



The Future for Rosin Esters in Hot Melt Adhesives

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+ Agenda

- Introduction- Adhesive market status and trends
- Trends affecting Rosin Ester usage in Hot Melt Adhesives
- Rosin Ester consumption by Adhesive market segment
- Trends by market segment
- 2028 forecast for Rosin Ester usage in Hot Melt Adhesives
- Global perspective
- Conclusion

+ Introduction

Hot Melt Adhesives European Market

- European market size estimated at 650kT
- Growing at around 3.5% per year
- Tackifier market is ca. 250kT (38% of total adhesive)
- Rosin Ester market is ca. 90kT
 - 14% of total adhesive
 - 36% of tackifier portion
 - Rosin Ester market has declined by ca. 1% per year over last 5-10 years, despite overall adhesive market growth
- Rosin Ester usage varies by Adhesive market segment and geography

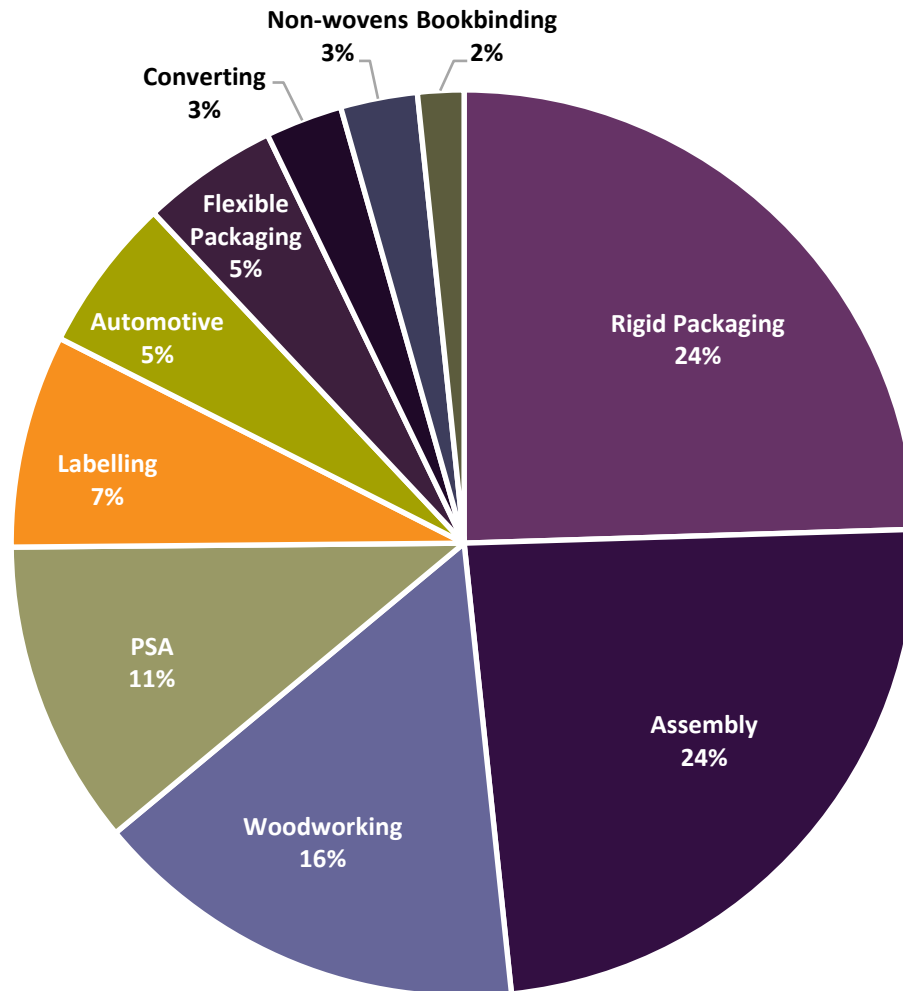
+ Hot Melt Adhesives

Key Market Trends and Developments

Trends & Demands	Developments
Lower application temperatures to save energy and improve handling safety	Lower softening point adhesives with equivalent or better properties
Reduced downtime due to equipment breakages and cleaning	Clean-running, highly thermally stable products that do not char or break down
Cost saving- increased recycled content, smaller reserves, less adhesive	Next generation products with excellent specific adhesion to low energy substrates at low usage rates
Renewable, recyclable	Not yet solved!
Avoid having to think about adhesives!	Turn-key adhesive solutions based on total cost in use- partnerships with equipment manufacturers

