For more information about VISCOWAX® from Innospec Leuna, please contact:

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The facts stated and the recommendations made are based on our own research and/or the research of others, and are believed to be accurate. No guarantee of their accuracy is made, however, and unless otherwise expressly provided by law or in written contract, the materials are sold without warranties, expressed or implied, in particular without guarantee as to suitability for particular purpose. Innospec assumes no responsibility for injury or damage to users or third parties. Recipient agrees to assume all risk and liability whether used singly or in combination with other materials.

VISCOWAX® applications

- Plastics processing
- Coatings
- Compounds
- Emulsions
- Bitumen
- Polishes
- Release agents
- Lubricants for plastics and PVC processing
- Masterbatches
- Rubber
- Printing inks
- Paints, lacquers and varnishes
- Paper coating
- Corrosion protection
- Candles
- Hotmelts
- Thermoplastic road marking
- Insulating and cable compounds
- Engineering plastic compounds
- Textile and leather processing
- Fruit coating
- Roofing
- Road construction
- Floor polish
- Shoe polish
- Car polish
- Plastics industry
- Aluminium die cast

Important functions of PE-waxes

- LUBRICATING EFFECTS
- Because of their low viscosity at temperatures slightly above the melting point the polyethylene waxes have a lubricating effect in plastics processing.

- WETTING AND DISPERSING EFFECT
- Based on its low viscosity as a melt VISCOWAX® is able to wet the pigments or additives easily. Dispersing work is therefore reduced which results in higher dispersion quality.

- SURFACE MODIFYING EFFECTS
- Hydrophobing
- Sealing
- Smoothness
- Gloss
- Matting
- Slip, anti-blocking
- Scratch-, abrasion-, mar-resistance

- VISCOSITY ADJUSTMENT
- Increasing viscosity for paraffin blends, decreasing viscosity in plastics based compounds.

- RETENTION EFFECT / RHEOLOGY EFFECT
- Polyethylene waxes are able to incorporate lower molecular organic substances, like oils or solvents, in their polymeric structure forming pastes.

- RELEASE / PARTING EFFECTS
- Except for the EVA-waxes, all VISCOWAX® grades can form inert, non-sticky films on several surfaces. In sticky materials PE-waxes can reduce the stickiness and be helpfully in de-moulding.

Important functions of EVA-waxes

- ADHESIVENESS EFFECT
- EVA-waxes are in opposite to PE-waxes rather sticky and can improve the stickiness of adhesive materials.

- COMPATIBILIZER EFFECT
- EVA-waxes consist of polar and non-polar segments. Therefore they have better compatibility with more polar plastics or additives and may be used as compatibilizer in formulations with ingredients of different polarity.

- WETTING AND DISPERSING EFFECT
- EVA-waxes show a very good wetting and dispersion performance for heavy to disperse polar pigments / additives.

- FLEXIBILITY
- Whereas PE-waxes are relatively brittle the EVA-waxes are more flexible.
VISCOWAX® PRODUCTS

Innospec Leuna is one of the leading polyethylene wax producer globally. With production plants located at the vast Leuna chemical site in Germany. The extensive Innospec Leuna wax portfolio is well known under the brand VISCOWAX®.

The following wax categories are produced:
- Polyethylene waxes (PE-waxes)
- Ethylene vinyl acetate copolymer waxes (EVA-waxes)
- Oxidized PE-waxes
- Oxidized EVA-waxes
- Polar modified PE-Waxes

**PE-waxes**

Innospec Leuna is able to produce a wide range of molecular weights, as indicated by the different values of melt viscosity. Furthermore the polymer structure can be adjusted to obtain either hard waxes with higher melting points and higher densities or softer waxes with lower melting points and lower densities. The structure determines also the degree of crystallinity.

