**HYPERDISPERSANTS AND COUPLING AGENTS FOR THERMOPLASTICS AND THERMOSETS**

Solplus™ and Solsperse™ hyperdispersants and coupling agents have been developed to meet the needs of the plastic industry, for both thermoplastic and thermoset polymers, as well as polyurethanes.

**THERMOPLASTIC MASTERBATCH AND COMPOUNDING**

Solplus™ DP310 hyperdispersant is recommended for the dispersion of organic and inorganic pigments and fillers in thermoplastic masterbatch and compound applications. It can be used in a variety of thermoplastic polymers including polyethylene, polypropylene, polystyrene, ABS and PVC.

**MORE EFFICIENT DISPERSION**

- Increased productivity
- Higher pigment/filler loadings
- Increased color strength
- Less filter blockage/fiber breakage
- Upgraded performance of lower cost systems

**COST SAVINGS**

- Decreased filter blockage
- Reduced viscosities
- Improved color strength development
- Better dispersion of color in finished polymer
- Cost reductions
- Increased productivity
- Fewer passes on the mill

**IMPROVED QUALITY**

- Stronger, brighter colors
- Less specks
- Improved mechanical properties
- Improved stability
- Improved flame retardancy
- Meets new environmental standards

**PLASTICIZER AND POLYOL DISPERSIONS**

- In both phthalate and non-phthalate plasticizer systems and in polyether and polyester polyols for conversion to polyurethanes, Solplus hyperdispersants improve dispersion of:
  - Organic and inorganic pigments
  - Fillers
  - Flame retardants
  - Stabilizers
  - Blowing agents

As a result, manufacturers achieve:
- Higher solids loadings/increased pigment concentration
- Reduced viscosities (more Newtonian rheology)
- Improved color strength development
- Better dispersion of color in finished polymer
- Cost reductions (increased productivity and fewer passes on the mill)

**THERMOSET/COMPOSITE APPLICATIONS**

- Engineered specifically for composite fillers and resins—and based on proprietary polymer chemistry—Solplus™ additives offer major process advantages to the thermoset industry, including the combination of dispersing/wetting and anti-settling benefits in a single additive.
- From being 100% active and solvent free, Solplus™ hyperdispersants also help to reduce environmental impact from the styrene content levels that characterize most unsaturated polyester based systems.
- Solplus™ dispersants have been developed to improve dispersion of fillers, flame retardants and reinforcements (fibers) in thermoset systems, as well as for organic and inorganic pigments in gel coats.

**BENEFITS**

- Higher filler/flame retardant loadings
- Decreased viscosities
- Anti-settling
- Improved stability
- Improved color to white compatibility
- Improved processing

**HYPERDISPERSANTS AND COUPLING AGENTS**

Solplus™ and Solsperse™ hyperdispersants and coupling agents have been developed to meet the needs of the plastic industry, for both thermoplastic and thermoset polymers, as well as polyurethanes.

- Increased productivity
- Higher pigment/filler loadings
- Increased color strength
- Less filter blockage/fiber breakage
- Upgraded performance of lower cost systems

**COST SAVINGS**

- Decreased filter blockage
- Reduced viscosities
- Improved color strength development
- Better dispersion of color in finished polymer
- Cost reductions
- Increased productivity
- Fewer passes on the mill

**IMPROVED QUALITY**

- Stronger, brighter colors
- Less specks
- Improved mechanical properties
- Improved stability
- Improved flame retardancy
- Meets new environmental standards

**BENEFITS**

- Higher solids loadings/increased pigment concentration
- Reduced viscosities (more Newtonian rheology)
- Improved color strength development
- Better dispersion of color in finished polymer
- Cost reductions (increased productivity and fewer passes on the mill)
INFLUENCE OF MEDIA COMPATIBILITY ON PRODUCT SELECTION

For a Solsperse™ or Solplus™ hyperdispersant to be effective in specific applications, it must be compatible with the media in which the solid is being dispersed AND have an affinity with the surface of the material itself. These are the main criteria used in product selection. The main grades offered for a range of plastics applications are mapped out below:

With certain organic pigment dispersions it may be advantageous to include the use of a Solsperse™ synergist in combination with the polymeric Solplus™ or Solsperse™ hyperdispersant.

FORMULATING GUIDELINES

MASTERBATCH/COMPOUND

To determine the optimum dosage for masterbatch or compound applications, a “ladder series” should be carried out.

PLASTICIZERS AND GEL COATS

For many plasticizer and polyester gel coat applications, it has been established that the theoretical dosage level of the appropriate Solplus™ or Solsperse™ hyperdispersant in a pigment dispersion equates to 2 mg of Solplus™ or Solsperse™ polymeric hyperdispersant/square meter of pigment surface area.

This can be expressed as % Agent On The Weight of Pigment (% AOWP).

\[
% \text{AOWP} = \frac{\text{pigment surface area (m}^2/\text{g})}{5}
\]

THERMOSET COMPOSITES

For thermoset composite applications, testing has confirmed a loading of between 0.5% and 2% of the appropriate Solplus™ hyperdispersant on the weight of filler is effective.

