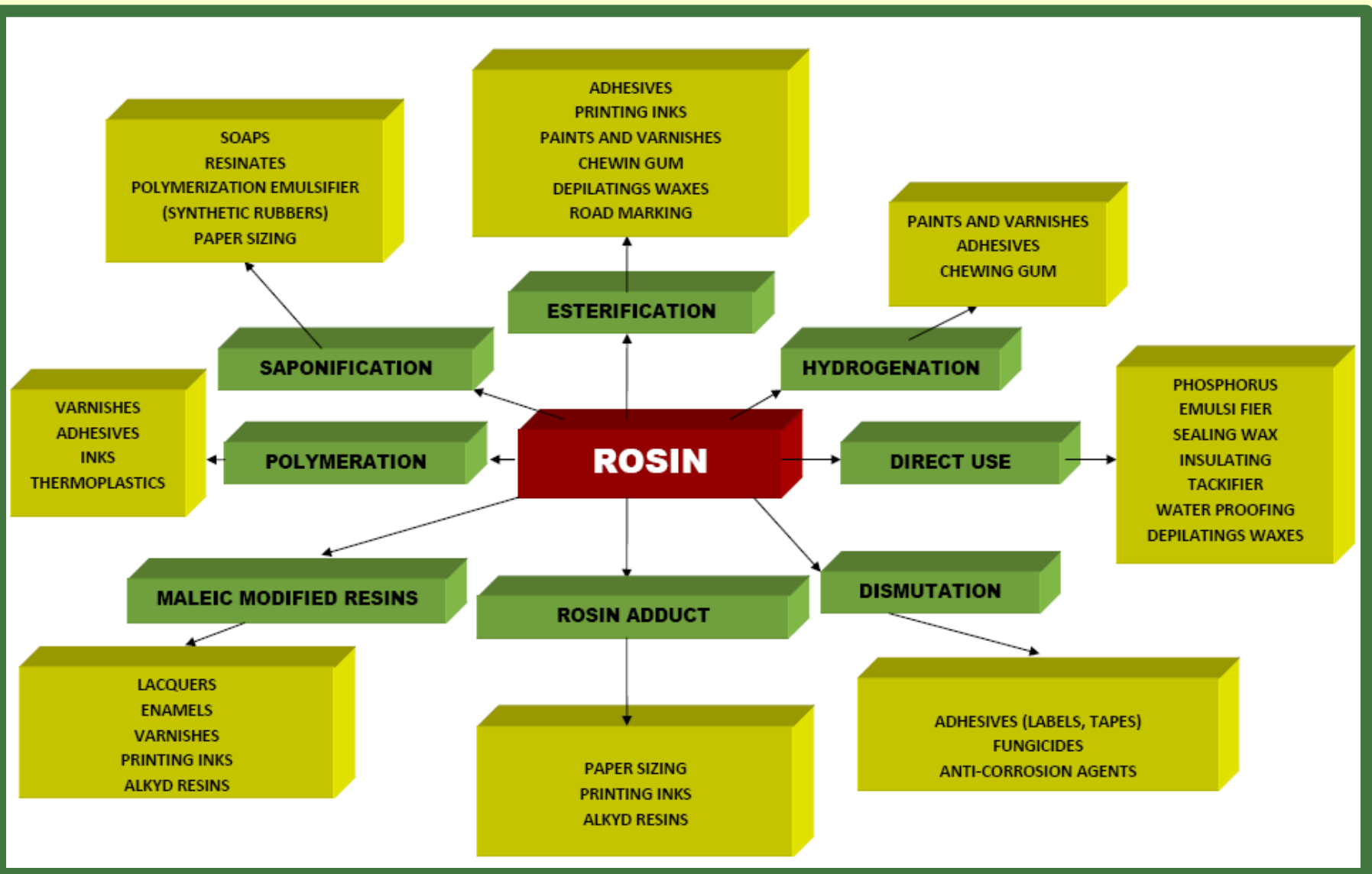
■ ***Reaction of Double Bonds:***

- *Adduction*
- *Hydrogenation*
- *Disproportionation*
- *Polymerization*
- *Etc.*

■ ***Reaction of Carboxylic Acid:***

- *Esterification*
- *Salt Formation (Soaps, Resinates)*
- *Phenolic modified rosins*
- *Etc.*

Rosin Resins Uses





Rosin Resins Industrial Applications





Rosin good or poor?

