



Interregional Workshop on innovative
bio-based resin derivatives
April 13-14, 2021

Pine Chemical industry Global overview and Trends



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Pine Chemicals: 3 Different Processes

Tree Tapping:

- Gum Turpentine
- Gum Rosin



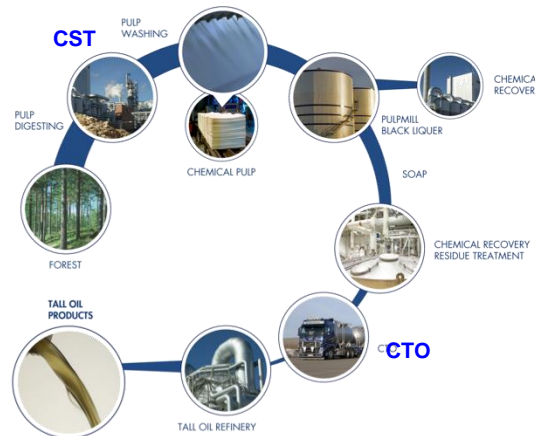
Extraction from pine stumps:

- Wood Turpentine
- Wood Rosin



Kraft process at Pulpmills:

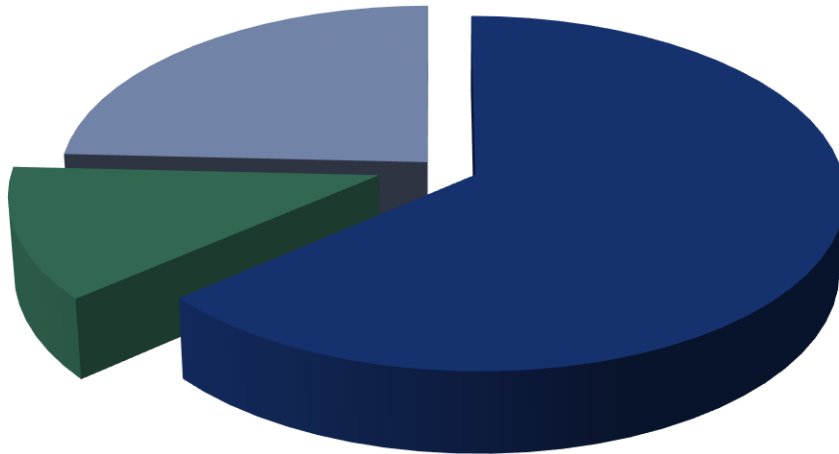
- Crude Sulfate Turpentine
- Crude Talloil (CTO) :
 - Talloil Rosin
 - Talloil Fatty acids
 - Talloil Pitch
 - Sterols



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Pulp Production



- Other pulp
- SW Sulphate Kraft Pulp
- HW Sulphate Kraft Pulp

**Global Pulp Production from virgin + recovered fibers:
330 Million T**

Global Virgin Wood Pulp Production: 160 Million T

130 Million T Chemical process

30 Million T Mechanical process

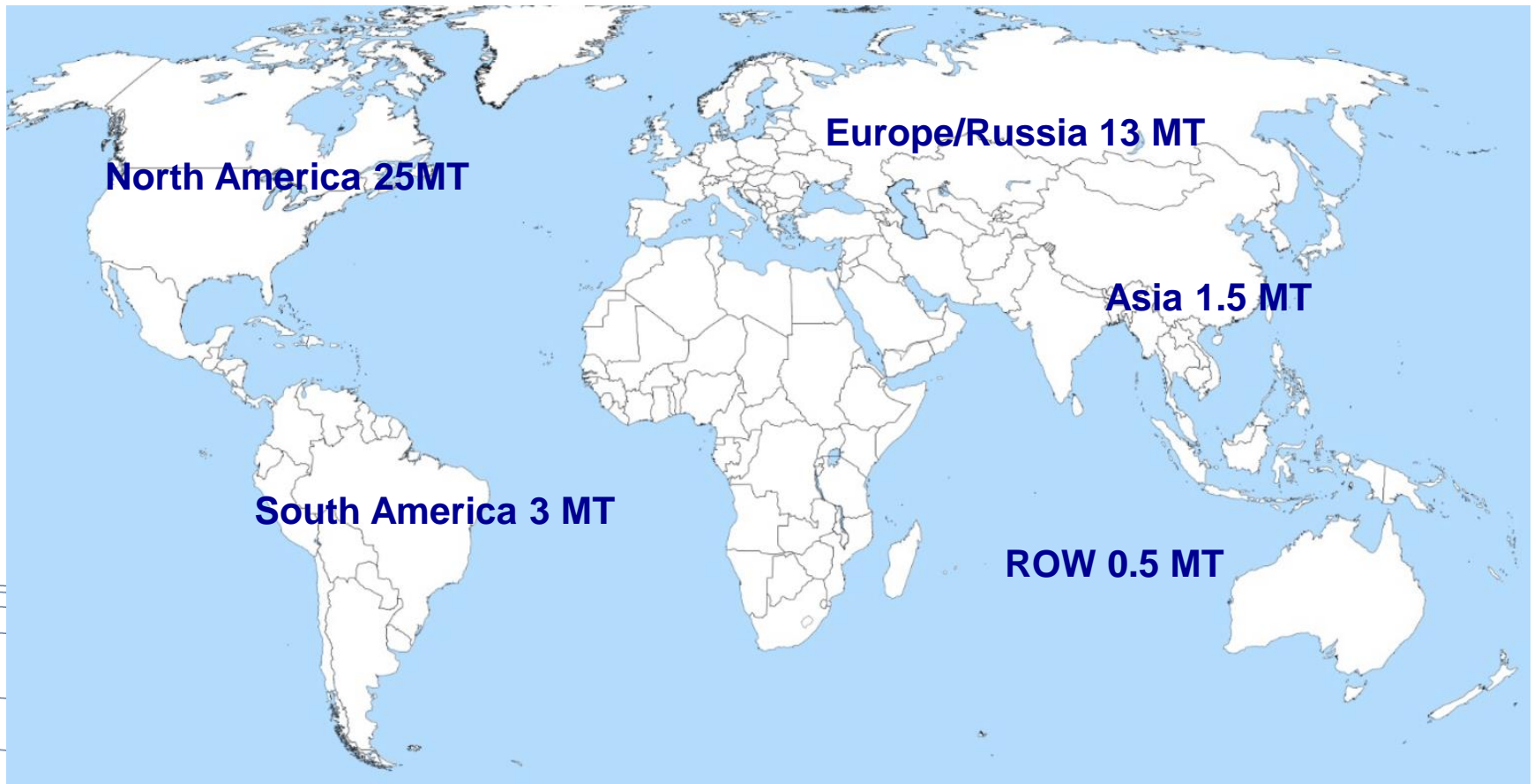
Kraft process 90% of Chemical process

- Softwood Kraft pulp from coniferous trees : 43 Million T mainly concentrated (90%) in North America and Europe/Russia.
- Softwood kraft pulp production is forecast to increase by 1-2% pa in coming years. High demand for packaging (e-commerce) and hygiene products.
- Crude Tall Oil is mainly obtained from softwood kraft pulp.
- 40-60 Kg CTO /T softwood kraft pulp.
- Global Crude Talloil production : around 2 Million T

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Softwood Kraft Pulp production : 43 Million T



