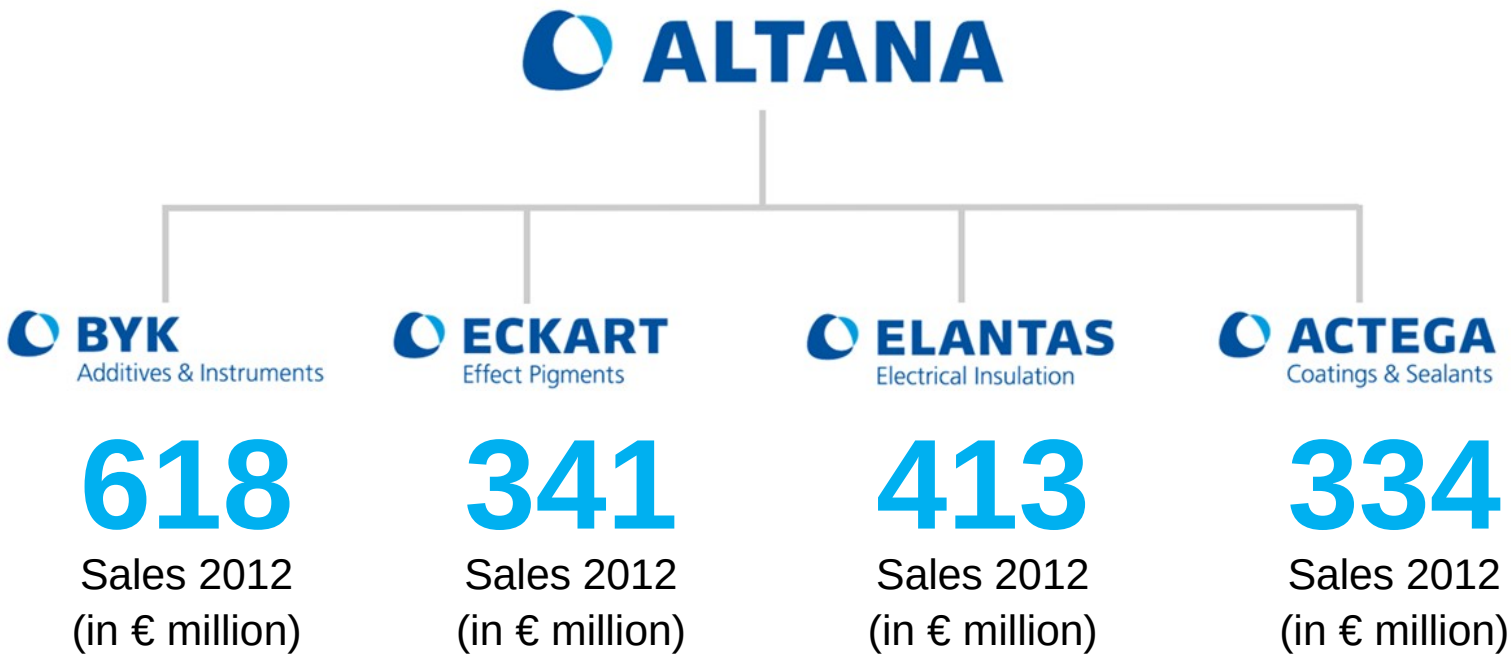
EPD® by BYK-Chemie

Bologna, Italy, 2013

A member of ALTANA

BYK
Additives & Instruments

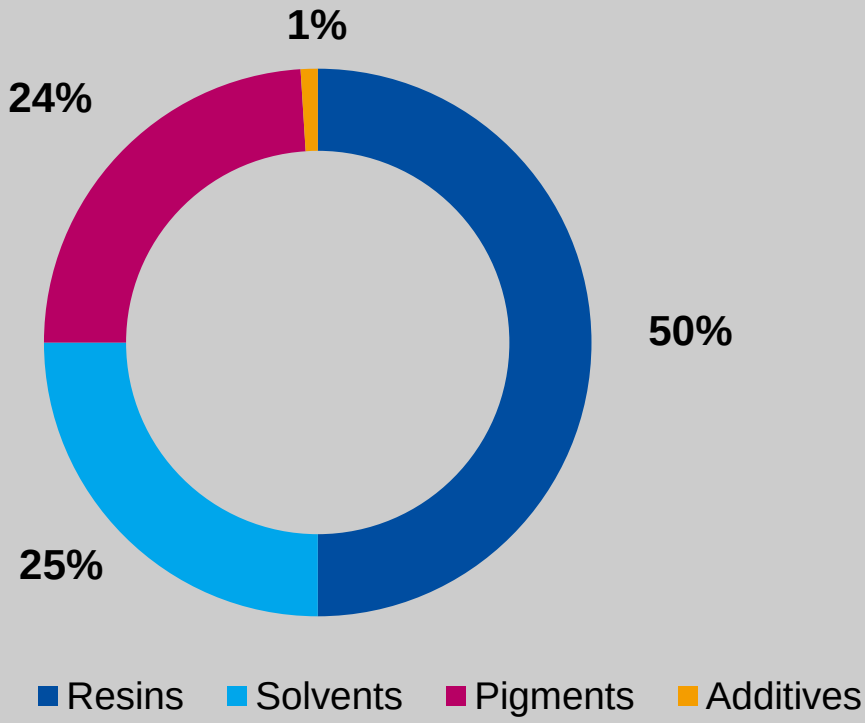


A global specialty chemicals player with leading positions in demanding specialty markets.

Products

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.



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Product Range Additives

- Additives to improve surface slip, leveling and substrate wetting
- Adhesion promoters
- Defoamers and air release agents
- Processing additives
- Rheological additives
- UV absorbers
- Viscosity depressants
- Wax additives
- Wetting and dispersing additives for pigments and extenders

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End Uses

Coatings Industry