It depends on the particular industrial use

some examples:

Brazilian rosin (P. elliottii) is suitable for depilatory waxes

Indonesian rosin (P. merkusii) is suitable for inks

Chinese rosin (P. massoniana) is suitable for adhesives

SUDOE rosin (P. pinaster) is suitable for most uses (versatile)

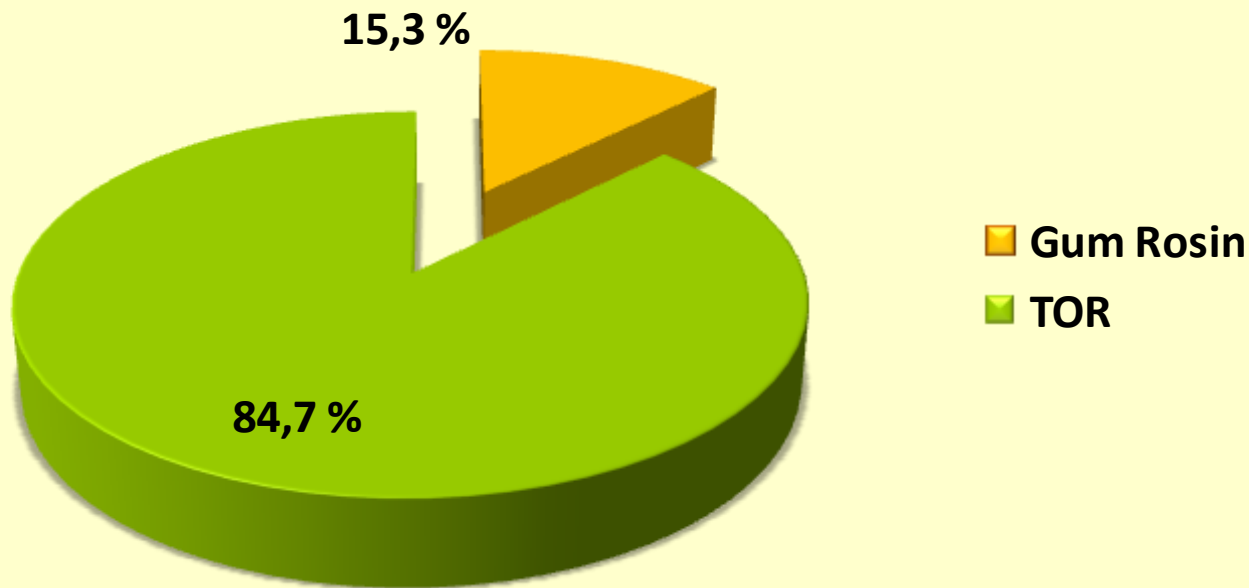


EU Rosin Production (Forecast 2012)

Gum Rosin + Tall-Oil Rosin = 147,500 MT

UE Gum Rosin Production = 22,500 MT.(15.3%)

UE TOR production = 125,000 MT. (84.7%)

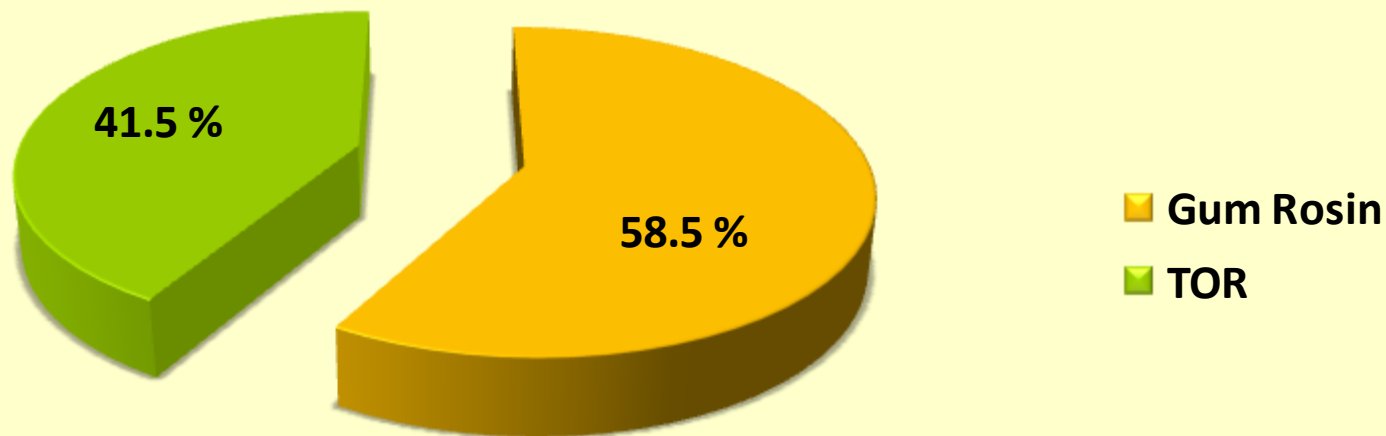


EU Rosin demand (Forecast 2012)

