New Developments in Coatings with Soybean Oil

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Rust-Oleum Corporation
American Coatings Association Classification

- Architectural
- DIY type paints/coatings
- Industrial
- Special Purpose
- Industrial maintenance
- Aerosols
- Traffic marking
- Marine
Areas of Architectural Finishes

- **Interior Products**
  - Paints – wall and trim
  - Wood stains
  - Polyurethanes

- **Exterior Products**
  - Paint - siding
  - Deck stains
  - Waterproofers and sealers
  - Concrete coatings
Paint and Coatings Market

- Gallons
- $B

2005: 1.6
2007: 1.2
2008: 0.8
2009: 0

2005: 15
2007: 10
2008: 5
2009: 0
Drivers of the Market

- VOC Regulations
- Volatility in petroleum feedstocks
- Monomer shortages 2009-2010
- Water based finishes becoming larger contributor
VOC Regulations

- SCAQMD
- Most stringent
- US AIM
- All categories dropping
- CARB - OTC
- Seem to work in concert with each other
- Air Canada
- First ever “regulations” on paints
Soy oil - Better than Crude

- Price stability
- Sustainable
- Multiple sources
- Cleaner process
- Contributes to the GDP
USDA or DOE annual average (2009 estimate)
Acrylic Monomer Shortage

- Only a few domestic monomer plants
- Lucite plant shutdown due to fire
- R&H plant shutdown for maintenance
- Market very tight still due to plants producing strictly on demand
- China/EU demand
Traditional Oils used in Coatings Resins

- Soybean
- Linseed
- Castor
- Tall Oil
- Sunflower/Safflower/Canola
- Coconut
- Fish
Soybean Usage Currently

- Alkyds
- Oil Modified Polys
- Acrylies
Alkyd Evolution

- Oil created in 1927
- Waterborne 1950s
- Reaction of-
  - Phthalic anhydride
  - Polyol
  - Fatty acid oil
  - Solvent
Polyurethane Evolution

- Oil created in 1937
- Waterborne 1950s
- Reaction of-
  - Fatty acid oil
  - Isocyanate
  - Solvent
Acrylic Evolution

- Created in 1933
- Reaction of-
  - Acrylic acids
  - Methacrylates
  - Other monomers
Soy Acrylic Evolution

- Created in 2008
- Reaction of-
  - Soy fatty acid
  - Epoxy acrylate
  - Styrene
  - Butyl methacrylate
  - Methyl methacrylate
  - Methacrylic acid
Water based Soy Alkyd Applications

- Metal finishes
- General purpose
- Wood Products
- Decking
- Siding
- Concrete coatings
## Water vs Oil Alkyd Testing

<table>
<thead>
<tr>
<th>Property</th>
<th>Oil Based</th>
<th>Water Based</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy Content</td>
<td>65%</td>
<td>60%</td>
</tr>
<tr>
<td>Solids</td>
<td>60%</td>
<td>55%</td>
</tr>
<tr>
<td>VOC at 125 cps</td>
<td>375 g/l</td>
<td>50 g/l</td>
</tr>
<tr>
<td>Sward Hardness</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>(Higher is harder)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composite Chemical</td>
<td>50</td>
<td>49</td>
</tr>
<tr>
<td>(50 points total)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Time</td>
<td>8 hours</td>
<td>4 hours</td>
</tr>
<tr>
<td>Gloss Potential</td>
<td>93</td>
<td>88</td>
</tr>
<tr>
<td>(For high gloss product)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Water based Soy Poly
Applications

- Wood Products
- General purpose
- Flooring
- Concrete coatings
## Water vs Oil Poly Testing

<table>
<thead>
<tr>
<th>Property</th>
<th>Oil Based Product</th>
<th>Water Based Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soy Content</td>
<td>51%</td>
<td>40%</td>
</tr>
<tr>
<td>VOC at 125 cps</td>
<td>470 g/l</td>
<td>180 g/l</td>
</tr>
<tr>
<td>Hoffman Scratch (Higher is better)</td>
<td>3000 grams to rupture</td>
<td>2800 grams to rupture</td>
</tr>
<tr>
<td>Taber Abrasion (1000 grams &amp; 1000 cycles)</td>
<td>125 mg loss</td>
<td>100 mg loss</td>
</tr>
<tr>
<td>Sward Hardness (Higher is harder)</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>Composite Chemical (50 points total)</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>Dry Time</td>
<td>6 hours</td>
<td>4 hours</td>
</tr>
<tr>
<td>Gloss Potential (For high gloss product)</td>
<td>93</td>
<td>87</td>
</tr>
</tbody>
</table>
Water based Soy Acrylic Applications

- Wood Products
- General purpose
- Flooring
- Decking
- Metal coatings
- Concrete coatings
- Stains
# Soy Acrylic Physical Testing

<table>
<thead>
<tr>
<th>Test</th>
<th>Soy Water Product</th>
<th>Oil Based Product</th>
<th>Water Based Product</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Soy Content</strong></td>
<td>28% (55% of the product at 50% of the polymers)</td>
<td>51% (85% of the product at 60% of the polymer)</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Petro Content</strong></td>
<td>22% (coalescent, additives, polymer)</td>
<td>49% (solvent, additives, polymer)</td>
<td>38% (coalescent, additives, polymer)</td>
</tr>
<tr>
<td><strong>Hoffman Scratch</strong></td>
<td>3200 grams to rupture</td>
<td>3000 grams to rupture</td>
<td>2800 grams to rupture</td>
</tr>
<tr>
<td>(Higher is better)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Taber Abrasion</strong></td>
<td>48 mg loss</td>
<td>125 mg loss</td>
<td>64 mg loss</td>
</tr>
<tr>
<td>(1000 grams &amp; 1000 cycles)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sward Hardness</strong></td>
<td>26</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>(Higher is harder)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Composite Chemical</strong></td>
<td>48.5</td>
<td>50</td>
<td>48</td>
</tr>
<tr>
<td>(50 points total)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dry Time</strong></td>
<td>2 hours</td>
<td>4 hours</td>
<td>2 hours</td>
</tr>
<tr>
<td><strong>Gloss Potential</strong></td>
<td>91</td>
<td>93</td>
<td>84</td>
</tr>
<tr>
<td>(For high gloss product)</td>
<td></td>
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</tr>
</tbody>
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Future for Soy water based resins

- Performance comparable with oil counterparts
- More options for resins as suppliers are working with these materials
- Volatility in petroleum used in many oil systems as well as water based acrylic