1 MT = 1 Million Metric T

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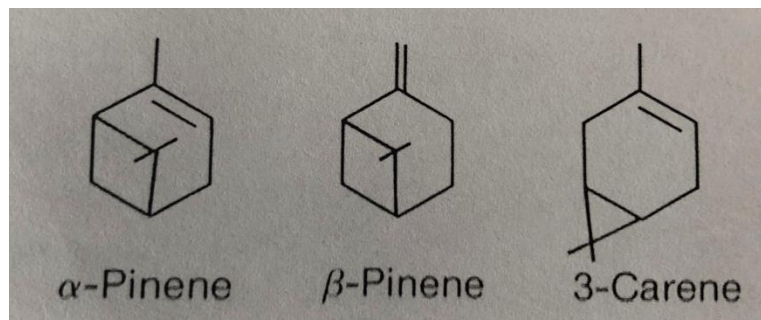
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KRAFT Process

- Invented in Danzig/Prussia in 1879 by Carl Dahl
- Superior strength of the resulting paper (Kraft = Strength in German)
- Invention of the recovery boiler in 1930 enabling the recovery and reuse of the inorganic pulping chemicals
- Raw Talloil soap which rises to the surface of the intermediate black liquor tank is skimmed off and acidified with sulfuric acid to produce Crude Talloil
- Dissolved organic compounds in heavy Black Liquor are burned to produce steam and power.
- **Black liquor can be considered as the most important renewable bio-fuel**

Turpentine

- Volatile fraction of the oleoresin in the coniferous trees
- Largest volume essential oil in nature
- Chemical composition depending on the species and age of the tree and geographical location.
- Main components are C₁₀H₁₆ bicyclic, unsaturated monoterpene hydrocarbons such as:



- Chemical structure: Terpenes can be considered as polymers of isoprene (C₅H₈)_n but isoprene is not involved in the biosynthesis

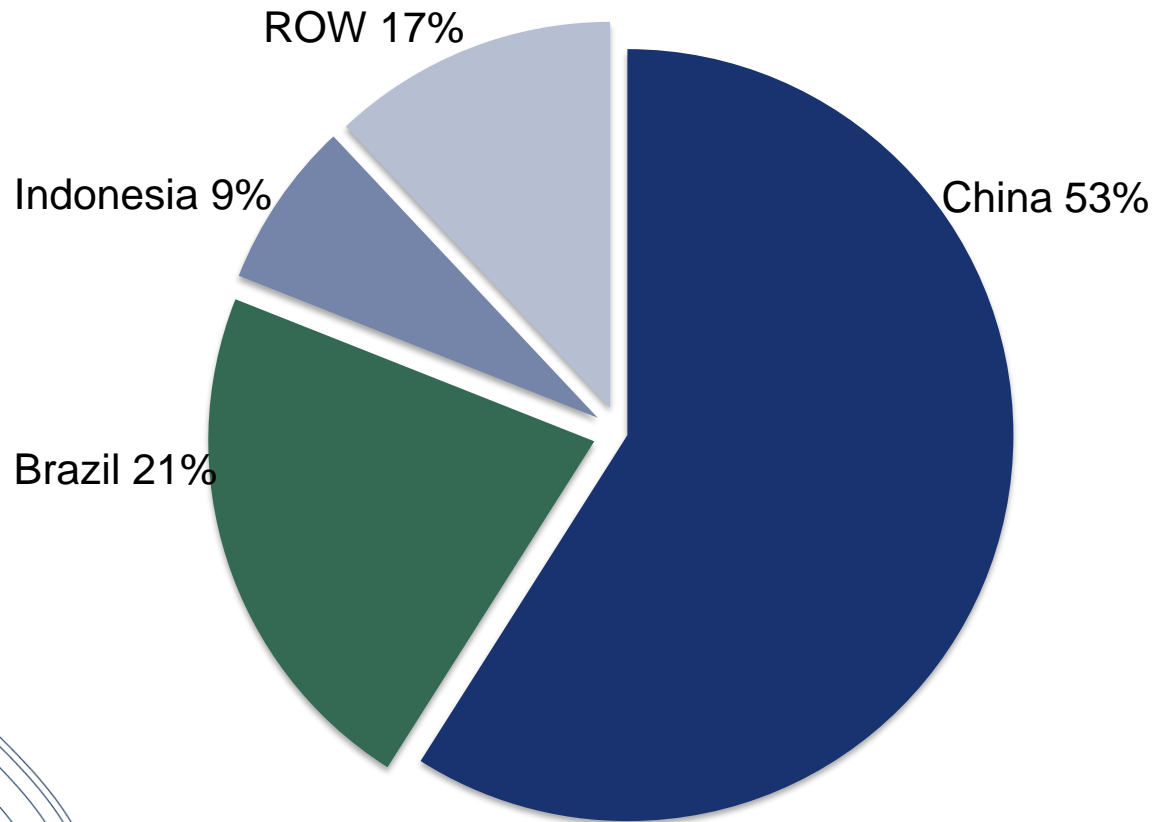
Turpentine Main Components

Average Composition (%)

	Alpha Pinene	Beta Pinene	Delta 3 Carene
China / P.Massoniana	80	7	
China / P.Elliottii	52	36	
China / P.Yunanensis	60	25	
Brazil/P.Elliottii	40	45	
Brazil /P.Tropical	80	5	
Indonesia /P.Merkusii	80	2	12
Portugal	75	17	
India	25	3	60
USA (South East)	62	25	
USA (NW)/Canada	30	10	20
Finland/Sweden/Russia	55	4	25
Austria	60	13	15