Gum Rosin + Tall-Oil Rosin = 325,000 MT

UE Gum Rosin market= 190,000 MT.(58.5%)

UE TOR market=135,000 MT. (41.5%)

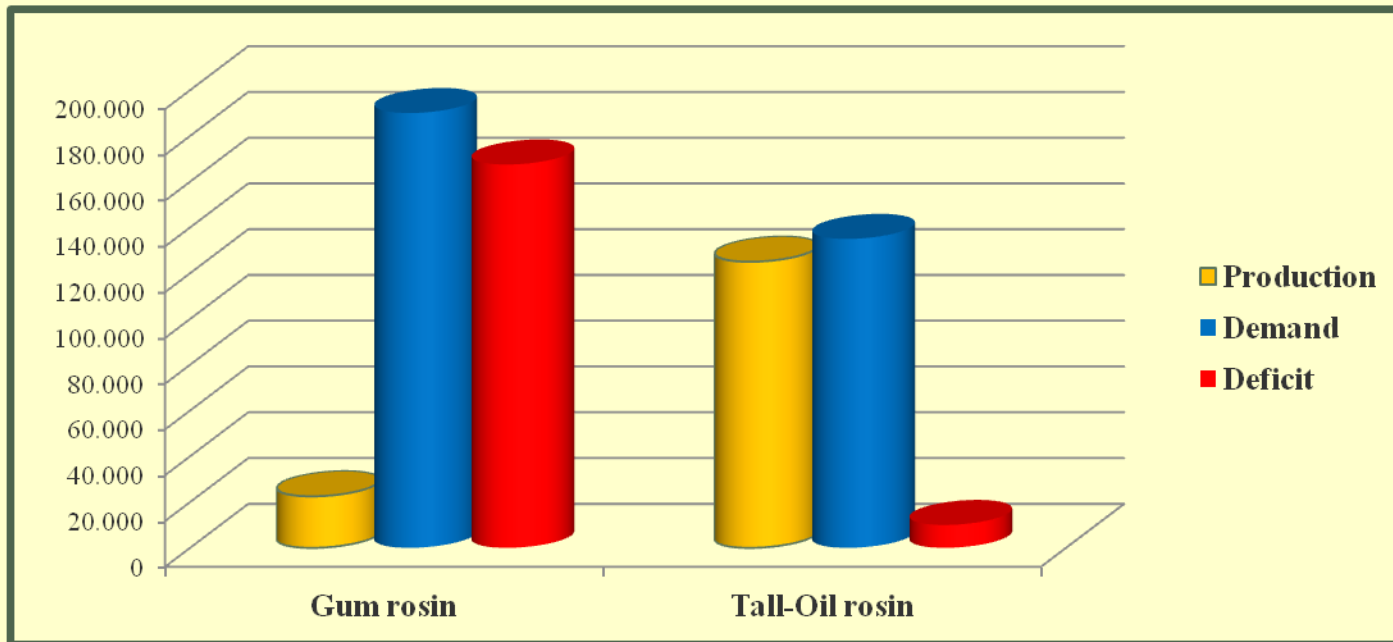


EU Rosin Balance (Production vs. Demand)