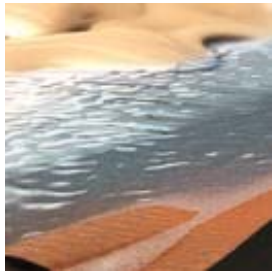
Architectural Coatings

Automotive Coatings

Can Coatings

Coil Coatings

Industrial Coatings



Leather Finishes

Powder Coatings

Protective & Marine Coatings

Wood & Furniture Coatings

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End Uses

Plastics Industry

Ambient Curing Systems

PVC Pastisols

SMC/BMC

Thermoplastics

Pigment Concentrates

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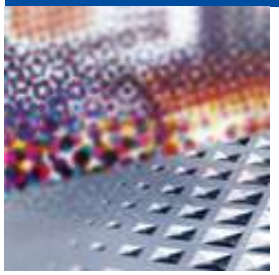
End Uses

Printing Ink Industry



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

Paper Coatings

- Impregnation
- Coatings

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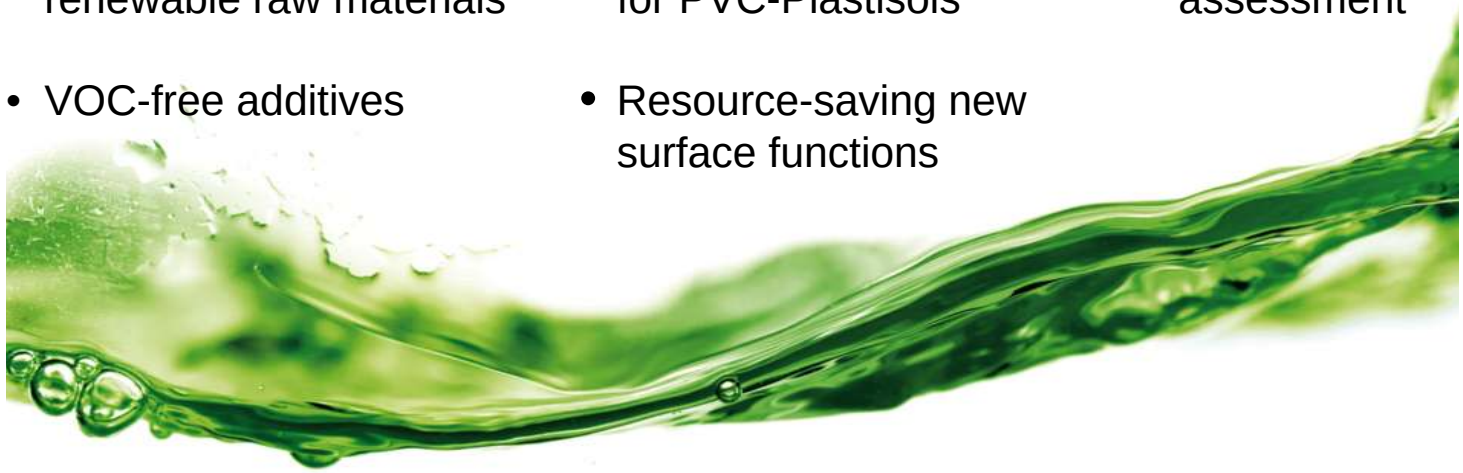
Additives for environmentally-friendly formulations