Minor adjustments may, however, be required depending on the specific grade of filler used.

FILLER COUPLING IN THERMOPLASTIC COMPOUNDS

The recommended dosage level of Solplus™ C800 to use is calculated as follows:

\[
1.2 \times \text{surface area of filler (m}^2/\text{g}) = \text{weight in grams (g) of Solplus C800 required per kg of filler}
\]

Please refer to Lubrizol technical contacts for more details.

METHOD OF USE/OVERD ORDER OF ADDITION – PLASTIC APPLICATIONS

MASTERBATCH/COMPOUND

1. Charge polymer to pre-blending equipment.
2. Add Solplus™ or Solsperse™ agent and blend thoroughly with the polymer to coat the surface of the polymer.
3. Add pigments, fillers, processing aids and other essential ingredients and continue pre-blending.
4. Process the resultant blend in normal manner (extrusion, internal mixer, 2-roll mill, etc.).

It is essential to follow this order of addition carefully since it allows for maximum distribution of the Solplus™ or Solsperse™ additive and produces intimate contact between the hyperdispersant and the polymer. This intimate contact gives the best results.

PLASTICIZERS, GEL COATS AND THERMOSET COMPOSITES

1. Dissolve the appropriate Solsperse™ or Solplus™ hyperdispersant in the millbase plasticizer or resin.
2. If required, add a synergist and distribute evenly with stirring (note: the synergist is virtually insoluble).
3. Add the pigment or filler in stages and disperse in normal manner.
<table>
<thead>
<tr>
<th>PRODUCT NAME</th>
<th>PHYSICAL DESCRIPTION</th>
<th>PACKAGE SIZE (kg)</th>
<th>% ACTIVE CONTENT</th>
<th>SOLVENT/ CARRIER</th>
<th>SUITABLE APPLICATION(S)</th>
<th>SUITABLE APPLICATION(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solplus™ D510</td>
<td>Yellow viscous liquid</td>
<td>D/20/D/180</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites, pigmented gel coats</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D520</td>
<td>Straw colored viscous liquid</td>
<td>P/25/P/200</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D540</td>
<td>Pale amber to brown viscous liquid</td>
<td>P/20/P/200</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D541</td>
<td>Amber liquid</td>
<td>D/25, D/180</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D545</td>
<td>Pale amber to brown viscous liquid</td>
<td>P/25, P/1000</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D560</td>
<td>Pale yellow liquid</td>
<td>P/20/P/80</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D570</td>
<td>Colorless to brown viscous liquid</td>
<td>P/25, P/180</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites</td>
<td></td>
</tr>
<tr>
<td>Solplus™ D610</td>
<td>Yellow viscous liquid</td>
<td>P/20, D/180</td>
<td>100</td>
<td>–</td>
<td>Thermoset composites and gel coats, polyester polyols</td>
<td></td>
</tr>
<tr>
<td>Solplus™ DP310*</td>
<td>Off white powder</td>
<td>B/25</td>
<td>100</td>
<td>–</td>
<td>Masterbatch/compounding</td>
<td></td>
</tr>
<tr>
<td>Solplus™ DP320**</td>
<td>White powder</td>
<td>B/25</td>
<td>100</td>
<td>–</td>
<td>Masterbatch/compounding especially fibers and engineering plastics</td>
<td></td>
</tr>
<tr>
<td>Solplus™ DP330*</td>
<td>White powder</td>
<td>P/20</td>
<td>100</td>
<td>–</td>
<td>Masterbatch/compounding</td>
<td></td>
</tr>
<tr>
<td>Solplus™ DP700</td>
<td>Brown liquid</td>
<td>D/20, D/180, I/50</td>
<td>100</td>
<td>–</td>
<td>Plasticizers</td>
<td></td>
</tr>
<tr>
<td>Solplus™ ES5000</td>
<td>White to off-white liquid</td>
<td>D/20, D/60</td>
<td>50</td>
<td>–</td>
<td>Masterbatch/compounding</td>
<td></td>
</tr>
<tr>
<td>Solplus™ K200*</td>
<td>Pale yellow to brown viscous liquid</td>
<td>D/20, D/180</td>
<td>50</td>
<td>–</td>
<td>Masterbatch/compounding</td>
<td></td>
</tr>
<tr>
<td>Solplus™ K210</td>
<td>Pale yellow to brown viscous liquid</td>
<td>D/20, D/180</td>
<td>50</td>
<td>–</td>
<td>Plasticizers and liquid colors for plastics</td>
<td></td>
</tr>
<tr>
<td>Solplus™ K220</td>
<td>Amber to brown viscous liquid</td>
<td>D/10/D/80/I/940</td>
<td>100</td>
<td>–</td>
<td>Plasticizer and liquid colors for TP and PVC</td>
<td></td>
</tr>
<tr>
<td>Solplus™ K240*</td>
<td>Pale yellow to brown viscous liquid</td>
<td>D/20, D/550</td>
<td>100</td>
<td>–</td>
<td>Plasticizer and liquid colors for plastics</td>
<td></td>
</tr>
<tr>
<td>Solplus™ K441*</td>
<td>Pale yellow to brown viscous liquid</td>
<td>D/20, D/550</td>
<td>50</td>
<td>FDA compliant</td>
<td>Natural oil</td>
<td>Liquid colors for plastics</td>
</tr>
<tr>
<td>Solplus™ K541*</td>
<td>Pale yellow to brown viscous liquid</td>
<td>D/20, D/550</td>
<td>50</td>
<td>FDA compliant</td>
<td>Natural oil</td>
<td>Liquid colors for plastics</td>
</tr>
<tr>
<td>Solplus™ R700</td>
<td>Amber liquid</td>
<td>D/25/D/90/I/1000</td>
<td>100</td>
<td>–</td>
<td>Polyether or polyester polyol</td>
<td></td>
</tr>
<tr>
<td>Solplus™ R720</td>
<td>Amber liquid</td>
<td>D/25/D/190/I/1000</td>
<td>100</td>
<td>–</td>
<td>Polyether or polyester polyol</td>
<td></td>
</tr>
<tr>
<td>Solplus™ R730</td>
<td>Pale yellow to amber viscous liquid</td>
<td>D/25/D/100/I/1000</td>
<td>100</td>
<td>–</td>
<td>Polyether or polyester polyol</td>
<td></td>
</tr>
<tr>
<td>Solplus™ TX4</td>
<td>Pale yellow liquid</td>
<td>D/25, D/200</td>
<td>50</td>
<td>FDA compliant</td>
<td>Natural oil</td>
<td>Liquid colors for plastics</td>
</tr>
<tr>
<td>Solperse™ 3000*</td>
<td>Waxy paste/ viscous liquid</td>
<td>D/20, D/170</td>
<td>100</td>
<td>–</td>
<td>Plasticizers</td>
<td></td>
</tr>
<tr>
<td>Solperse™ 5000S</td>
<td>Blue powder</td>
<td>B/25</td>
<td>100</td>
<td>–</td>
<td>Synergist</td>
<td></td>
</tr>
<tr>
<td>Solperse™ 11000*</td>
<td>Amber liquid</td>
<td>D/20/D/80</td>
<td>50</td>
<td>FDA compliant</td>
<td>Natural oil</td>
<td>Plasticizers and liquid colors for plastics</td>
</tr>
<tr>
<td>Solperse™ 12000S</td>
<td>Blue powder</td>
<td>B/25</td>
<td>100</td>
<td>–</td>
<td>Synergist</td>
<td></td>
</tr>
<tr>
<td>Solperse™ 21650</td>
<td>Amber liquid</td>
<td>D/20/D/50</td>
<td>50</td>
<td>FDA compliant</td>
<td>Diundecyl- phthalate</td>
<td>Plasticizers</td>
</tr>
<tr>
<td>Solperse™ 21000*</td>
<td>Waxy paste/ viscous liquid</td>
<td>D/20, D/170</td>
<td>100</td>
<td>–</td>
<td>MBX/compound</td>
<td></td>
</tr>
<tr>
<td>Solperse™ 22000</td>
<td>Yellow powder</td>
<td>B/20</td>
<td>100</td>
<td>–</td>
<td>Synergist</td>
<td></td>
</tr>
</tbody>
</table>