Deficit = - 177,500 MT

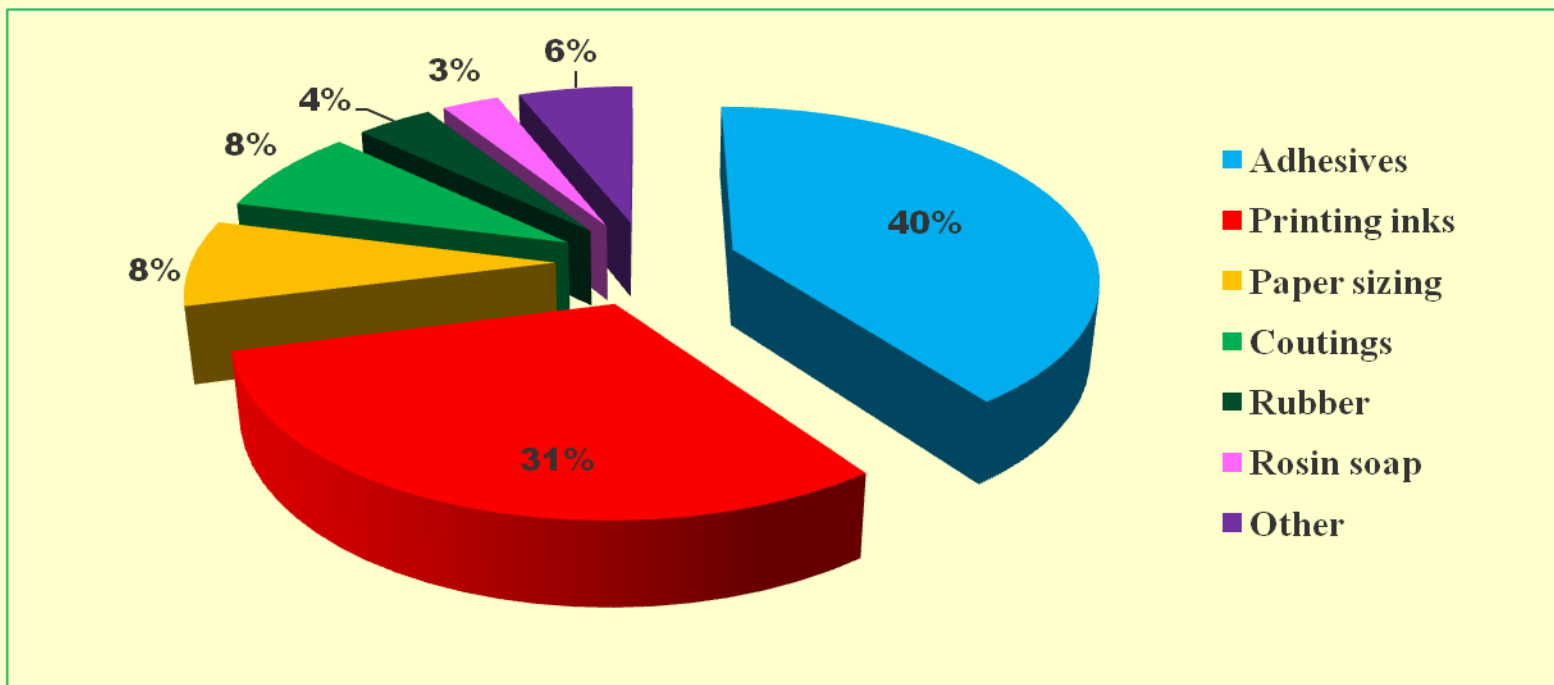
EU Deficit of Gum Rosin = - 167,500 MT. (94.4%)

EU Deficit of TOR = - 10,000 MT. (5.6 %)