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



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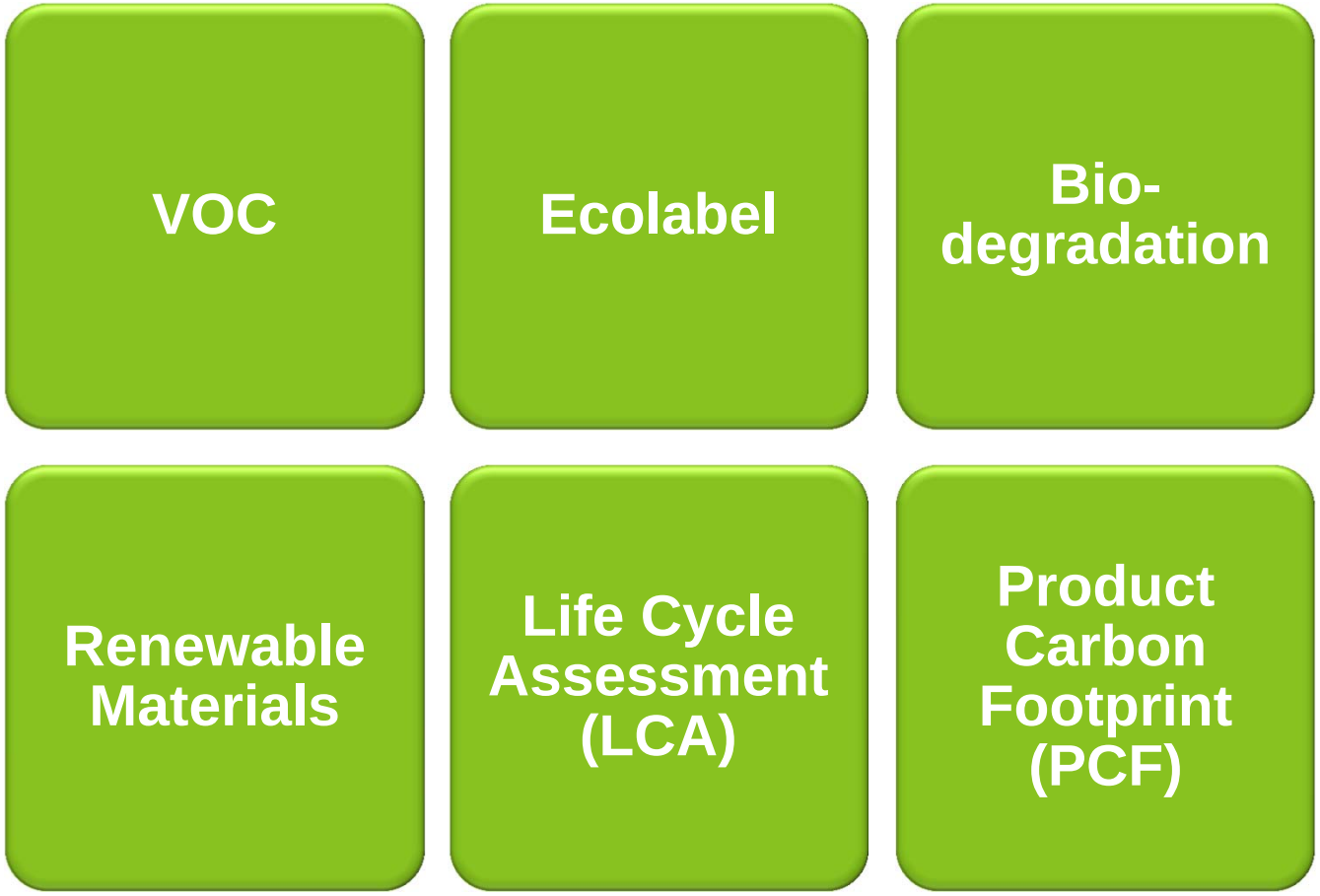
Criteria for “Green Additives”