+ Hot Melt Adhesives- ca. 650kT

Estimated Quantity by Market Segment- Europe 2018





Trends Affecting Rosin Ester Usage in Hot Melt Adhesives



Positives

- Superior adhesion in many applications
- Good hedge against hydrocarbon price and availability swings
- Seen as “renewable” alternative to hydrocarbon tackifiers (but still need hydrocarbon for the polymer, so not a “green” adhesive)
- Odour of RE is sometimes favoured over hydrocarbons

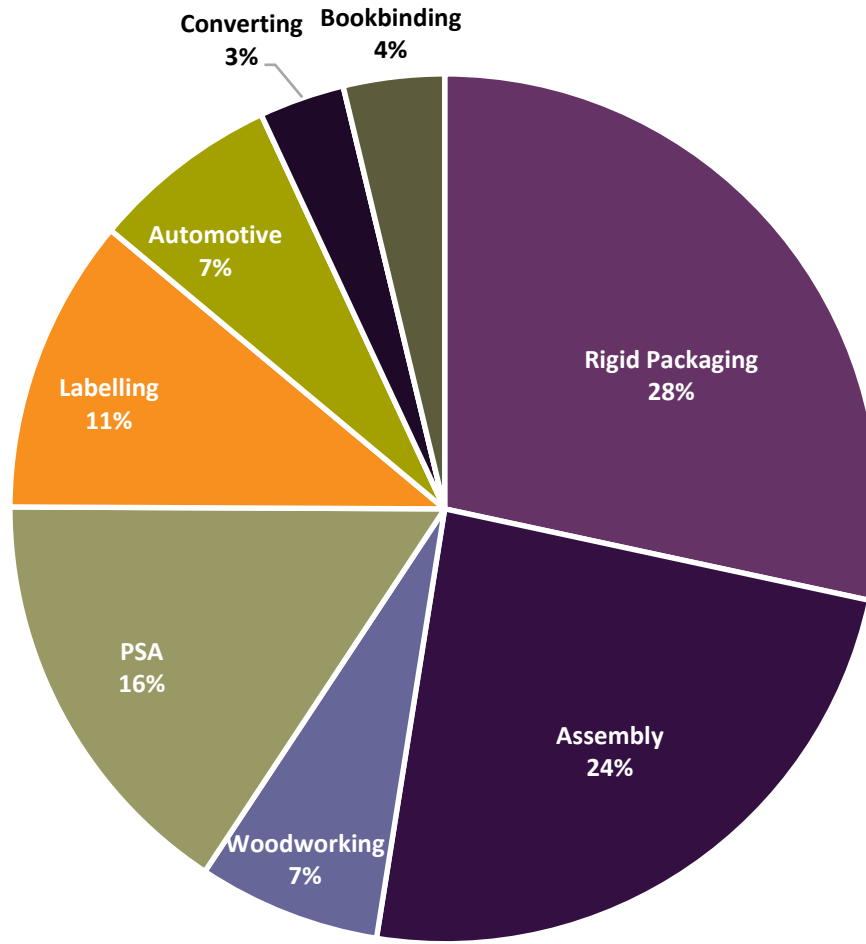
Negatives

- Growth in metallocene catalysed PP and PE polymers which are generally incompatible with rosin ester tackifiers
 - Driven by market leaders, Henkel and HB Fuller, who were given early access to the technology
 - First products had very poor adhesion, but later generations improved on this
 - Metallocene catalysed polymers enable more stable, cleaner running and lower usage adhesives to be formulated
- Rosin esters sometimes associated, unfairly, with “old technology”- dirty, smelly and poor stability
- “Standard” hydrocarbon tackifiers have also improved