European Rosin market by applications

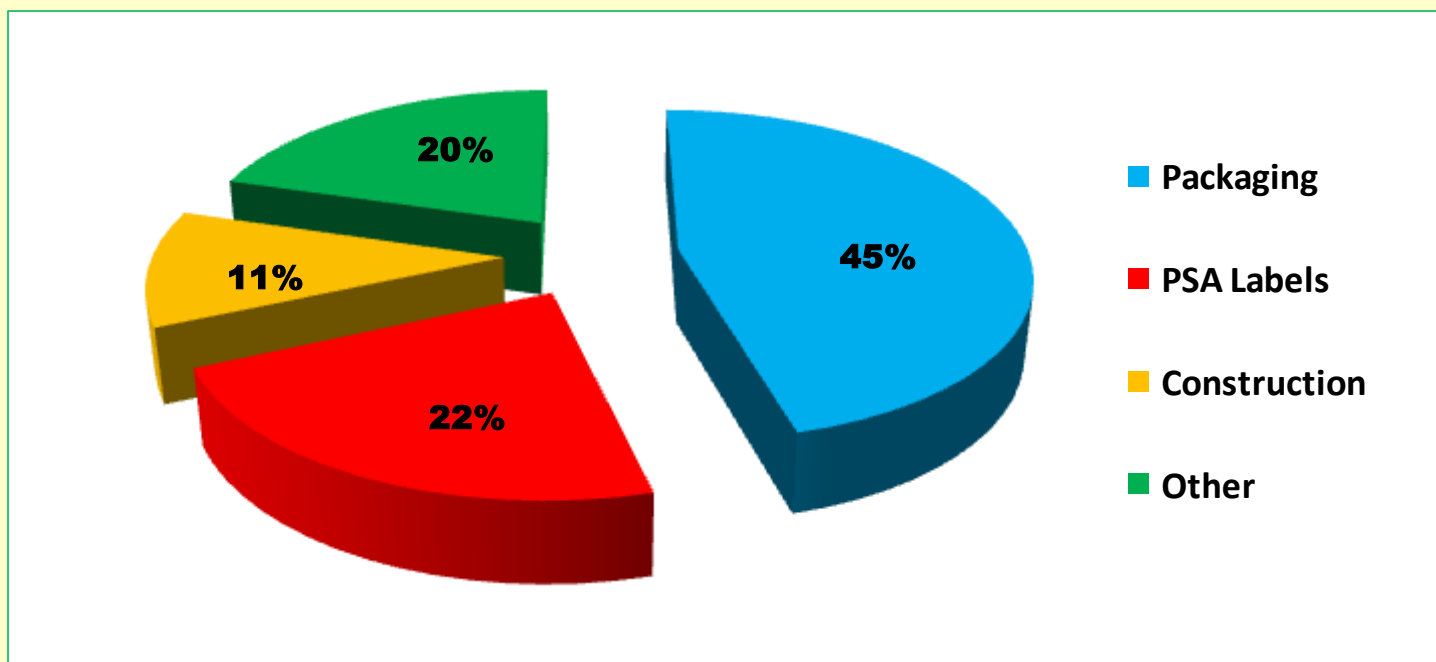
Gum Rosin + Tall-Oil Rosin = 325.000 MT



European Rosin Adhesives and Sealants market

Gum Rosin + Tall-Oil Rosin = 130.000 MT

