Dispersing at its best

TEGOMER® Dispersants for Masterbatches and Compounds

Evonik Nutrition & Care GmbH
IM Interfaces & Performance Technical Service Polymers
Masterbatches – Requests and Demands

TEGOMER® Dispersants will bridge the gap by cost reduction and by product differentiation.
TEGOMER® – Amphiphilic Additives Mode of Action

Due to their special chemical nature they:

- are highly temperature stable.
- will compatibilize the pigment/filler to the polymer matrix.
- are compatible to polyolefins and technical polymers.
- can interact with the pigment surface and will form a stable layer on it.

TEGOMER® Dispersants allow high flexibility in application and excellent efficiency due to high temperature stability and amphiphilic character.
TEGOMER® E 525

- For PE based color concentrates and compounds
- For colorizing POM and PVC
- For carbon black, transparent iron oxides, inorganic fillers
- Outstanding clarity and reduction of specks in film applications
- Enhanced productivity and throughput in highly filled compounds
- For direct coloration of compounds

Food contact status

**GB 9685**: TEGOMER® E 525 may be used in plastics based on PE, PP, PS, AS, ABS, PET, PC and PVC.

**European Regulation 10/2011**: TEGOMER® E 525 may be used in compliance with the EU-Regulation 10/2011 up to 3.2 % w/w in polyolefin materials and articles.

**FDA Regulations**: TEGOMER® E 525 may be used in compliance with FDA Regulation 21 CFR 177.1520 (Olefin polymers).
TEGOMER® Dispersing Additives – Product Overview II

TEGOMER® P 121

- For PP and technical polymers, e.g. PA, PBT/PET
- For all kind of pigments in demanding masterbatch application, e.g. blow films (PP, PA and PET) or molded appliances (PA, PBT, ABS)
- For carbon black and color pigments which are difficult to disperse used in masterbatches for dyeing of spin fibers
- For direct coloration of compounds
- Excellent thermal and color stability

Food contact status

**GB 9685:** Less than 50 % of TEGOMER® P 121 may be used in in compliance with the GB 9685-2008 when used in adhesives. All other components may be used in plastics based on PE, PP, PS, AS, ABS and PC up to a level of 2.5 % and in PET up to a level of 0.5 % in compliance with the Chinese guideline GB 9685-2008.

**European Regulation 10/2011:** TEGOMER® P 121 in compliance with the EU-Regulation 10/2011 up to 4.5 % in the finished article.

**FDA Regulations:** TEGOMER® P 121 may be used as a dispersant for colorants at a maximum level of 0.166 % in polyolefin, in contact with all types of food, except foods containing greater than 13 % alcohol under conditions of use B ("Boiling water sterilized") through H ("Frozen or refrigerated storage: Ready-prepared foods intended to be reheated in container at time of use").
TEGOMER® Dispersing Additives – Product Overview III

➢ **TEGOMER® P 122**

- Comparable application profile to TEGOMER® P 121:
- For PP and technical polymers, e.g. PA, PBT/PET
- For all kind of pigments in demanding masterbatch application, e.g. blow films (PP, PA and PET) or molded appliances (PA, PBT, ABS)
- For carbon black and color pigments which are difficult to disperse used in masterbatches for dyeing of spin fibers
- For direct coloration of compounds
- Excellent thermal and color stability
- It is delivered as a free flowing micro granulate for easy handling and quick dust free feeding

**Food contact status**

**GB 9685:** TEGOMER® P 122 may be used in plastics based on PE, PP, PS, AS, ABS and PC up to a level of 5% and in PET up to a level of 0.5%.

**European Regulation 10/2011:** TEGOMER® P 122 may be used without a specific migration limit (SML-value) in the Regulation 10/2011/EU

**FDA Regulations:** TEGOMER® P 122 may be used as a dispersant for colorants at a maximum level of 2% in polyolefins. In all other types of plastics TEGOMER P 122 may be used as a dispersing additive up to 400 mg/sqm food contact area (e.g. 0.4% in a film with 100 g/sqm).
TEGOMER® E 525 – Effect on Inorganic Pigment

Formulation
Additive: 0 - 5 %
Iron Oxide Red P.R. 101: 20 %
PE-LD (MFI 15): 75 - 80 %

Concentrate was heightened with TiO₂ to determine the color strength Pigment:TiO₂-ratio 1:10

TEGOMER® E 525 – highly efficient even at low dosages
TEGOMER® P 121 & P 122 - Designed for use in Masterbatches and Films

**Masterbatches**

TEGOMER® P 121/ P 122
- Higher pigment loadings
- Improved color strength
- Positive influence on rheology
- Excellent thermal and color stability even in technical polymers

**PP Films**

TEGOMER® P 121/ P 122
- Speck free and high transparent films are obtained
- No reflockulation in down streaming
- Avoid film fracture

Outstanding performance in masterbatching and direct coloration of technical polymers and PP
TEGOMER® P 121 & P 122 - Designed for Colorizing Technical Polymers

Mass dyeing of Polyester fibers

TEGOMER® P 121/ P 122
- Improved color strength
- Reduced fiber fracture
- Low pressure index values

Colorizing of PET

TEGOMER® P 121/ P 122
- Excellent clarity with no haze
- High color yield

First choice for PP and all kinds of technical polymers in high demanding applications where a superior pigment dispersion is essential
Formulation of the Masterbatch
Additive: 0 - 10 %
Pigment: 30 %
Polyamide 6: 60 - 70 %

By using TEGOMER® P 121 a tremendous reduction of the pressure index value (< 2 bar/g for fiber grades) and a significant increased color strength is obtained.
TEGOMER® P 121 - in Comparison to Waxes with Pigment Yellow 155

Formulation
Additive: 15 %
Pigment Yellow 155: 30 %
PP (MFI = 50 g/10 min.): 55 %

TEGOMER® P 121 enables to reduce the pressure index value below 2 bar/g which is essential for spun fine fiber qualities.

Concentrate was heightened with TiO₂ to determine the color strength Pigment:TiO₂–ratio 1:10.
Cost Saving by Pigment Reduction - PG 7 in PP with TEGOMER® E 525

Pigment reduction by 33%, dispersant reduction by 33%, increase of base polymer by 15%
TEGOMER® Dispersants – Test Methods

➢ Color Strength measurement
➢ Gloss
➢ Transparence
➢ Microscopy examination
➢ Filter pressure value
➢ Speck evaluation
  • On blow films and molded plates
  • Press out method
➢ Mechanical properties
  • Impact strength
  • Elongation/ tensile strength…etc.
TEGOMER® Dispersants –
General dosage recommendations

<table>
<thead>
<tr>
<th>Product</th>
<th>Suitable Polymers</th>
<th>Dosage in [%] AOP*</th>
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<tr>
<td></td>
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<td>Organic Pigments</td>
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<td>Inorganic Pigment</td>
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<td>Carbon Black</td>
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<td>Fillers</td>
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<tr>
<td>TEGOMER® E 525</td>
<td>PE, EVA, POM and PVC</td>
<td>30-50</td>
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<td>TEGOMER® P 121</td>
<td>PP, PA, PET/PBT, ABS/PS and other technical polymers</td>
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* % AoP: Additive calculated on Pigment in parts by weight
# TEGOMER® Dispersants – Polymer Recommendation

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<tr>
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<th>PE/EVA</th>
<th>PP</th>
<th>POM</th>
<th>PA</th>
<th>PET/PBT</th>
<th>ABS/PS</th>
<th>PVC</th>
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<tbody>
<tr>
<td>TEGOMER® E 525</td>
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- ■: highly recommended
- ○: suitable