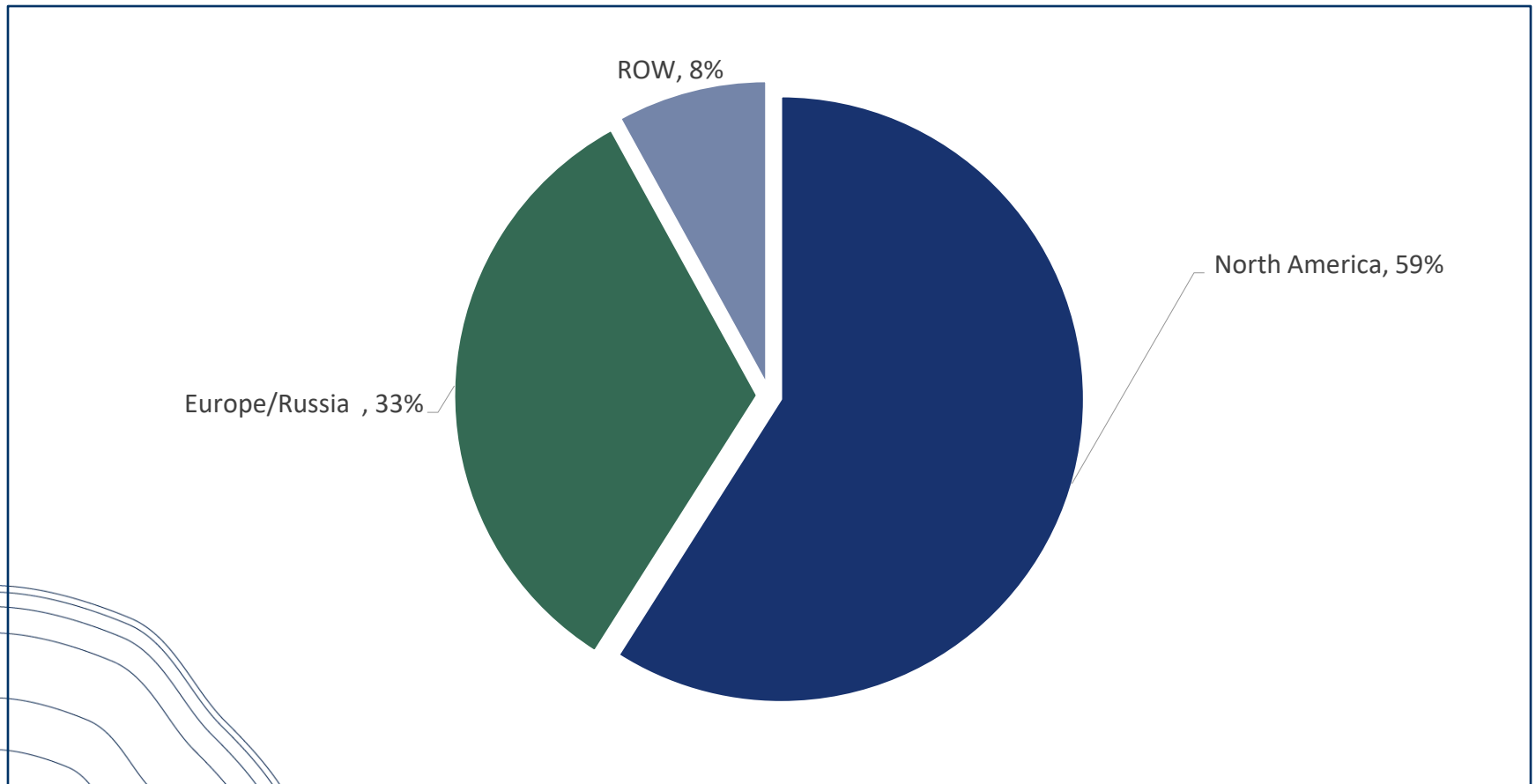
CST: Sulfur compounds 1 – 5 %

Y2021 Gum Turpentine Production: 125 000T



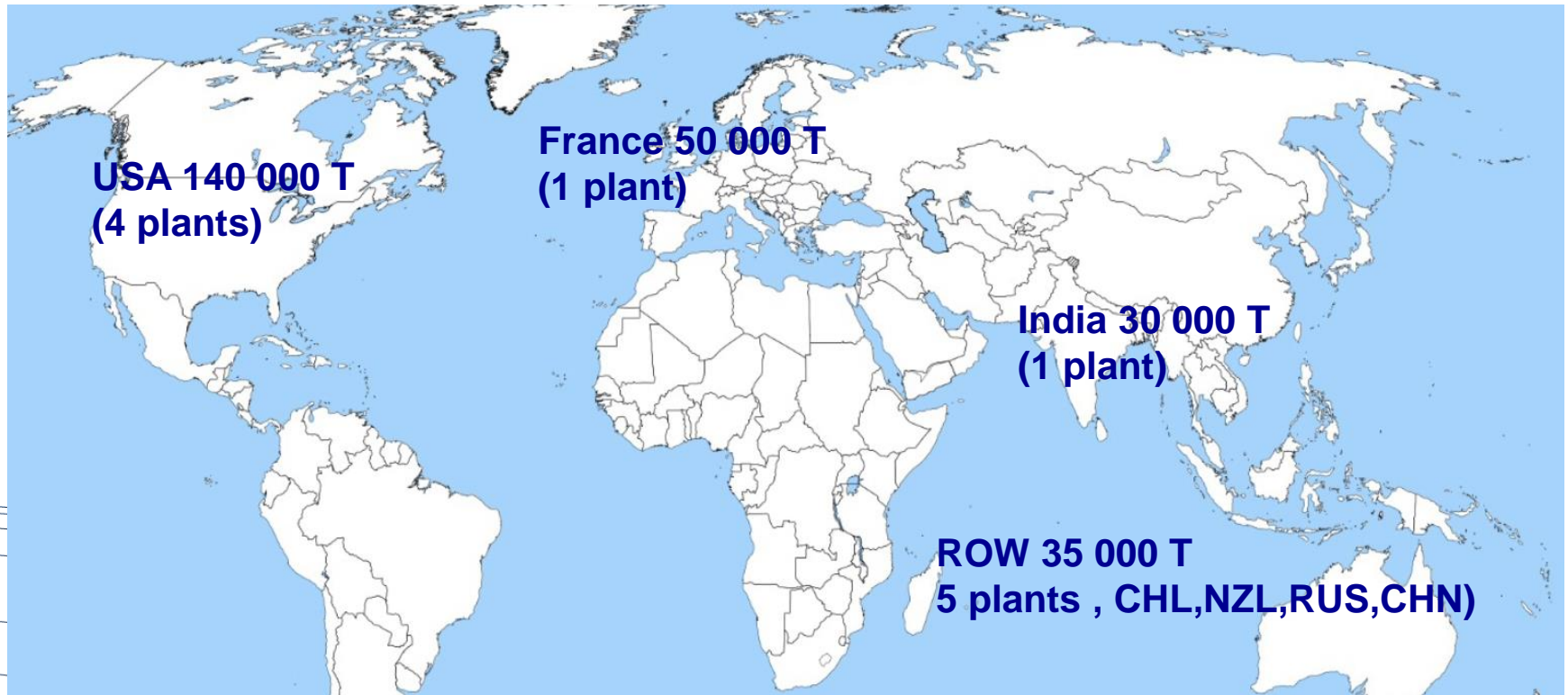
Y2021 CST Production: 205 000 T*

3-5 Kg / T Softwood Kraft Pulp

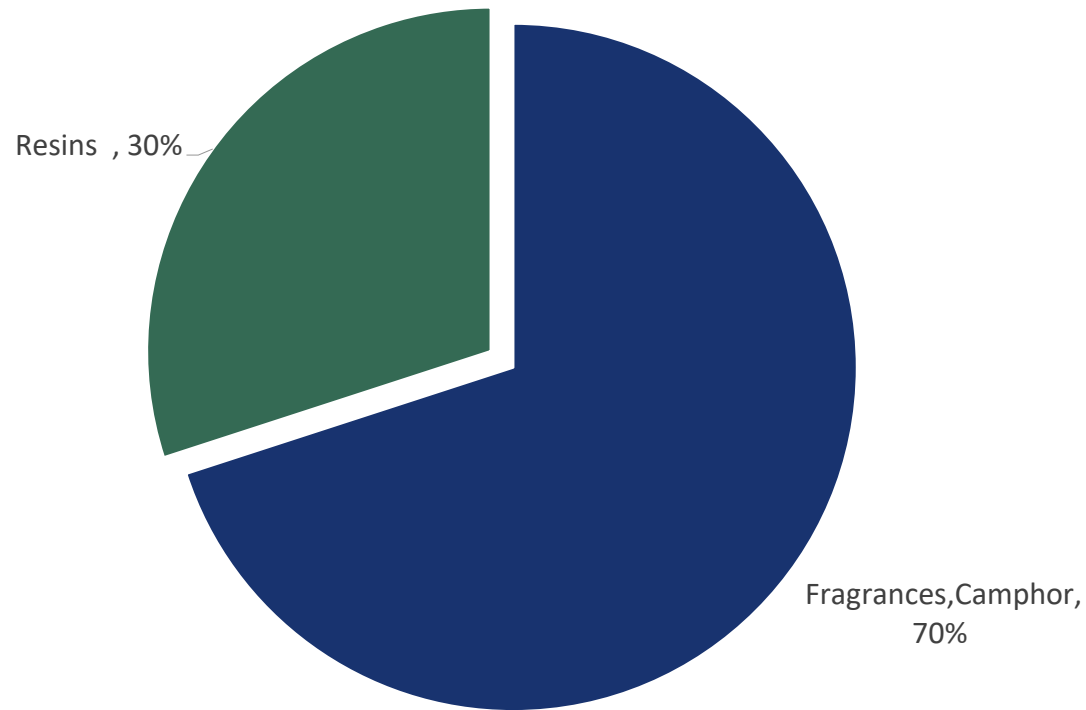


*Including 20 000 T ? CST from CTO

Y2021 World CST fractionation capacity 255 000 T (Capacity in use: 205 000T)

