Superior high-solvating plasticizer drives efficiency, productivity and performance.

**reFlex™ 100 Solutions**

Many companies who have historically used fast gelling, high solvating plasticizers have been compelled by regulation or safety concerns to switch to alternative plasticizers, most of which are not as efficient and process more slowly. PolyOne’s reFlex 100 bioplasticizer provides customers with a powerful formulation tool providing an excellent balance of properties and improved productivity. reFlex 100 is an exceptional, high solvating, non-phthalate, bio-derived alternative to conventional high solvating plasticizers for use with both phthalate and non-phthalate plasticizer systems as described below.
Benefits:

Bio-Derived—Allows the incorporation of rapidly renewable content

Certified to Contain 94% Biobased Content—Customers may be able to certify their products under the USDA BioPreferred® standard and potentially qualify for Federal Procurement Preference

Improved Air Release—Increased productivity and quality through reduced evacuation time and defect rates

Greater Efficiency—Reduced usage levels

Fast Gelation and Fusion—Faster processing and reduced energy usage from lower gelation and fusion temperatures

Lower Paste Viscosity—Easier material handling

Imparts Excellent Thermal Stability—Reduced levels of heat stabilizer and/or more robust performance

Test Formulations:

Key Characteristics and Benefits of reFlex™ 100:

- Imparts excellent thermal stability eliminating the need for epoxidized soybean oil (ESO) in the formulation
- Maintains excellent air release at all levels
- Offers greater efficiency—less plasticizer is required to achieve equal hardness

<table>
<thead>
<tr>
<th>Material</th>
<th>100% DIPN</th>
<th>25% reFlex 100</th>
<th>25% BBP</th>
<th>25% DPGDB</th>
<th>25% IDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geon 121AR Resin</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>DINP</td>
<td>67</td>
<td>52.5</td>
<td>50.2</td>
<td>50.2</td>
<td>50.2</td>
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<tr>
<td>reFlex 100</td>
<td>0</td>
<td>17.5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Butyl Benzyl Phthalate (BBP)</td>
<td>0</td>
<td>0</td>
<td>16.75</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dipropylene Glycol Dibenzoate (DPGDB)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16.75</td>
<td>0</td>
</tr>
<tr>
<td>Isodecyl Benzoate (IDB)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16.75</td>
</tr>
<tr>
<td>Epoxidized Soybean Oil (ESO)</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Ba/Zn Heat Stabilizer</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Air Release</td>
<td>Excellent</td>
<td>Excellent</td>
<td>Poor</td>
<td>Poor</td>
<td>Excellent</td>
</tr>
<tr>
<td>Shore A Hardness</td>
<td>80</td>
<td>75</td>
<td>77</td>
<td>77</td>
<td>77</td>
</tr>
</tbody>
</table>

Typical Properties:

Volatility and Heat Loss

reFlex 100 exhibits acceptable volatility and heat loss for many applications when blended as an accelerator.

<table>
<thead>
<tr>
<th></th>
<th>100% DIPN</th>
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<th>25% BBP</th>
<th>25% DPGDB</th>
<th>25% IDB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volatility (%loss) Neat Accelerator</td>
<td>na</td>
<td>11.9%</td>
<td>4.8%</td>
<td>6.7%</td>
<td>44.8%</td>
</tr>
<tr>
<td>Volatility (%loss) Plasticizer Blend</td>
<td>1.6%</td>
<td>3.5%</td>
<td>2.1%</td>
<td>2.8%</td>
<td>13.2%</td>
</tr>
<tr>
<td>Heat Loss @180°F (%) , 7Day</td>
<td>0.6%</td>
<td>2.9%</td>
<td>2.0%</td>
<td>1.7%</td>
<td>9.5%</td>
</tr>
<tr>
<td>Heat Loss @180°F (%) , 14Day</td>
<td>0.9%</td>
<td>4.0%</td>
<td>3.1%</td>
<td>2.4%</td>
<td>9.8%</td>
</tr>
</tbody>
</table>

Mechanical Properties

reFlex 100 promotes rapid development of mechanical properties, but ultimate tensile strength is slightly reduced due to reFlex 100’s superior efficiency, resulting in the lowest durometer. Adjusting for hardness will restore mechanical properties.
**Viscosity**

reFlex™ 100 provides exceptional paste viscosity reduction and stability without the introduction of excess volatility.

**Gel Temperatures**

reFlex 100’s superior solvating power provides the greatest reduction in gel temperature.

**Thermal Stability**

reFlex 100 significantly improves heat stability compared to other high solvating plasticizers.
reFlex™ 100 Renewable Content

reFlex 100 is primarily derived from rapidly renewable feedstocks and has been certified to the USDA BioPreferred® content standard to be 94% biobased. This may allow customers to have their products certified to this standard at loadings as low as 20-25 phr, potentially qualifying them for the Federal Procurement Preference program.

Who will benefit from this technology?
Customers who:
- are seeking a high solvating plasticizer to assist in formulation optimization
- have sacrificed productivity as a result of plasticizer selection/substitution
- value high levels of rapidly renewable content
- require a totally non-phthalate plasticizer system
- desire to have their products certified USDA BioPreferred

Typical Applications
- Resilient flooring
- Carpet backing
- Vinyl foams
- Plastisol inks
- General purpose plastisols
- Vinyl plastisols

Product choices often vary by region due to differences in regulatory and agency requirements, availability and other key factors. Please contact your nearest sales office for assistance in choosing the right solution for your locale.

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CONTACT INFORMATION
Americas
U.S. – Avon Lake, Ohio
1 866 POLYONE (765-9663)

PolyOne Americas
33587 Walker Road
Avon Lake, Ohio 44012
United States
+1 440 930 1000

PolyOne Asia
Guoshoujing Road No. 88
Z.J Hi-Tech Park, Pudong
Shanghai, 201203, China
+86 (0) 21 5080 1188

PolyOne Europe
6, Giäléwее
L-9749 Fischbach
Luxembourg
+32 (0) 83 660 211

www.polyone.com

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