Rosin Esters in HM Adhesives- ca. 90kT

Estimated Quantity by Market Segment- Europe 2018





Rigid Packaging

Segment growing at 2% per year

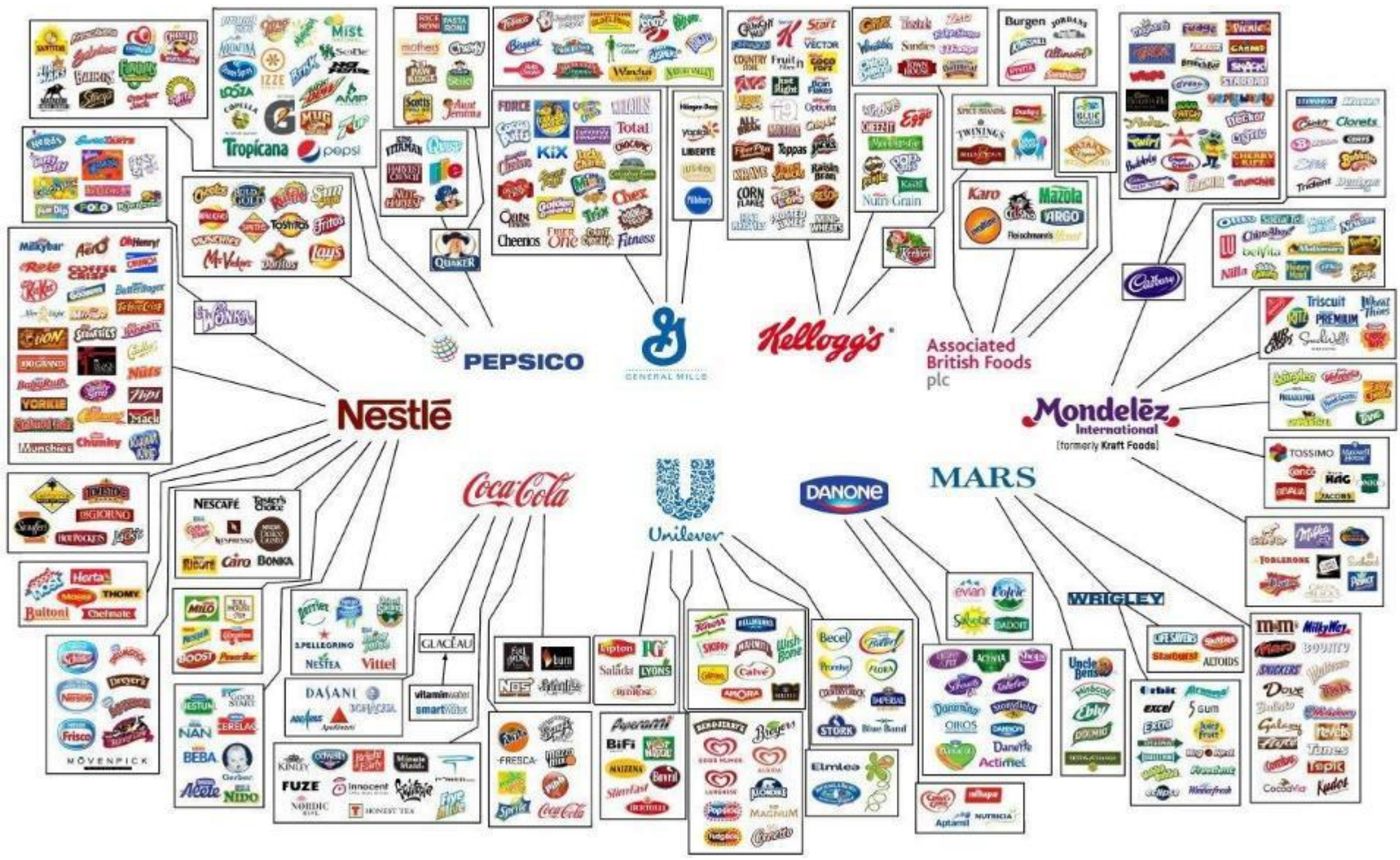
Case & carton sealing (“End of Line”), case and tray erection, aseptic cap and straw attach, many other niches (e.g. roll and ream wrap in paper industry)