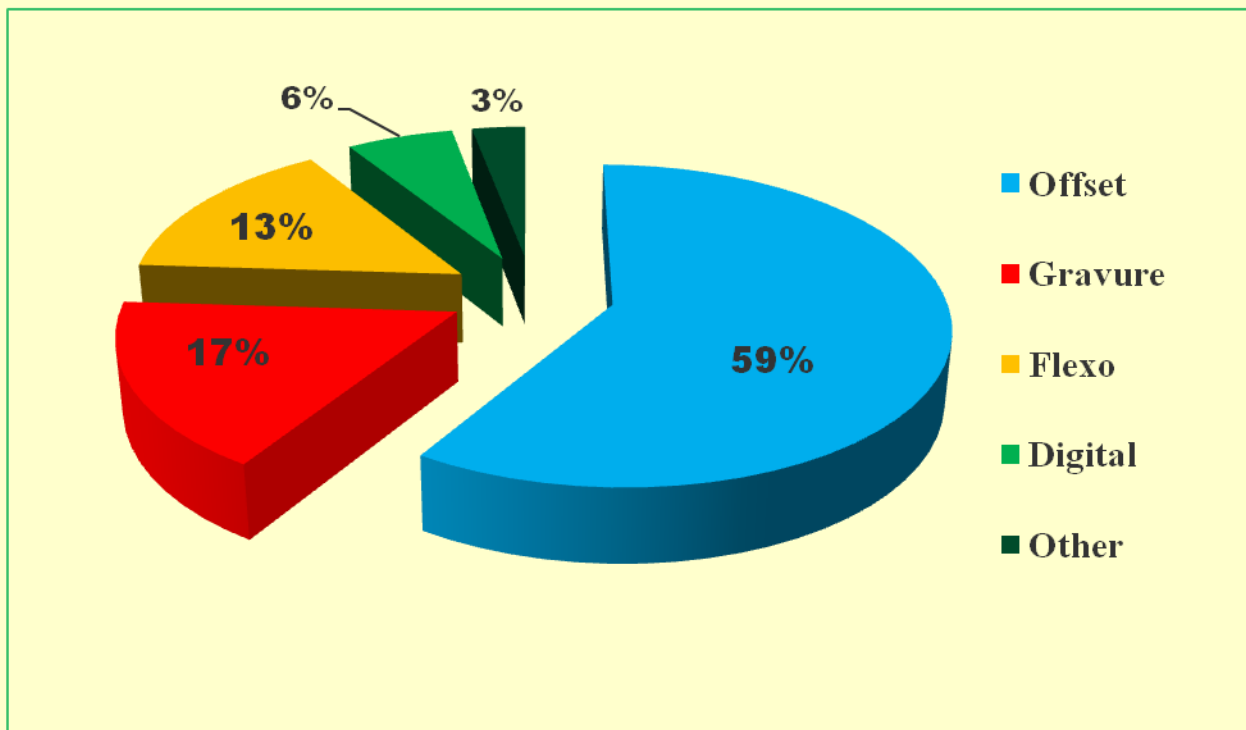
Average annual market growth : 4-5%



European Rosin Printing Inks market

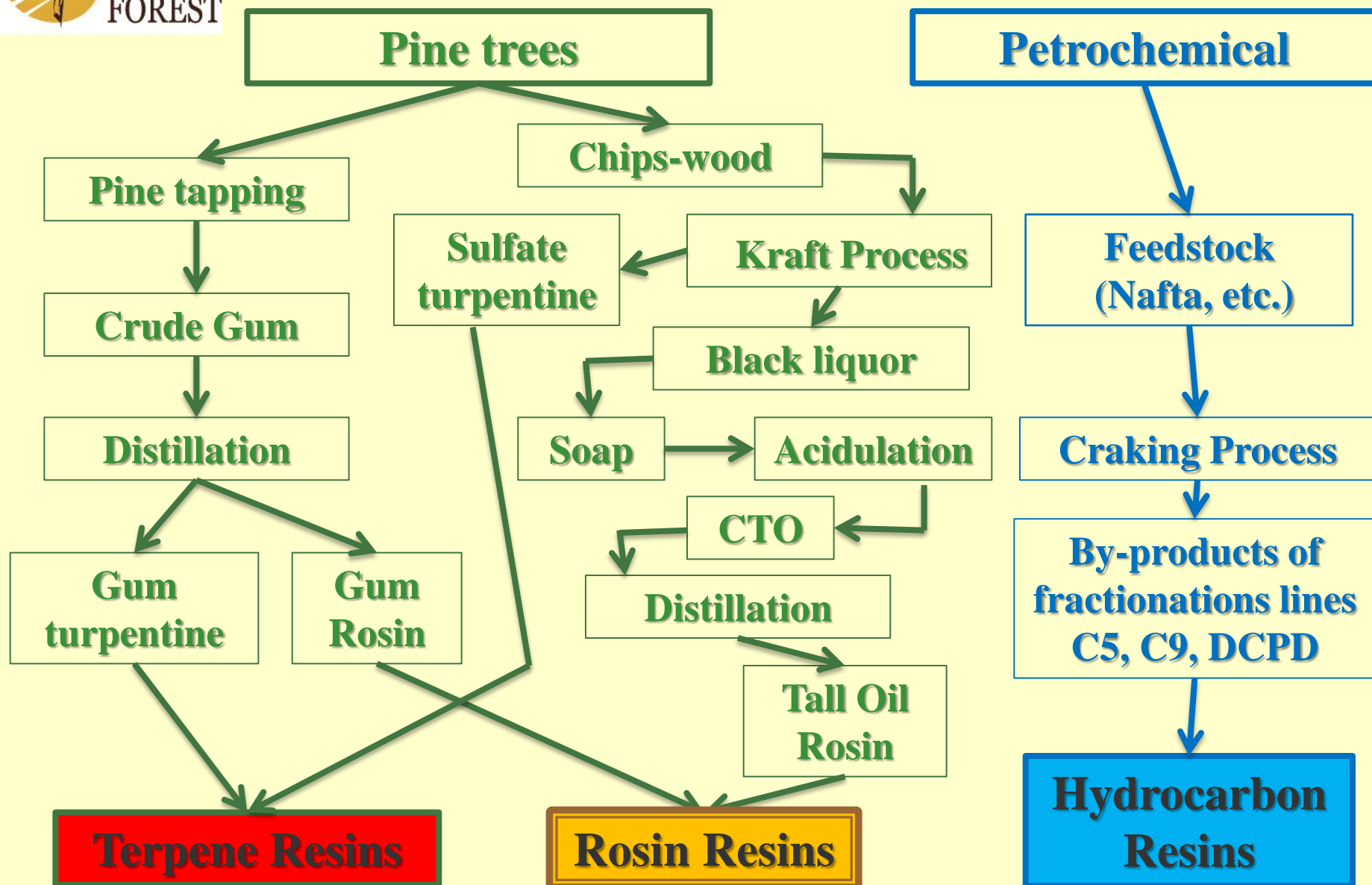
Gum Rosin + Tall-Oil Rosin = 100.000 MT

Average annual market growth : 3-3,5%





