Rosin Based Tackifier & resin dispersions from Eastman Chemical Company
Agenda

- Rosin Based Tackifier
- Resin dispersions
- Applications for waterborne adhesives
Rosin Based Tackifier
Rosin-based tackifiers

- Derived directly or indirectly from pine trees
- Three sources of rosin acids:
  - **Gum rosin**: harvested directly from a living tree; China is currently the largest supplier
  - **Wood rosin**: solvent extraction from aged tree roots; relatively expensive and limited supply
  - **Tall oil rosin**: collected as a by-product of wood fiber pulping for papermaking; crude tall oil can also be burned as fuel
Rosin is a mixture of naturally occurring organic acids, including:

- Abietic
- Neoabietic
- Dehydroabietic
- Tetrahydroabietic

Chemical modification of rosins typically involves:

- Neutralization
- Hydrogenation
- Esterification
- Maleic, Fumaric, Phenolic Adducts
- Polymerization
- Disproportionation

Typically rosins are modified to improve color, stability, and/or to expand usability.
Esterification

Glycerol Ester
E.g.: *Permalyn* 5095-C

Pentaerythritol Ester + 4H2O
E.g.: *Permalyn* 5110-C
Eastman Chemical Company – a key supplier of tackifying resins

- Permalyn™ Stabilized Rosin Esters
- Staybelite™ E, Foral™ E & Foralyn™ Hydrogenated Rosin/Esters
- Tacolyn™ Resin Dispersions
### Rosin resins from Europe
#### Typical Properties

<table>
<thead>
<tr>
<th>Product</th>
<th>Softening Point, °C&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Color, Gardner&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Acid No.</th>
<th>End Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Staybelite Resin-E™</td>
<td>79</td>
<td>5</td>
<td>162</td>
<td>Hot melt adhesives, solder flux, pigment coating</td>
</tr>
<tr>
<td>Foralyn™-E</td>
<td>81</td>
<td>2</td>
<td>168</td>
<td></td>
</tr>
<tr>
<td>Foral™ AX-E</td>
<td>81</td>
<td>&lt;1</td>
<td>166</td>
<td></td>
</tr>
<tr>
<td>Permalyn™ 5095</td>
<td>92</td>
<td>3</td>
<td>8</td>
<td>Hot melt adhesives</td>
</tr>
<tr>
<td>Eastman Ester Gum™ 8D</td>
<td>93</td>
<td>USRG WW</td>
<td>7</td>
<td>Chewing gum</td>
</tr>
<tr>
<td>Staybelite Ester™ 5-E</td>
<td>85</td>
<td>USRG X</td>
<td>8</td>
<td>Chewing gum</td>
</tr>
<tr>
<td>Staybelite Ester™ 10-E</td>
<td>86</td>
<td>6</td>
<td>8</td>
<td>Adhesives, cosmetics</td>
</tr>
<tr>
<td>Foral™ 85-E</td>
<td>86</td>
<td>2</td>
<td>9</td>
<td>Hot melt adhesives, solvent based adhesives</td>
</tr>
<tr>
<td>Foralyn™ 90</td>
<td>89</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Permalyn™ 5110</td>
<td>106</td>
<td>6</td>
<td>14</td>
<td>Hot melt adhesives</td>
</tr>
<tr>
<td>Permalyn™ 6110</td>
<td>110</td>
<td>&lt;1</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Pentalyn™ H-E</td>
<td>108</td>
<td>8</td>
<td>14</td>
<td>Pressure sensitive adhesives</td>
</tr>
<tr>
<td>Foral™ 105-E</td>
<td>106</td>
<td>5+</td>
<td>14</td>
<td>Hot melt adhesives, solvent based adhesives</td>
</tr>
<tr>
<td>Foralyn™ 110</td>
<td>109</td>
<td>2</td>
<td>14</td>
<td></td>
</tr>
</tbody>
</table>
## Liquid & specialty rosin derivatives