Positives for Rosin Esters

- Buyer lack of focus / resistance to change, especially for small users
- Drive towards good housekeeping- cleaning and maintenance of equipment
- Cost focus of buyers/ tendency for RFQs
 - Adhesive cost relatively small as % of total- often part of MRO spend
 - Perceived total cost benefits of metallocene can be overlooked
- Increased recycled content and changing designs creates adhesion challenges

Negatives for Rosin Esters

- Metallocene has grown fastest in this segment, taking share from EVA / RE
 - Allows less focus on the adhesive process
 - Enables faster line speeds
- Unlikely to return to EVA / RE after metallocene adoption
 - Standardisation is appealing
- Metallocene can be attractive for turn-key solutions involving application equipment and/or complete packaging lines
 - BUT!...can also be perceived as a threat for those selling equipment spares





Assembly

Segment growing at 4% per year overall

Many diverse applications, including: Transportation (Automotive considered separately), Filter, Construction, Spring and Mattress, Appliances, Carpeting and Textiles, Cord-strapping

Positives for Rosin Esters

- Adhesives are specified into parts, often for many years, especially in Transportation, Filters, Construction and Appliances, leading to few changes
- Addresses specific adhesion challenges, e.g in Spring and Mattress sub-segment
- Focus on adhesive cost
 - Adhesive is high proportion of part cost
 - Drive towards good housekeeping-cleaning and maintenance of equipment

Negatives for Rosin Esters

- Metallocene can be favoured where water-white adhesive colour is important



Woodworking

Segment growing at 2% per year

Edge-banding, profile-wrapping and top lamination of finishes onto various wood and fibre-based materials (e.g. IKEA furniture products)

Positives for Rosin Esters

- Traditional segment of high RE usage
- Addresses specific adhesion challenges
- Focus on adhesive cost
 - Adhesive is high proportion of part cost
 - Drive towards good housekeeping-cleaning and maintenance of equipment

Negatives for Rosin Esters

- Trend towards polyolefin products that rival environmental resistance of PURs



PSA

Segment growing at 3% per year

Labels, tapes and self-adhesive coatings- this is an application-defined segment (not a market) so there is sometimes confusion and overlap with other segments

Positives for Rosin Esters

- More complex systems- tackifier choice driven by polymers / rubbers used
- Addresses specific adhesion and conversion challenges
- Value of adhesive is inherently part of customer's "sell-on" value
- Tendency to lower coat weights on labels drives increased tackifier content (not only RE)

Negatives for Rosin Esters

- Doubts about colour and temperature stability for applications that demand them



Labelling

Segment growing at 1% per year

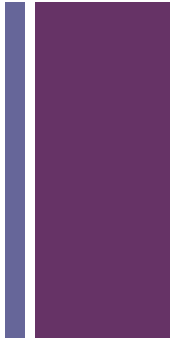
Bottle, jar and can labelling directly with hot melt- competes with PSA applications and water-based adhesive technology

Positives for Rosin Esters

- Low growth segment with little motivation for change from traditional formulations

Negatives for Rosin Esters

- Doubts about colour and temperature stability for applications that demand them





Automotive

Segment growing at 4% per year

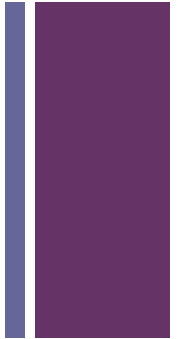
Non-structural (secondary) bonding, e.g. for thermal/ sound insulation, headlights, bumpers- many and varied applications

Positives for Rosin Esters

- Addresses specific adhesion challenges
- Adhesives are specified into parts, often for many years, leading to few changes
- Users are focused on good housekeeping- cleaning and maintenance of equipment