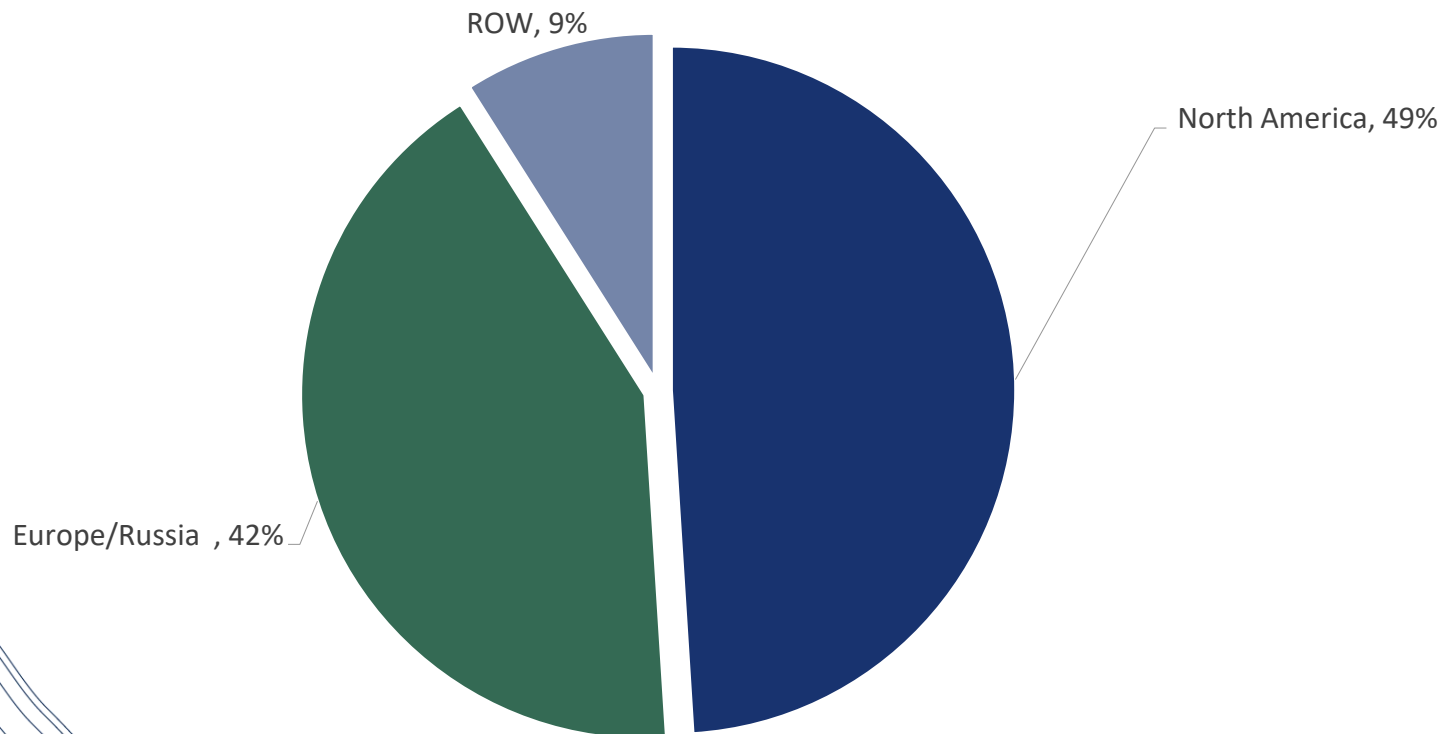


Turpentine demand / Market segment



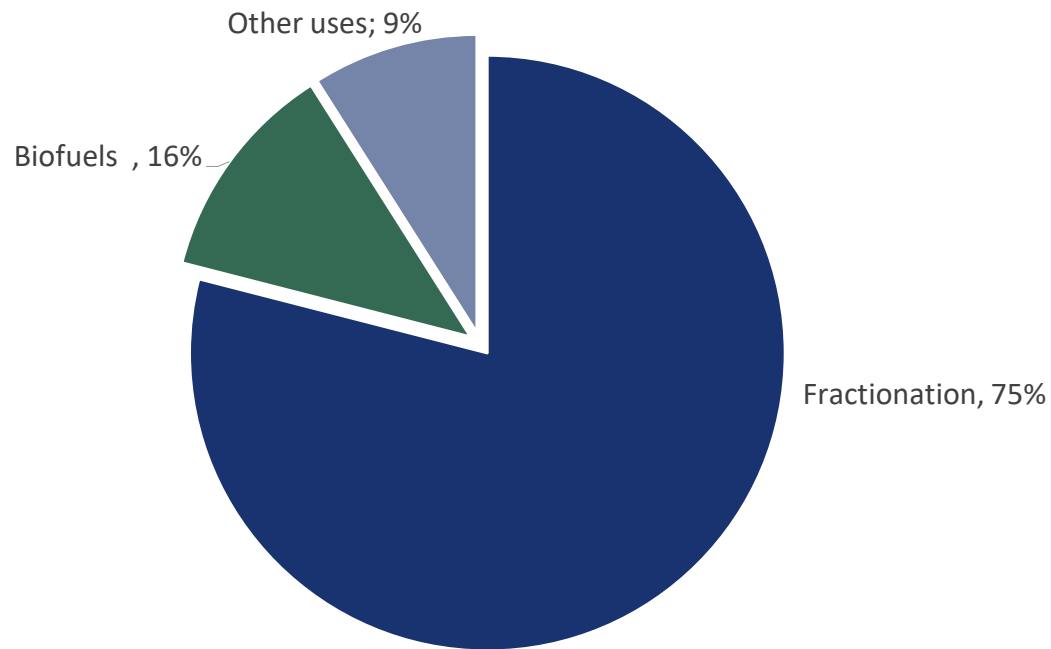
Y2021 CTO Production : 2 Million T

40-60 Kg / T Softwood Kraft Pulp

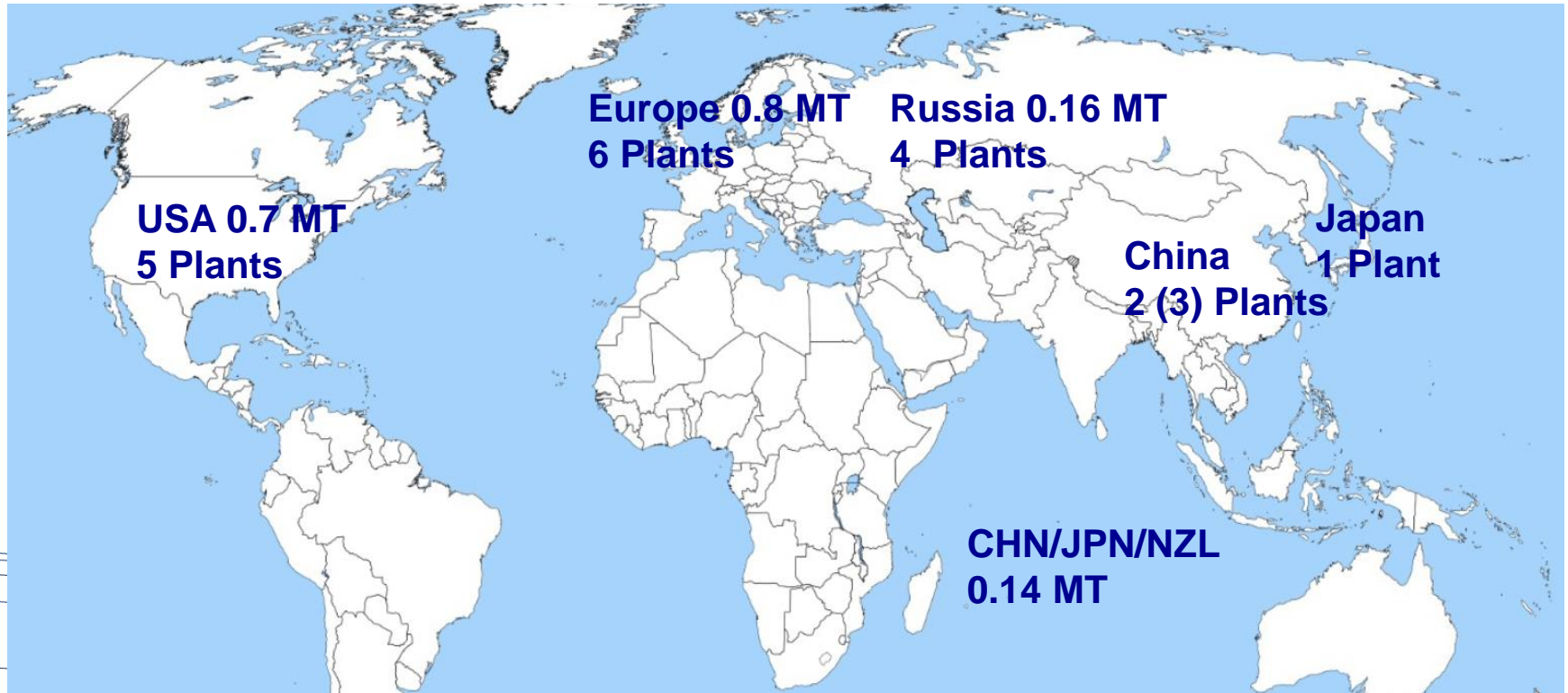


Y2021 CTO Demand / Market Segment

Increasing CTO demand for biofuels



Y2021 World CTO fractionation capacity 1.8 Million T (Capacity in use: 1.5 Million T)



1 MT = 1 Million Metric T

New Zealand
1 Plant

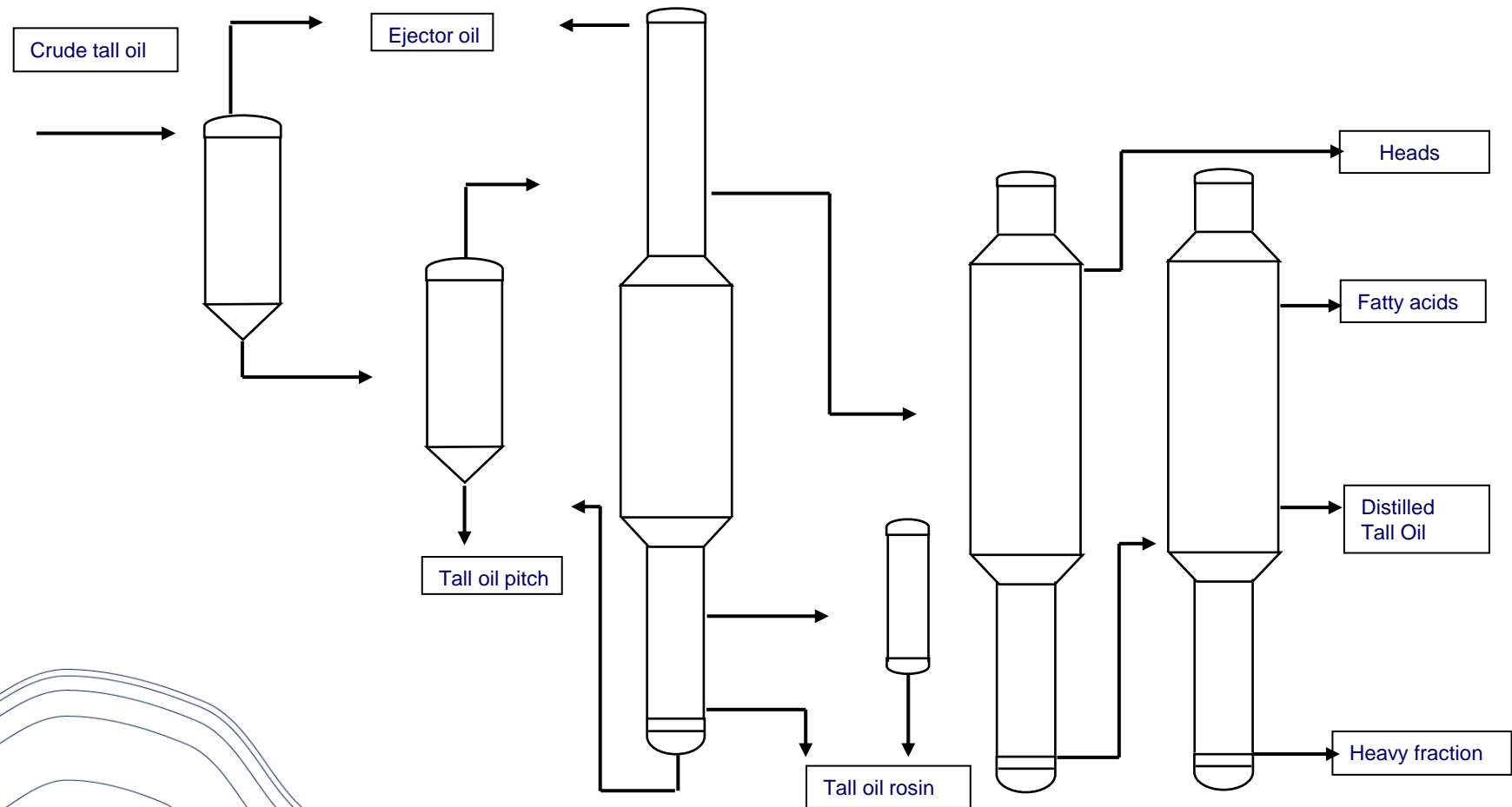
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Pulp And CTO Developments

- 2020/2025 : Investments at pulp mills will result in 200 kT additional CTO but CTO demand for biofuels might increase by 200 kT / 500 kT
- From CTO to Biofuels : FAME , HVO , Co-processing at refinery
- Biofuel prices based on fossil fuel prices + Taxes
- Regulations : Europe (RED , ILUC, REDII) , USA (AFMC expired end Y2013)
- Diesel technology questioned in many countries
- Bio-diesel production out of CTO: Destroying a precious resource