<table>
<thead>
<tr>
<th>Product</th>
<th>Viscosity @ 140°C [mm²/s]</th>
<th>Drop point [°C]</th>
<th>Penetration [0.1 mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISCOWAX® 111</td>
<td>65</td>
<td>111</td>
<td>≤ 2</td>
</tr>
<tr>
<td>VISCOWAX® 112</td>
<td>150</td>
<td>112</td>
<td>≤ 1</td>
</tr>
<tr>
<td>VISCOWAX® 122</td>
<td>150</td>
<td>109</td>
<td>≤ 5</td>
</tr>
<tr>
<td>VISCOWAX® 113</td>
<td>250</td>
<td>113</td>
<td>≤ 1</td>
</tr>
<tr>
<td>VISCOWAX® 123</td>
<td>250</td>
<td>109</td>
<td>≤ 4</td>
</tr>
<tr>
<td>VISCOWAX® 114</td>
<td>350</td>
<td>115</td>
<td>≤ 1</td>
</tr>
<tr>
<td>VISCOWAX® 124</td>
<td>350</td>
<td>112</td>
<td>≤ 2</td>
</tr>
<tr>
<td>VISCOWAX® 135</td>
<td>450</td>
<td>107</td>
<td>≤ 4</td>
</tr>
<tr>
<td>VISCOWAX® 115</td>
<td>450</td>
<td>115</td>
<td>≤ 1</td>
</tr>
<tr>
<td>VISCOWAX® 116</td>
<td>700</td>
<td>117</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>VISCOWAX® 126</td>
<td>700</td>
<td>110</td>
<td>≤ 2</td>
</tr>
<tr>
<td>VISCOWAX® 127</td>
<td>800</td>
<td>110</td>
<td>≤ 4</td>
</tr>
</tbody>
</table>
**Oxidized PE-waxes**

By catalyst-free oxidation of PE-waxes a number of polar, oxidized PE-waxes are accessible. Three different acid value ranges are covered. Others can be custom-made.

<table>
<thead>
<tr>
<th>Product</th>
<th>Viscosity @ 140°C [mm²/s]</th>
<th>Drop point [°C]</th>
<th>Penetration [0.1 mm]</th>
<th>Acid value [mg KOH/g]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISCOWAX® 253</td>
<td>200</td>
<td>109</td>
<td>≤ 2</td>
<td>16</td>
</tr>
<tr>
<td>VISCOWAX® 252</td>
<td>200</td>
<td>106</td>
<td>≤ 3</td>
<td>16</td>
</tr>
<tr>
<td>VISCOWAX® 272</td>
<td>170</td>
<td>108</td>
<td>≤ 3</td>
<td>22</td>
</tr>
<tr>
<td>VISCOWAX® 271</td>
<td>170</td>
<td>104</td>
<td>≤ 4</td>
<td>22</td>
</tr>
<tr>
<td>VISCOWAX® 262</td>
<td>150</td>
<td>107</td>
<td>≤ 4</td>
<td>27</td>
</tr>
<tr>
<td>VISCOWAX® 261</td>
<td>150</td>
<td>104</td>
<td>≤ 5</td>
<td>27</td>
</tr>
<tr>
<td>VISCOWAX® 2628</td>
<td>50</td>
<td>105</td>
<td>≤ 6</td>
<td>27</td>
</tr>
</tbody>
</table>

**EVA-waxes**

Depending on their vinylactate content and other characteristics, EVA waxes offer a number of interesting properties.

<table>
<thead>
<tr>
<th>Product</th>
<th>Viscosity @ 140°C [mm²/s]</th>
<th>Drop point [°C]</th>
<th>Penetration [0.1 mm]</th>
<th>Vac-content [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISCOWAX® 331</td>
<td>65</td>
<td>99</td>
<td>≤ 12</td>
<td>11</td>
</tr>
<tr>
<td>VISCOWAX® 334</td>
<td>400</td>
<td>99</td>
<td>≤ 7</td>
<td>11</td>
</tr>
<tr>
<td>VISCOWAX® 343</td>
<td>400</td>
<td>95</td>
<td>≤ 12</td>
<td>14</td>
</tr>
<tr>
<td>VISCOWAX® 353</td>
<td>600</td>
<td>93</td>
<td>≤ 12</td>
<td>17</td>
</tr>
</tbody>
</table>

**Oxidized EVA-wax**

Oxidized EVA-wax is a rare specialty and is based on VISCOWAX® 334. In the same way as with the oxidized PE-waxes, functional groups are added to the molecules. As a result of this modification the wax is able to be used in water borne emulsions maintaining the specific properties of an EVA, like flexibility and adhesion.

<table>
<thead>
<tr>
<th>Product</th>
<th>Viscosity @ 140°C [mm²/s]</th>
<th>Drop point [°C]</th>
<th>Penetration [0.1 mm]</th>
<th>Acid value [mg KOH/g]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISCOWAX® 453</td>
<td>200</td>
<td>95</td>
<td>≤ 10</td>
<td>16</td>
</tr>
</tbody>
</table>

**Maleic anhydride modified PE-waxes**

Taking advantage of a sophisticated grafting process VISCOWAX® 116 is modified with maleic anhydride. Using this process a polar wax with a very high thermostability is achievable. The final products are well-suited for hotmelts and processing of polar plastics.