KEY: Packaging: B = box, D = drum, I = IBC, P = plastic drum

*Approved for food contact. Some limitations apply. Please consult your regional Lubrizol sales office.

**Product not available in Europe.
WHAT WE ADD MAKES THE DIFFERENCE.

Lubrizol is a market-driven innovator of specialty chemicals that solve today’s challenges in the paints and coatings, printing and packaging, paper and textiles, plastics and composites and digital print markets. More than just a supplier, we are a collaborator with extensive experience in surface protection, dispersion, adhesion and barrier properties that enables us to enhance the performance, simplicity and sustainability benefits of our customers’ products. With a commitment to collaboration, applied science and demonstrated value, our team of experts is dedicated to exceeding customer expectations for both the simplest and toughest requirements. Count on Lubrizol to make the difference.

The information contained herein is believed to be reliable, but no representations, guarantees or warranties of any kind are made as to its accuracy, suitability for particular applications or the results to be obtained. The information is based on laboratory work with small-scale equipment and does not necessarily indicate end product performance. Because of variations in methods, conditions and equipment used commercially in processing these materials, no warranties or guarantees are made as to the suitability of the products for the applications disclosed. Full-scale testing and end product performance are the responsibility of the user. Lubrizol Advanced Materials, Inc. shall not be liable for and the customer assumes all risk and liability of any use or handling of any material beyond Lubrizol Advanced Materials, Inc.’s direct control. The SELLER MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Nothing contained herein is to be considered as permission, recommendation nor as an inducement to practice any patented invention without permission of the patent owner.

Trademarks owned by The Lubrizol Corporation or its affiliates.
©The Lubrizol Corporation 2019, All Rights Reserved.