Fractionation of CTO



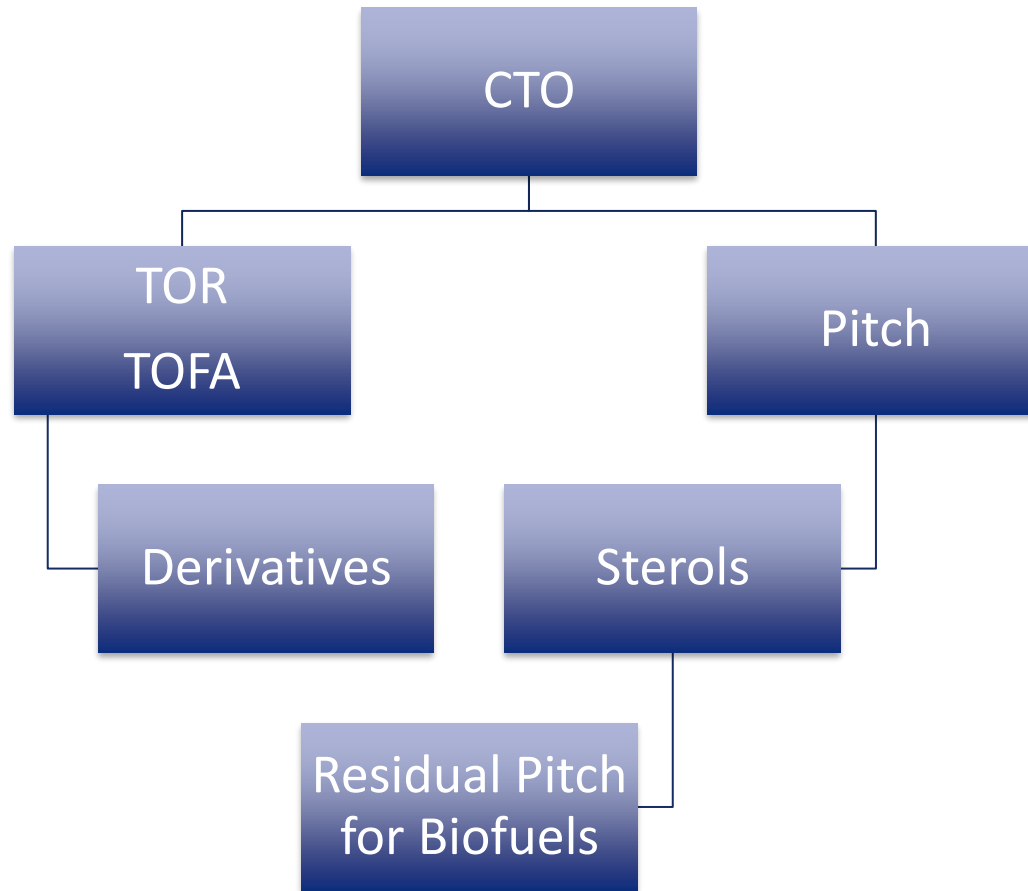
Dehydration

Separation of
Pitch

Separation of
Rosin

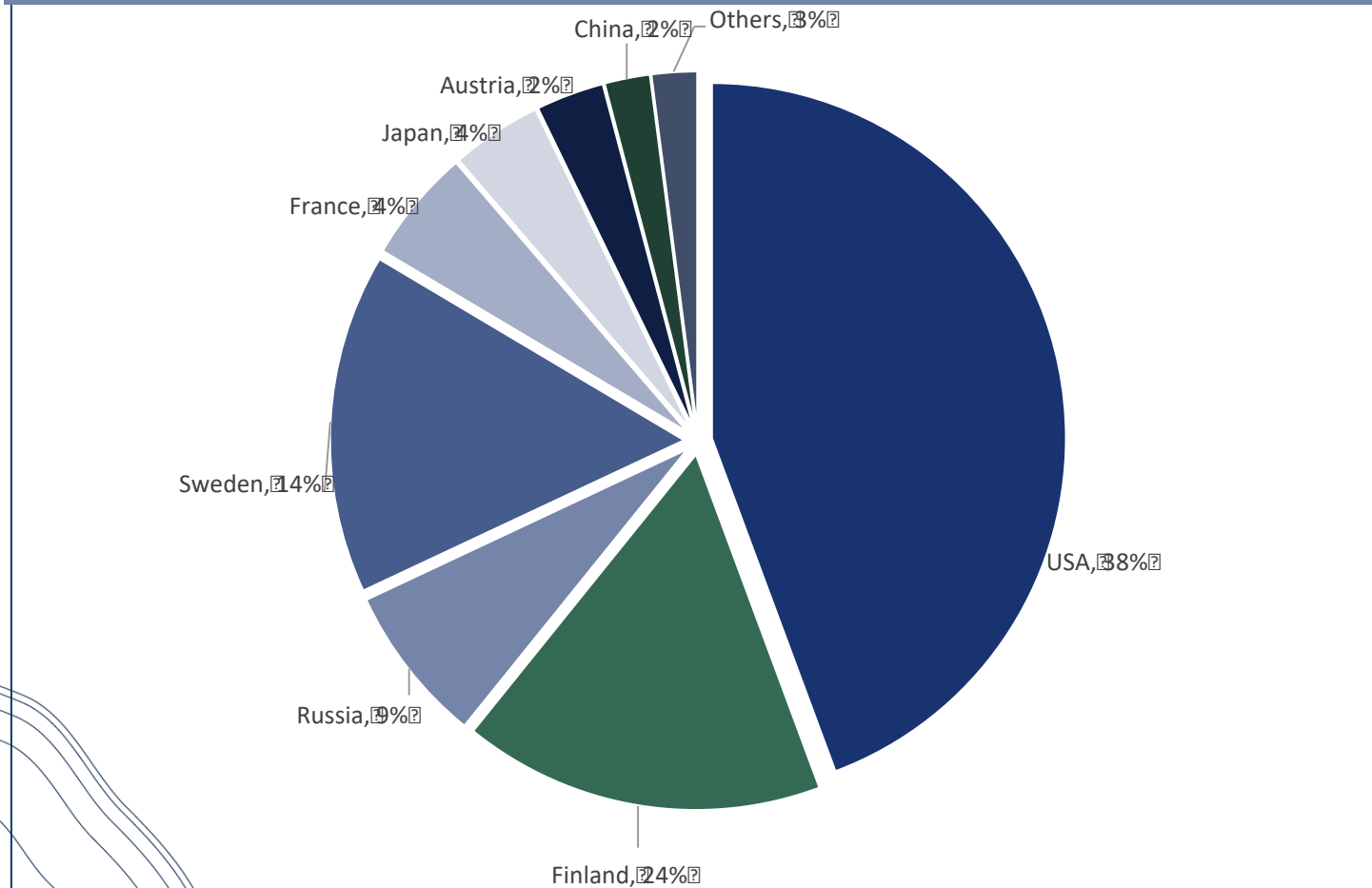
Separation of
Fatty Acids,
Heads, DTO