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Life Cycle Assessment (LCA) and Product Carbon Footprint

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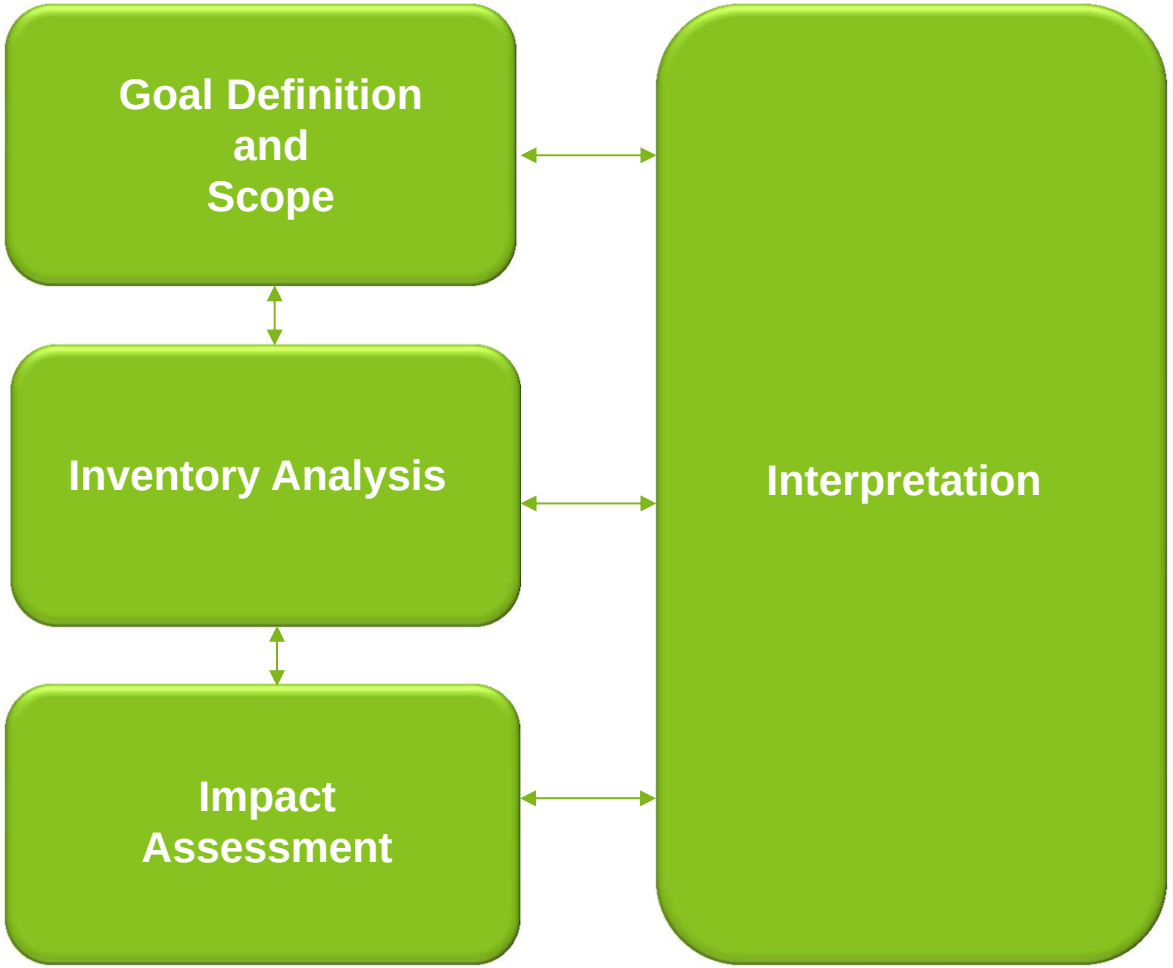
Life Cycle Assessment (LCA)

