A global specialty chemicals player with leading positions in demanding specialty markets.
Products

Additives are preparations, which are added in quantities of 0,1 to 1 % to ease the production process of paints and plastics or to improve the quality of the end products.
## Product Range Additives

<table>
<thead>
<tr>
<th>Additives to improve surface slip, leveling and substrate wetting</th>
<th>UV absorbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adhesion promoters</td>
<td>Viscosity depressants</td>
</tr>
<tr>
<td>Defoamers and air release agents</td>
<td>Wax additives</td>
</tr>
<tr>
<td>Processing additives</td>
<td>Wetting and dispersing additives for pigments and extenders</td>
</tr>
<tr>
<td>Rheological additives</td>
<td></td>
</tr>
</tbody>
</table>
End Uses

Coatings Industry

Architectural Coatings  Automotive Coatings  Can Coatings  Coil Coatings  Industrial Coatings

Leather Finishes  Powder Coatings  Protective & Marine Coatings  Wood & Furniture Coatings
End Uses

Plastics Industry

Ambient Curing Systems  PVC Pastisols  SMC/BMC  Thermoplastics

Pigment Concentrates
End Uses

Printing Ink Industry

- Flexo Inks
- Gravure Inks
- Silk Screen Inks
- Offset Inks
- Overprint Varnishes

Paper Coatings

- Impregnation
- Coatings
Additives for environmentally-friendly formulations

• Additives on basis of renewable raw materials
• Phthalate-free additives for PVC-Plastisols
• Life cycle assessment
• VOC-free additives
• Resource-saving new surface functions
Criteria for “Green Additives”

- VOC
- Renewable Materials
- Bio-degradation
- Ecolabel
- Life Cycle Assessment (LCA)
- Product Carbon Footprint (PCF)
Life Cycle Assessment (LCA) and Product Carbon Footprint

- Transport Manufacturing
- Production
- Raw materials/Suppliers
- Usage
- Disposal
Life Cycle Assessment (LCA)
Components of LCA according to ISO 14040+14044

- Goal Definition and Scope
- Inventory Analysis
- Impact Assessment
- Interpretation
Life Cycle Assessment (LCA)
“Cradle-to-gate” Approach

Life Cycle Assessment (LCA)
Results for two BYK products

<table>
<thead>
<tr>
<th>Impact categories according to CML 2001 (per ton product)</th>
<th>Biobased defoamer (96% renewable)</th>
<th>Viscosity depressant (65% renewable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy resources (non renewable) [MJ]</td>
<td>19,500</td>
<td>31,200</td>
</tr>
<tr>
<td>Energy resources (renewable) [MJ]</td>
<td>36,600</td>
<td>23,000</td>
</tr>
<tr>
<td>Euthrophication EP [kg PO₄³⁻ eq.]</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Ozone layer depletion ODP [kg R11 eq.]</td>
<td>3.7*10⁻⁵</td>
<td>2.6*10⁻⁶</td>
</tr>
<tr>
<td>Photochemical oxidation POCP [kg Ethylene-eq.]</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td><strong>Global Warming GWP₁₀₀ [kg CO₂-Äquiv.]</strong></td>
<td><strong>1,800</strong></td>
<td><strong>1,350</strong></td>
</tr>
<tr>
<td>Acidification AP [kg SO₂-Äquiv.]</td>
<td>17</td>
<td>12</td>
</tr>
</tbody>
</table>
Life Cycle Assessment (LCA)
Data Quality

- Results from Data Modeling
  - LCA according CML2001

- Validation
  - TÜV Rheinland

- Certification
  - TÜV Rheinland

- Documentation
  - Environment Product Declaration (EPD®)

- EPD verified

6/12/2013
Page 14
Greenability
Life Cycle Assessment (LCA)
EPD® (1)

• EPD® = Environmental Product Declaration (Environmental Declaration Typ III according to the standard ISO 14025)

• International communication tool to provide environmental related information

• based on PCR Basic Modul 35 (“Other Chemical Products; Man Made Fibres”)

• Until now 7 pre-registered EPD®s for different kind of additives

• structure:
  ➢ program-related information
  ➢ product-related information
  ➢ environmental performance related information
  ➢ potential environmental impact (LCA results)
  ➢ Verification and validation
Life Cycle Assessment (LCA)  
EPD® (2)

Environmental Product Declaration for BYK®-1740

1. Program-related Information

This document is based on the international EPD® system, which provides information on the environmental performance of products in an accessible way. The program operated by BYK Additives & Instruments is one of the world’s leading suppliers in the additives and instruments sector. The coatings, piercing tools, and plastic injection molding are some of the main areas of application of BYK additives. Yet, in paper surface finishing, the production of adhesives and waxes, and the production of roll goods and paper, BYK additives are also improving product properties and production processes. In 2009, BYK extended its portfolio with raw materials for the production of mold release agents for aluminum die-casting. In addition, the data in this EPD® system can quantify the properties of ceramics and glass and the physical properties of paints, plastics, and paper products. Instruments from BYK are predominantly used for quality control. BYK Additives & Instruments is a member of ALKNA, Wiesl, ALKNA develops and produces high-quality, innovative products in the sector of specialty chemicals. BYK Additives & Instruments employs around 1,300 people worldwide, 15% of whom work in research and development departments or at technical laboratories. The single value-added steps of the defoamer BYK®-1740, meaning development, research, and production, are located at BYK-Chemie GmbH, Wiesl, Germany. The production of the world’s natural resources is becoming one of the primary responsibilities. BYK is working intensively to develop the most sustainable production processes, conserve our natural resources, protect human life, and minimize the burden on the environment. Equally, it goes without saying that safety and health in the workplace take priority over economic concerns. With the strategic initiative called “Greenability”, BYK is focusing on the production of environmentally friendly additives with the aim of supporting the paint and coatings industry in achieving its “green” goals.