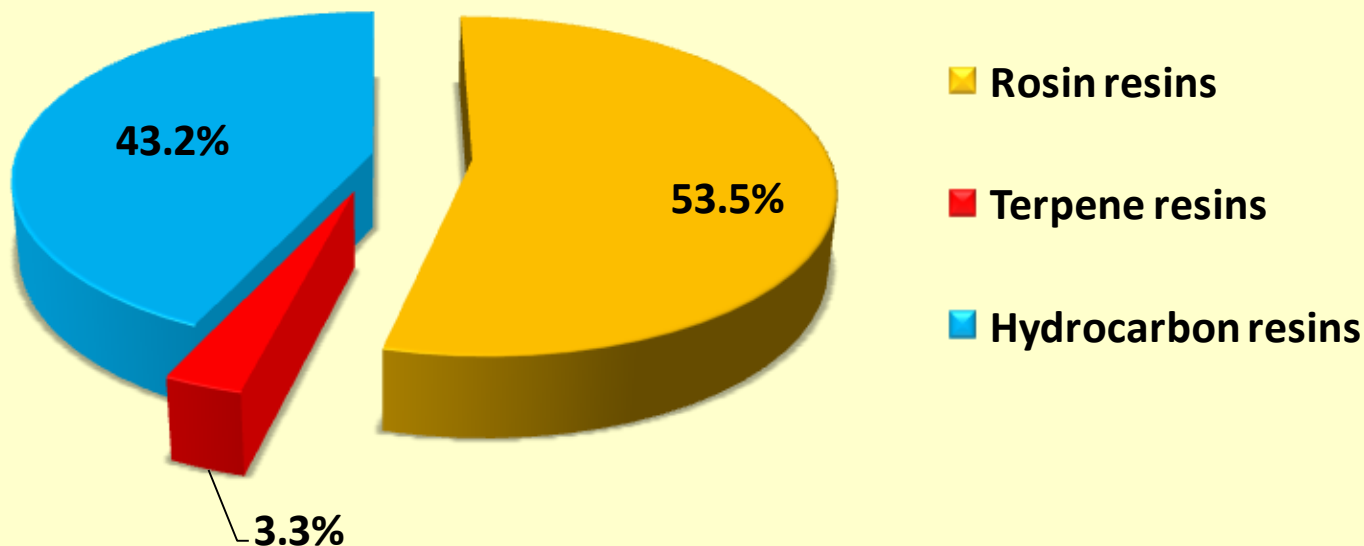
Rosin Resins are not alone



Global Resin Production (Forecast 2012)

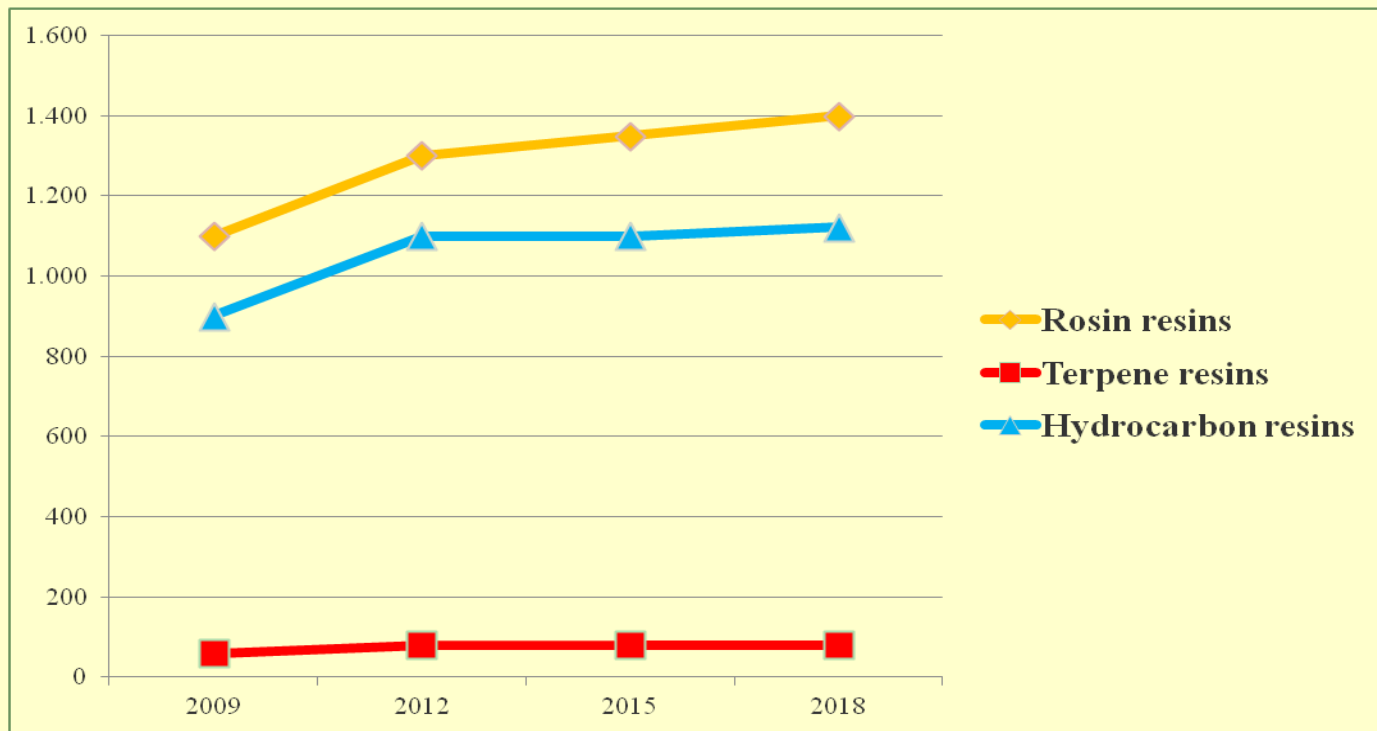
Total world resin production = 2,430,000 MT

