Santicizer® Platinum P-1700: A New High Performance Fast-Fusing Plasticizer
Discussion

• What are Fast-Fusing Plasticizers?
• What are Cyclohexanoates Fast-Fusing Plasticizers?
• How are Cyclohexanoates Unique in the Markets of:
  – Wear Layer Flooring
  – Wire and Cable
  – Automotive Synthetic Leather
  – Automotive Foam Applications
• Conclusions
Four Types of Plasticizers

1. General Purpose
   • Phthalate vs Non-phthalate

2. Fast-Fusers
   • Phthalate vs Non-phthalate

3. Specialty – for specific performance attributes
   • Low Temperature Flexibility
   • Outdoor Weathering
   • FDA approvals
   • Flame Retardancy

4. Secondary
   • Primarily used to improve processing or lowering cost
What is a fast-fusing plasticizer?

- Generally high solvators
- Highly efficient
- Used for ease of processing
- Help to compatibilize resin systems

**High Solvator Phthalates**
- Diisobutyl Phthalate
- Butyl Benzyl Phthalate
- C7-9 Alkyl Benzyl Phthalate

**High Solvator Non-Phthalates**
- Benzyl Cyclohexanoates
- Benzoates
- Alkyl Sulfonic Esters
Cyclohexanoate Plasticizers are well known

DINP
General Purpose
Phthalate Plasticizer

Hexamoll DINCH
General Purpose
Non-Phthalate Plasticizer
What is a Benzyl Cyclohexanoate?

- Santicizer 160
  - High Solvating
  - Phthalate Plasticizer

- Santicizer Platinum P-1400
  - High Solvating
  - Non-Phthalate Plasticizer
What is Texanol Benzyl Cyclohexanoate?

Santicizer Platinum P-1400
High Solvating
Non-Phthalate Plasticizer
MW – 318.8

Santicizer Platinum P-1700
High Solvating
Non-Phthalate Plasticizer
MW – 460.9
What is different about Texanol Benzyl Cyclohexanoate?

<table>
<thead>
<tr>
<th>Plasticizer</th>
<th>Molecular Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DBT</td>
<td>278</td>
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<tr>
<td>DEGDB</td>
<td>314</td>
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<tr>
<td><strong>Platinum P-1400</strong></td>
<td><strong>318</strong></td>
</tr>
<tr>
<td>DPGDG</td>
<td>342</td>
</tr>
<tr>
<td>DOTP</td>
<td>390</td>
</tr>
<tr>
<td>DINP</td>
<td>418</td>
</tr>
<tr>
<td>DINCH</td>
<td>424</td>
</tr>
<tr>
<td>DIDP</td>
<td>446</td>
</tr>
<tr>
<td><strong>Platinum P-1700</strong></td>
<td><strong>460</strong></td>
</tr>
<tr>
<td>TOTM</td>
<td>546</td>
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</table>
Why use Santicizer® Platinum P-1400 or Santicizer® Platinum P-1700?

Both products are fast fusers.

Santicizer Platinum P-1400 - ease of manufacturing.
• Viscosity stability.

Santicizer Platinum P-1700 – performance
• Retention of properties
• Longer term permanence attributes
  – Better Compatibility
  – Reduced Exudation
  – Better Extraction Resistance
  – Lower Volatility

Not only is it a fast fuser to aid in processing, but Santicizer Platinum P-1700 has many performance attributes, specifically when looking at permanence.
Why is Santicizer Platinum P-1700 Unique in the Market today?

To show these unique attributes we looked at 4 different applications:
- Wear Layer flooring
- Wire and Cable
- Automotive Synthetic Leather
- Automotive Foam

Test scenarios include:
A general purpose plasticizer relevant to the application

Santicizer Platinum P-1700
Santicizer Platinum P-1400
DPGDB
Alkyl Sulfonic Ester
Wear Layer Flooring
Formulation used:

<table>
<thead>
<tr>
<th>Formulation</th>
<th>phr</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC resin (K value 81)</td>
<td>80</td>
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<tr>
<td>PVC Resin (K value 65)</td>
<td>20</td>
</tr>
<tr>
<td>DOTP</td>
<td>28</td>
</tr>
<tr>
<td>Fast Fusers</td>
<td>13</td>
</tr>
<tr>
<td>Plas-Chek 775 (ESO)</td>
<td>3</td>
</tr>
<tr>
<td>Therm-Chek VT137L (Ca/Zn)</td>
<td>2</td>
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</table>
Wear Layer Flooring – Processing Volatilities

All Fast Fusers look acceptable for processing volatilities. Anything less than 0.3% is acceptable.
The Santicizer Platinum P-1700 has the lowest Carbon Volatility after 1 and 6 days.
The Santicizer Platinum P-1700 shows the lowest SVOC compared to the other fast fusers tested.
Santicizer Platinum P-1700 performs equally to the other fast fusers tested for stain resistance.
Formulation used:

<table>
<thead>
<tr>
<th>Formulation</th>
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</thead>
<tbody>
<tr>
<td>PVC resin (K value 71)</td>
<td>100</td>
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<tr>
<td>TOTM</td>
<td>35</td>
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<tr>
<td>Fast Fusers</td>
<td>15</td>
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<tr>
<td>Filler CaCO3</td>
<td>20</td>
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<tr>
<td>Therm-Chek RC-962P</td>
<td>12</td>
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</table>
The Santicizer Platinum P-1700 has the lowest percent water absorbed.
Wire and Cable – Congo Red Degradation Time

Congo Red at 200°C
method DIN 57472
(minutes)

Santicizer Platinum P-1700 is equal to the TOTM control for degradation time.
The Santicizer Platinum P-1700 has the lowest percent loss for Kerosene Extraction.
Santicizer Platinum P-1700 shows no concerns with ASTM Oil 2, where as the TOTM showed a percent loss, and the Alkyl sulfonic ester actually showed a weight gain.
Automotive Synthetic Leather
Formulation used:

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<thead>
<tr>
<th>Formulation</th>
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<tbody>
<tr>
<td>PVC resin (K value 74)</td>
<td>70</td>
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<tr>
<td>PVC resin (K value 80)</td>
<td>30</td>
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<tr>
<td>TOTM</td>
<td>50</td>
</tr>
<tr>
<td>Fast Fusing plasticizer</td>
<td>30</td>
</tr>
<tr>
<td>Plas-Chek 775 (ESO)</td>
<td>2</td>
</tr>
<tr>
<td>TiO2</td>
<td>10</td>
</tr>
<tr>
<td>Therm-Chek VT184L (Ca/Zn)</td>
<td>3</td>
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<tr>
<td>Therm-Chek 199</td>
<td>0.4</td>
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The Santicizer Platinum P-1700 is comparable in viscosity stability to the other fast fusing plasticizers tested.
When compared to the 100% TOTM, all plasticizers show faster fusion time and temperature.
Santicizer Platinum P-1700 when blended with the TOTM performs well for fogging at both 1 and 16 hrs. and with in the 60-90% range as specified.
Fast Fusers show no differences in elongation before and after heat age.
Automotive Foam
Formulation used:

<table>
<thead>
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<tbody>
<tr>
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<td>100</td>
</tr>
<tr>
<td>TOTM</td>
<td>50</td>
</tr>
<tr>
<td>Fast Fusers</td>
<td>30</td>
</tr>
<tr>
<td>Plas-Chek 775 (ESO)</td>
<td>1</td>
</tr>
<tr>
<td>TiO2</td>
<td>3</td>
</tr>
<tr>
<td>ADCA</td>
<td>2</td>
</tr>
<tr>
<td>Therm-Chek 710 (Zn kicker)</td>
<td>1</td>
</tr>
</tbody>
</table>
Santicizer Platinum P-1700 has a similar expansion percentage to the other fast fusers tested.
Automotive Foam - Density

<table>
<thead>
<tr>
<th></th>
<th>TOTM</th>
<th>TOTM/P-1700</th>
<th>TOTM/P-1400</th>
<th>TOTM/DPGDB</th>
<th>TOTM/Alkyl Sulfonic Ester</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 Seconds</td>
<td>0.830</td>
<td>0.889</td>
<td>0.858</td>
<td>0.847</td>
<td>0.880</td>
</tr>
<tr>
<td>60 Seconds</td>
<td>0.624</td>
<td>0.623</td>
<td>0.583</td>
<td>0.611</td>
<td>0.595</td>
</tr>
<tr>
<td>80 Seconds</td>
<td>0.452</td>
<td>0.442</td>
<td>0.411</td>
<td>0.416</td>
<td>0.445</td>
</tr>
<tr>
<td>120 Seconds</td>
<td>0.343</td>
<td>0.293</td>
<td>0.271</td>
<td>0.319</td>
<td>0.306</td>
</tr>
</tbody>
</table>
Automotive Foam – Density – 500 µm

100% TOTM

60% TOTM

40% Santicizer Platinum P-1700

60% TOTM

40% Santicizer Platinum P-1400

60% TOTM

40% DPGDB

60% TOTM

40% Alkyl Sulfonic Ester
Conclusions

Santicizer Platinum P-1700 is a new and unique, fast fusing, cyclohexanoate plasticizer.

Santicizer Platinum P-1700 uniqueness comes from its ability to fuse fast but also to have properties with exceptional permanence, extraction resistance, and volatility.

Whether it is:

- **low volatility** for flooring applications
- exceptional *wire and cable extraction* applications
- synthetic leather formulation with *exceptional fogging*,
- automotive foam with *excellent structure and density*,

Santicizer Platinum P-1700 shows it versatility.