2. Product-related Information

2.1 The production company

BYK Additives & Instruments is one of the world’s leading suppliers in the additives and instruments sector. The coatings, piercing tools, and plastic injection molding are some of the main areas of application of BYK additives. Yet, in paper surface finishing, the production of adhesives and waxes, and the production of roll goods and paper, BYK additives are also improving product properties and production processes. In 2009, BYK extended its portfolio with raw materials for the production of mold release agents for aluminum die-casting. BYK Additives & Instruments can quantify the properties of ceramics and glass and the physical properties of paints, plastics, and paper products. Instruments from BYK are predominantly used for quality control. BYK Additives & Instruments is a member of ALKNA, Wiesl, ALKNA develops and produces high-quality, innovative products in the sector of specialty chemicals. BYK Additives & Instruments employs around 1,300 people worldwide, 15% of whom work in research and development departments or at technical laboratories. The single value-added steps of the defoamer BYK®-1740, meaning development, research, and production, are located at BYK-Chemie GmbH, Wiesl, Germany. The production of the world’s natural resources is becoming one of the primary responsibilities. BYK is working intensively to develop the most sustainable production processes, conserve our natural resources, protect human life, and minimize the burden on the environment. Equally, it goes without saying that safety and health in the workplace take priority over economic concerns. With the strategic initiative called “Greenability”, BYK is focusing on the production of environmentally friendly additives with the aim of supporting the paint and coatings industry in achieving its “green” goals.

3. Environmental Performance-related Information

3.1 Life cycle assessment

The life cycle assessment (LCA) provides a detailed view of the environmental impact of a product throughout all the stages of its life and is based on the rules of the International Standard Organization DIN EN ISO 14040 and 14044. The product BYK®-1740 is a polymer-based defoamer and only one example of the many additives of BYK's portfolio.

Product range additives at BYK

Additives are chemical substances that are used in small quantities to improve product properties such as scratch resistance or surface gloss. Manufacturing processes are also optimized through the use of additives. A defoamer is used to prevent foam during the production process, the bottling, and the packaging.

The content of the additives, environmental aspects, and other information related to BYK®-1740 are presented in the declared unit of 1 ton product. It should be mentioned that EPDs from different programs might not be comparable.

Table 1: Material resources

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit: 1 ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-renewable resources</td>
<td>250 kg</td>
</tr>
<tr>
<td>Renewable resources</td>
<td>200 kg</td>
</tr>
</tbody>
</table>

Table 2: Energy resources (used for energy conversion purposes)

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit: 1 ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-renewable sources</td>
<td>16895.32 kWh</td>
</tr>
<tr>
<td>Renewable sources</td>
<td>3205.97 kWh</td>
</tr>
</tbody>
</table>

Table 3: Electricity consumption

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit: 1 ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity consumption</td>
<td>62.47 kWh</td>
</tr>
</tbody>
</table>

Table 4: Water use

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit: 1 ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>2.3 m³</td>
</tr>
</tbody>
</table>
4. Potential Environmental Impact

Table 5 shows the environmental impact categories, which are based on the CML2001 assessment method developed by Leibniz University.

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>Unit</th>
<th>Life Stage</th>
<th>Normalizing</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Warming Potential (GWP)</td>
<td>kg CO₂-eq/t</td>
<td>1622.80</td>
<td>233.04</td>
<td>9946.85</td>
</tr>
<tr>
<td>Climate Change Potential (CCP)</td>
<td>kg CO₂-eq/t</td>
<td>2.72</td>
<td>1.07</td>
<td>1.02</td>
</tr>
<tr>
<td>Acidification Potential (AP)</td>
<td>kg SO₂-eq/t</td>
<td>0.06</td>
<td>0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Photochemical Ozone Creation (POCP)</td>
<td>kg SO₂-eq/t</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Eutrophication Potential (EP)</td>
<td>kg P2O₅-eq/t</td>
<td>0.01</td>
<td>0.04</td>
<td>0.04</td>
</tr>
</tbody>
</table>

5. Verification and Validity

Verification conducted by: International EPD System

Independent verification of the declaration and data, according to ISO 14025:

- External

TOV Fleischer & LCA Products GmbH
Zur Großen Gasse 29, 51105 Koblenz, Germany
www.epd.com/safety

If changes in any of the environmental impacts are greater than 5 %, the EPI shall be adjusted. Only apart from this, the EPI shall be reviewed every three years.

6. References

- Modelcode for the Product EPD BYK 1010, Assessment study for the product EPD BYK 1010, 2011.
Roundtable Discussion

1. Why are you interested in the International EPD® system?

2. What do you need from it?
Questions?
Thank you for your attention!
Greenability

www.byk.com/greenability