Cascading is the only intelligent and efficient way to use CTO

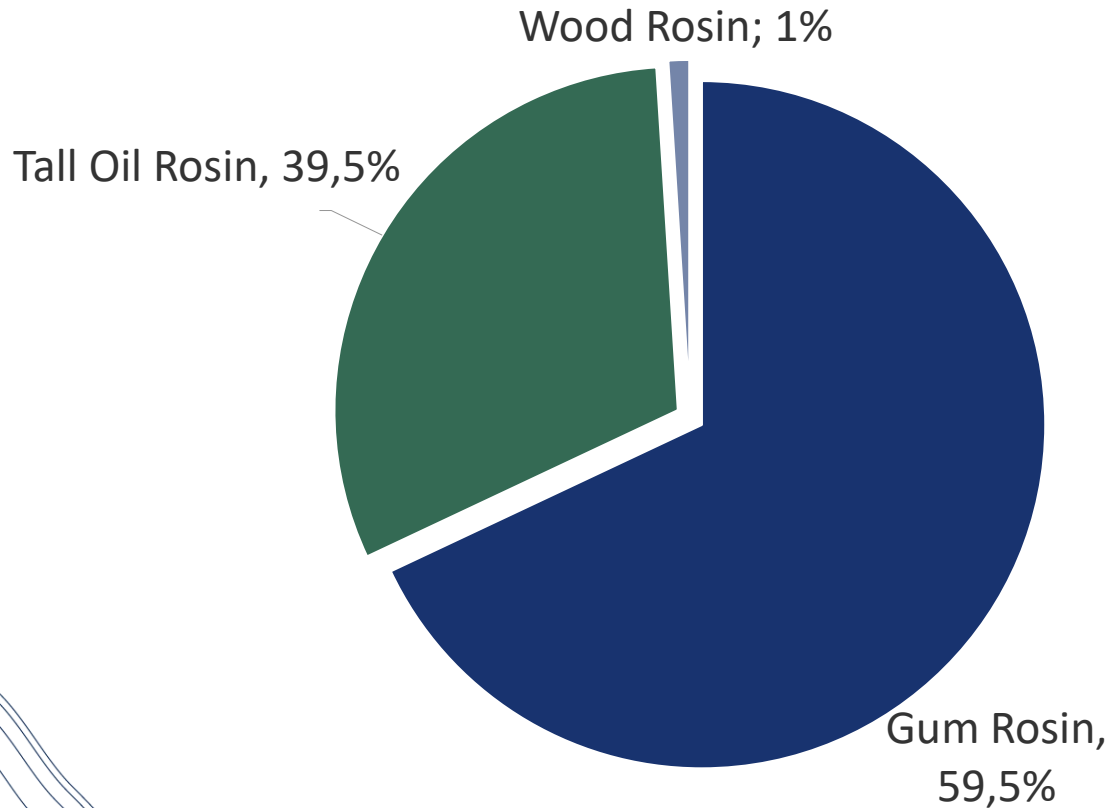


Y2021 Global TOFA Production: 460 000 T

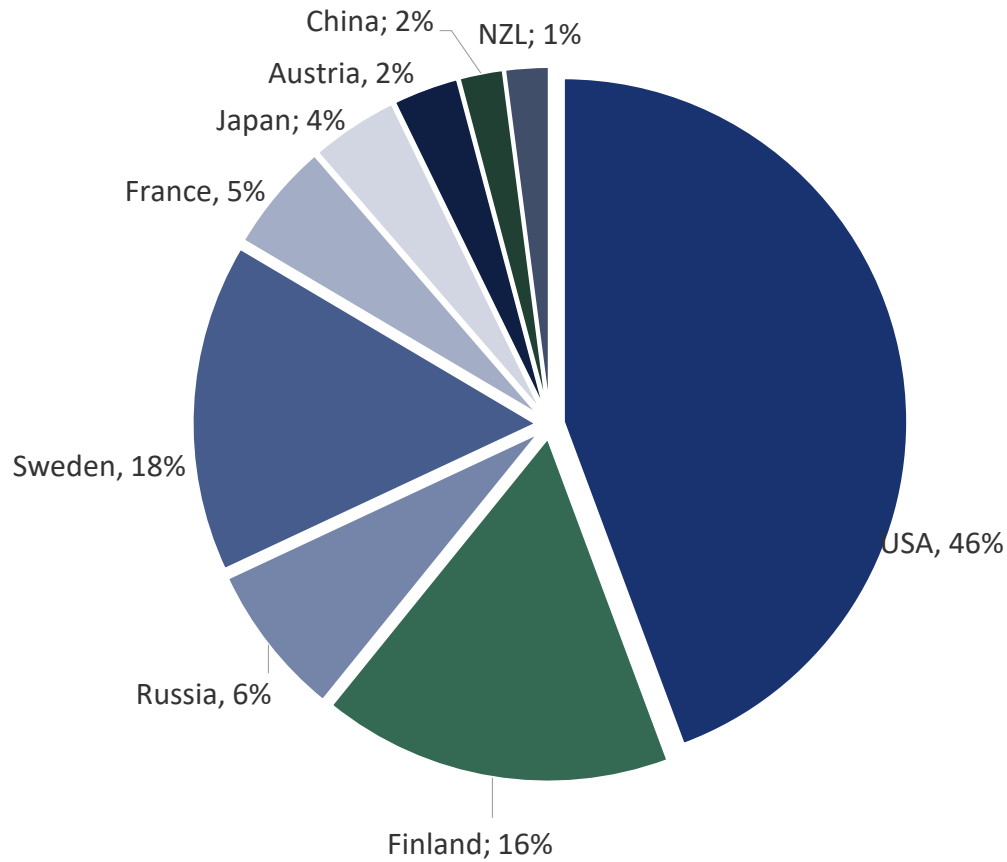
Palm Oil 70 Million T , SBO 55 Million T