### Typical properties

<table>
<thead>
<tr>
<th>Product</th>
<th>Chemical Type</th>
<th>Softening Point, °C&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Color, Gardner</th>
<th>Acid No.</th>
<th>Melt Viscosity, mPa.s @ 25°C</th>
<th>End Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquid Rosins</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foralyn™ 5020-F</td>
<td>Partially hydrogenated rosin ester</td>
<td>Liquid</td>
<td>3</td>
<td>6</td>
<td>5,400</td>
<td>Cosmetics, perfumery, tackifier, plasticizer</td>
</tr>
<tr>
<td>Abitol™-E</td>
<td>Technical hydroabietyl alcohol</td>
<td>Liquid</td>
<td>Hunter 2</td>
<td>0.1</td>
<td>6,500 @ 50°C</td>
<td>Tackifier, plasticizer</td>
</tr>
<tr>
<td><strong>Other Specialties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cellolyn™ 21-E</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tackifier for deep-freeze acrylic tape and label</td>
</tr>
</tbody>
</table>

<sup>a</sup> Softening point is measured according to ASTM D113-05.
Advantages of rosin resins

- Broad compatibility with many polymers
  - Natural rubber, polyisoprene, polybutadiene, EVA, polychloroprene, acrylic
  - Simple esters all have similar solubility and compatibility

- Broad range of properties
  - Softening point: liquid to 180°C
  - Color: Gardner <1 to >10

- Hydrogenated rosin resins have low color and improved oxidative stability

- Produced from renewable resources
Resin dispersions

- Most tackifiers can be dispersed in water
  - Rosin esters, aliphatic hydrocarbons, aromatic hydrocarbons, and combinations
  - The tackifier must be combined with a surfactant to form a dispersion

- The resin to be dispersed must have softening point <92°C
  - Needed if only ambient-pressure equipment is available
  - Softening point is reduced if necessary with oil or low softening point resins

- Additives affect the properties
  - Oils and surfactants reduce cohesion
  - Residual surfactant decreases water resistance
Resin Dispersion Formulation

- **Required**
  - Resin (40-60%)
  - Emulsifier (2-10%)
  - Water (40-60%)

- **Optional Additives**
  - Plasticizer (0-20%)
  - Stabilizer / Ion Tolerance Agents (0-3%)
  - Antioxidant (0-0.5%)
  - Biocide (0-0.1%)
Adhesive applications using resin dispersions

- White glue
- Paper labels
- Transparent labels
- PSA tapes
- Protective films
- Contact adhesives
  - Foam assembly for furniture
  - Show construction
- Others
Global structure of the waterborne adhesive market

- White Glue: 57%
- Labels: 34%
- Tapes: 3%
- Protective Films: 3%
- Contact Adhesives: 2%
- Others: 1%

1 Source: SRI: Chemical Economics Handbook, 2004
2 Source: Adhesives and Sealants Industry, November 2003
## Selecting *Tacolyn* Resin Dispersions for Specific Applications

<table>
<thead>
<tr>
<th>Tacolyn Dispersion</th>
<th>Latex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Acrylic</td>
</tr>
<tr>
<td><strong>Hybrid</strong></td>
<td></td>
</tr>
<tr>
<td>Tacolyn 4603</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Rosin Ester</strong></td>
<td></td>
</tr>
<tr>
<td>Tacolyn 3179HA, 3509</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Hydrogenated Rosin Ester</strong></td>
<td></td>
</tr>
<tr>
<td>Tacolyn 3100, 3185, 3280, 3400</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Aliphatic HCR (C5)</strong></td>
<td></td>
</tr>
<tr>
<td>Tacolyn 5070, 5085, 5095</td>
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</tr>
<tr>
<td><strong>Aromatic HCR (PMR)</strong></td>
<td></td>
</tr>
<tr>
<td>Tacolyn 5194</td>
<td>Y</td>
</tr>
<tr>
<td><strong>Aromatic Modified HCR (C5/C9)</strong></td>
<td></td>
</tr>
<tr>
<td>Tacolyn 1070, 5002, 5003</td>
<td>Y</td>
</tr>
</tbody>
</table>
Thanks!