Negatives for Rosin Esters

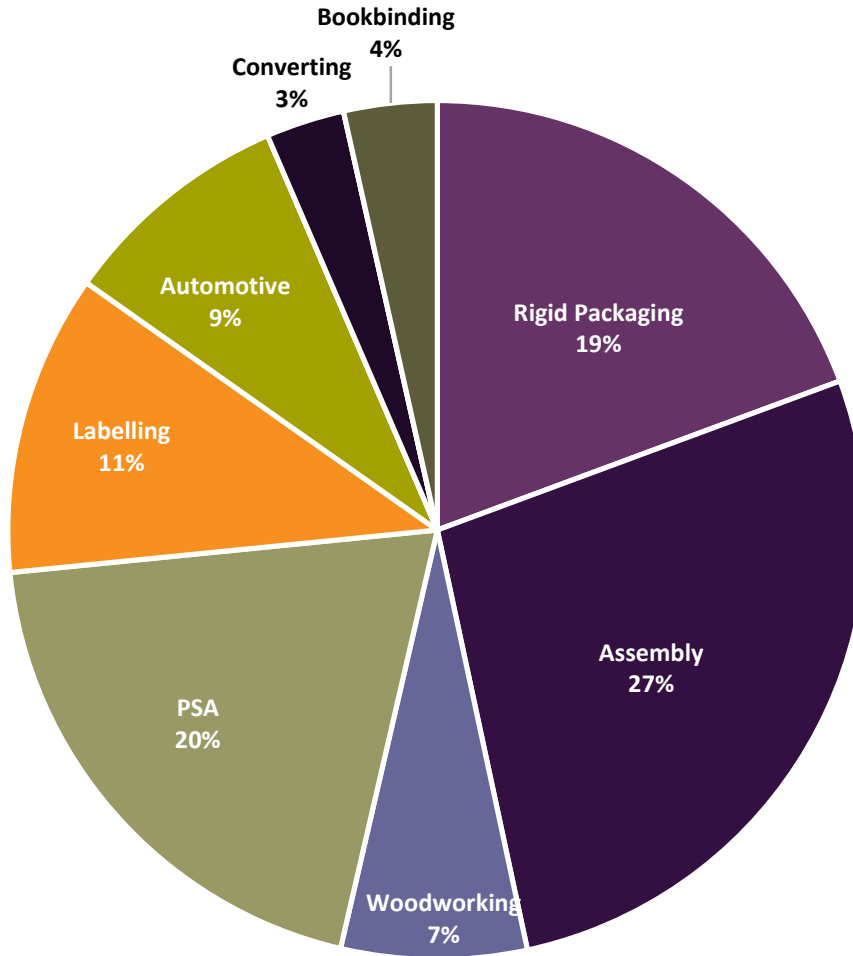
- Doubts about colour and temperature stability for applications that demand them





Rosin Esters in HM Adhesives- ca. 97kT

Projected Quantity by Market Segment- Europe 2028





Rosin Esters in Hot Melt Adhesives

Regional Variations



Europe

- Market uptake of metallocene higher in Western and Northern Europe than Southern and Eastern Europe
 - Focus on technology advancement and “total cost of ownership” of adhesive
 - Partnerships with equipment companies (Nordson, Robatech, etc.) to sell solutions to customers rather than just products
 - Many small to medium hot melt producers in Italy, Spain and Portugal with long-standing customer and supplier relationships and more market inertia

North America

- Evidence that market penetration of metallocene has been slower than in Europe
 - Customers are more adhesive price-driven
 - Users have more “hands on the machine”- focus on equipment maintenance



Rosin Esters in Hot Melt Adhesives

Regional Variations



South America

- Market uptake of metallocene seems low
 - Perhaps due to traditional high usage of gum rosin esters

Asia

- Appreciable adoption of metallocene for new applications and with global users
- Operator education is not always sufficient to benefit from material savings
- Equipment maintenance is low cost, and/ or comes included as part of a service package with the equipment
- EVA / Rosin Esters still maintain a healthy share due to local manufacture

+ Conclusion

- New technologies such as metallocene have taken, and will continue to take share from "traditional" hot melts such as those that use rosin esters
- This is particularly true in the largest segment for hot melts, Rigid Packaging
- In other segments, the arguments for metallocene technology are not so compelling
- However, it is expected that an equilibrium will be reached, and rosin ester will remain a significant tackifier technology, due to its adhesion performance, specific polymer compatibilities and renewable nature

ROSIN ESTERS HAVE A FUTURE IN HOT MELT ADHESIVES!



Thank You!

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