- Rosin resins = 1,300,000 MT.**
- Hydrocarbon resins = 1,050,000 MT.**
- Terpene resins = 80,000 MT.**



Global Resin Trend

- Moderate growth production of hydrocarbon resins (2%) →
- Slightly more sharper growth production of rosin resins (3%) ↗
- Stable production of terpene resins (0%) →



Source: PCA International Conference, Boston September 2012

Rosin Resin Trend

Gum Rosin



- Production is closely linked to the market price and the increase in living standards (labor costs).
- Moderate growth of production in the short term (3%) and increased market demand as a renewable raw material.
- Long term limited availability of crude gum rosin (Eucaliptus vs. Pinus, salary increases, etc.)

Tall Oil

- Production limited by the unavailability of crude tall-oil, linked to the price of energy (biodiesel production).
- Stable production in the short and medium term and longer-term shortages.

Long term limited availability of crude gum rosin (Eucaliptus vs. Pinus)



Wood Rosin

Sharp decline of wood rosin production in the long term. Small and irrelevant proportion of total rosin production.

World Rosin Resin Trend

- Moderate growth of Gum Rosin production in the coming years (3% p.y.), but high risk of decline in the longer term.
- TOR production expected to remain flat because production of softwood kraft pulp also will be flat in the long term.
- Market demand for Rosin Resins 4 to 5 % p. y., leaded by emerging countries (China, India, Brazil, etc.)
- At longer term Trend, demand for Rosin Resins will exceed the offer.

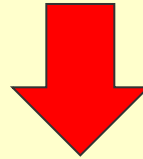


Higher prices and limited availability in the future



Rosin resins advantages

- Rosin market demands the more and more for ecological, biological and green products.
- Current economy requires development of products from renewable resources for sustainable industrial activities.
- Development of friendly environmental products (pine chemicals industry helps to preserve pine forests and reduce carbon footprint).



**Clear advantage of Rosin resins over
Hydrocarbon resins**

Conclusions

- *Pine chemical industry in EU has a growing raw material demand, limited only by supply difficulties. This limited availability of rosin and turpentine will probably increase in near future.*
- *The geographic pine forest area of SUST-FOREST (Portugal, Spain and France), has enough resources to meet their own industrial needs.*
- *Pine chemical industry is sustainable and environmentally friendly.*
- *Pine chemical industry generates economic, social and environmental benefits.*



Multifuncionalidad, conservación y empleo rural
en el territorio del sur de Europa a través de la
ordenación de la **masa**.

Multifonctionnalité, conservation et emplois ruraux
dans le territoire du Sud de l'Europe au moyen de
l'ordonnement de la **masse**.

Multifunktionalität, Konservierung und ländliche
Arbeitsplätze im südlichen Europa unter der
Ordnung der **masse**.

Diagnostic du secteur industriel de la résine et produits dérivés dans le monde et en Europe

COFINANCIER



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