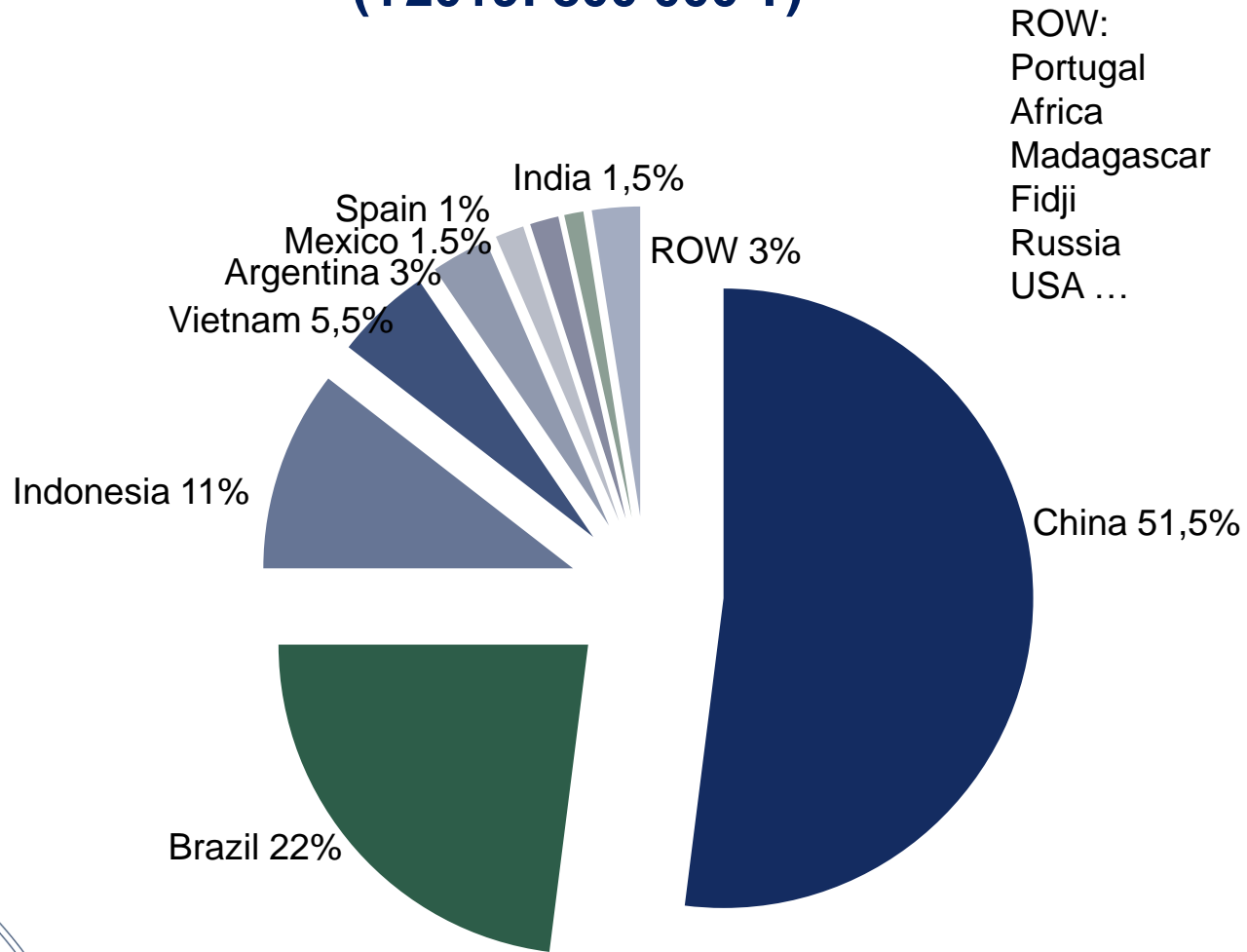
Y2021 Global Rosin Production 1 160 000 T



Y2021 Global Talloil Rosin (TOR) Production 460 000 T



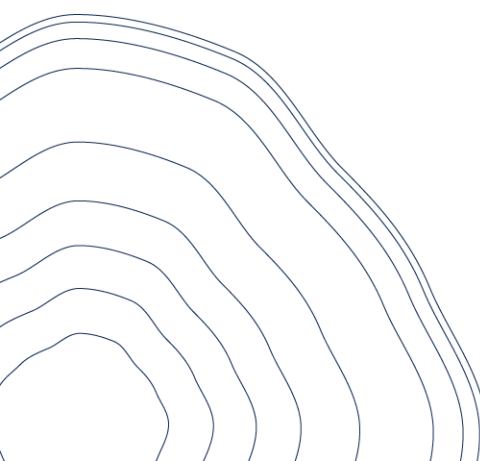
Y2021 Global Gum Rosin production: 690 000 T (Y2019: 800 000 T)



Rosin quality

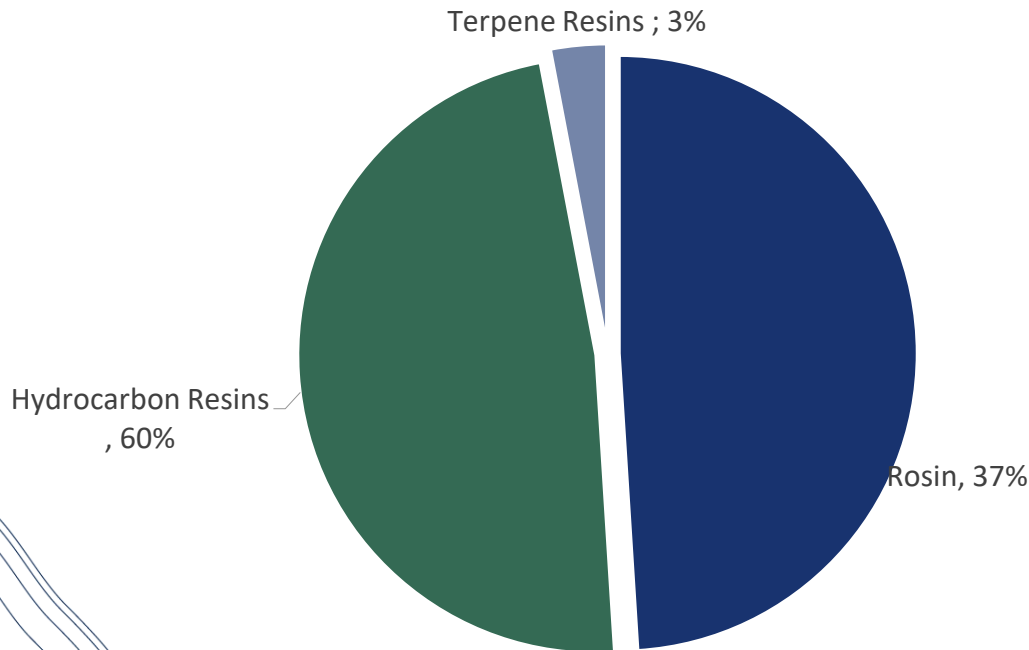
- Significant differences in composition
- Fast growing Pinus Elliotii with lower PAN content

	P. Massoniama	P. Elliotii	SCAN TOR	P. Merkusii
Pimaric acid	8%	4%	2%	0.5%
Sandaraco pimaric acid	1.5%	1.5%	1%	9%
Isopimaric acid	1%	14%	7%	17%
Dehydroabietic acid	3%	3%	19%	4%
Palustric acid	16%	20%	13%	22%
Abietic acid	49%	20%	43%	20%
Neoabietic acid	14%	16%	4%	11%
Others (RA,Unsaps)	7.5%	21.5%	11%	16,5% (10% Merkusic)



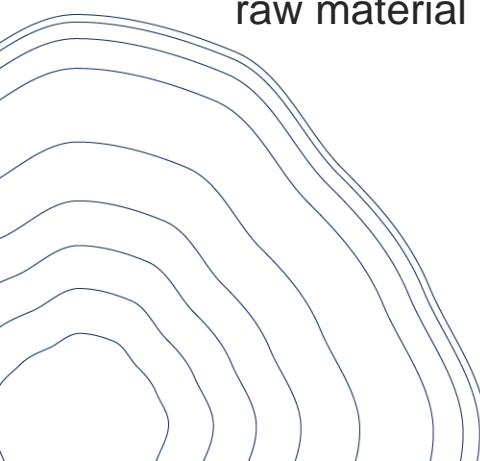
Y2021 Global Resin Production : 3 150 000 T

Hydrocarbon resins becoming commodities...capacity expansions in Asia in excess of demand growth ...but crackers in China might change from Naphta to Gas
Higher demand for natural resins



Outlook for the Pine Chemical market

- Pine Chemical market reaching 5 Billions USD and growing at a higher rate than average GDP growth .
- Asia will have the fastest growth and will drive the demand.
- Lower carbon footprint of Pine derived chemicals.
- Growing environmental concerns will favour Pine Chemicals.
- Pine Chemical market has proven its resilience and capability to adapt to variations of raw material costs.





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