<table>
<thead>
<tr>
<th>Product</th>
<th>Viscosity @ 140°C [mm²/s]</th>
<th>Drop point [°C]</th>
<th>Penetration [0.1 mm]</th>
<th>MA-content [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>VISCOWAX® 516 MA</td>
<td>800</td>
<td>117</td>
<td>&lt; 1</td>
<td>0.5</td>
</tr>
</tbody>
</table>
**PROPERTIES AND FUNCTIONS**

Waxes from the broad VISCOWAX® portfolio are commonly used as additives in a wide range of applications to produce very different effects, mainly to improve processability and product properties. The requirements for the properties of the waxes are different depending on which function they perform in the final product.

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**Valuable properties of polyethylene waxes:**

- Melting temperatures
- Structure, crystallinity, melting heat
- Crystallization temperature and heat
- Melt viscosity
- Polarity, reactivity
- Chemical inertness
- Hardness
- Gloss
- Dispersability
- Emulsifiability
- Adhesion
- Hydrophobic properties
- Thermostability
- Film forming

---

**Methods of characterization:**

<table>
<thead>
<tr>
<th>Properties</th>
<th>Analysis</th>
<th>Unit</th>
<th>Method</th>
<th>Analogous methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal properties</td>
<td>Congealing point/Set point</td>
<td>°C</td>
<td>DGF M III 4a,</td>
<td>DIN 51 556, ISO 2207, ASTM D 938-60</td>
</tr>
<tr>
<td></td>
<td>Drop melting point</td>
<td>°C</td>
<td>DGF M III 3 (Mettler)</td>
<td>DIN 51 801</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>DSC</td>
<td>DIN 53 765</td>
</tr>
<tr>
<td>Rheology</td>
<td>Kinematic viscosity</td>
<td>mm²/s</td>
<td>DGF M III 8</td>
<td>DIN 51 562</td>
</tr>
<tr>
<td></td>
<td>(Ubbelohde)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dynamic viscosity</td>
<td>mPas</td>
<td>DGF M III 8</td>
<td>ISO 2884</td>
</tr>
<tr>
<td></td>
<td>Needle penetration</td>
<td>0.1 mm</td>
<td>DGF M III 9b</td>
<td>DIN 51 579</td>
</tr>
<tr>
<td>Colour</td>
<td>Yellowness index</td>
<td>-</td>
<td>Dr. Lange</td>
<td>ASTM E313</td>
</tr>
<tr>
<td>Density</td>
<td></td>
<td>g/cm³</td>
<td>ISO 1183, C</td>
<td></td>
</tr>
<tr>
<td>Acid value</td>
<td>Titrimetric</td>
<td>mg KOH/g</td>
<td>DGF M IV 2</td>
<td>ISO 3682</td>
</tr>
<tr>
<td>Saponification value</td>
<td>Titrimetric</td>
<td>mg KOH/g</td>
<td>DGF M IV 2</td>
<td>ISO 3681</td>
</tr>
<tr>
<td>Vinyl acetate content</td>
<td>Titrimetric, FTIR</td>
<td>%</td>
<td>Internal method</td>
<td></td>
</tr>
</tbody>
</table>
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Status under food legislation

Most of the VISCOWAX® grades have been licensed for the manufacture of materials and articles intended to come into contact with food according to the respective FDA-rules and EU-regulations. Please find further details in the individual product data sheets.

Form of delivery, packaging and storage

VISCOWAX® is shipped palletised as dust-free powder or granules in PE and Paper sacks of 25kg each. Shipment in big bags of different sizes is possible upon request. The product shall be stored in its original packaging at room temperature in a dry place. It must not be stored together with amines. Avoid direct sun radiation and water contact.

Safety

VISCOWAX® has not been classified as hazardous materials in accordance with the Regulation (EC) No. 1272/2008 (CLP/GHS) and therefore it does not require marking. It is insoluble in water and has no harmful effect on fish and bacteria. Disposal of the product is to be carried out in accordance with the local regulations. Please refer to the Safety Material Data Sheet for further safety-relevant information.

Important functions of PE-waxes

**LUBRICATING EFFECTS**

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- Hydrophobing
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