Components of LCA according to ISO 14040+14044



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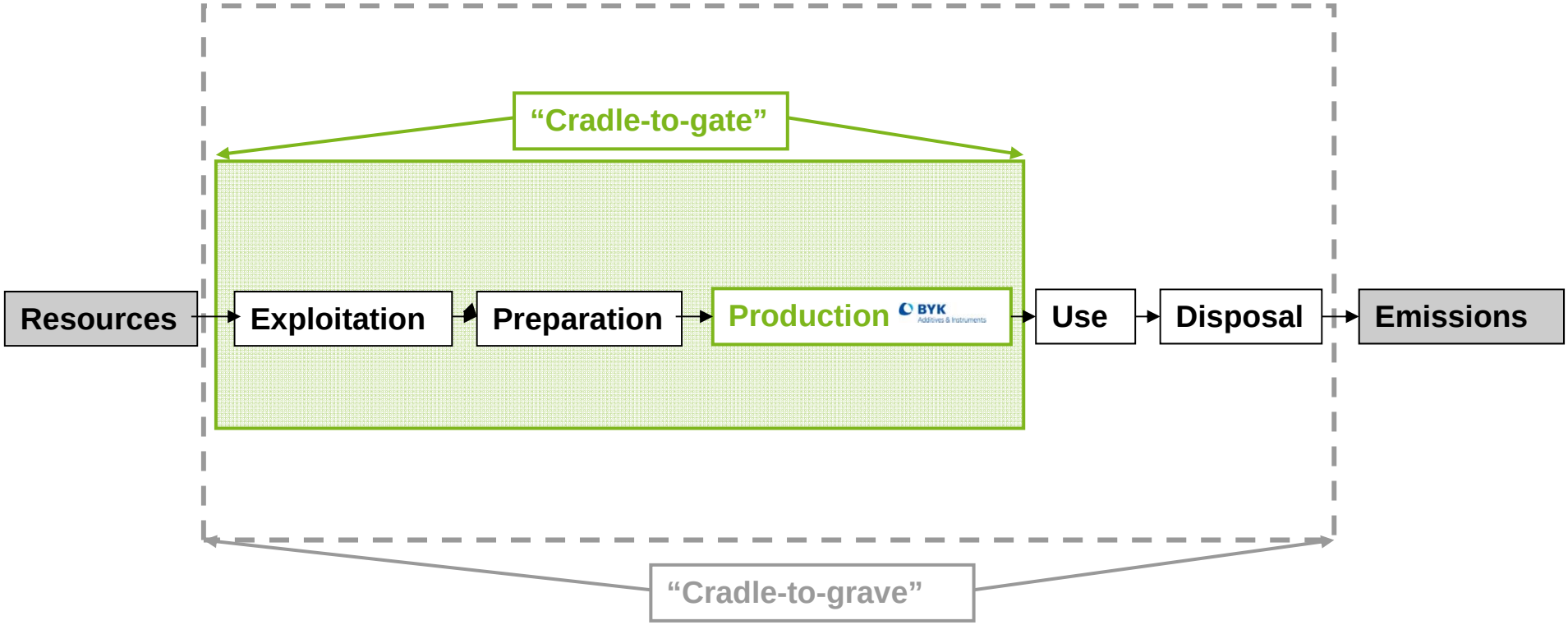
Life Cycle Assessment (LCA)

“Cradle-to-gate” Approach



Ref.: PE International GmbH, Handbuch GaBi 4 (2006)

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Life Cycle Assessment (LCA)

Results for two BYK products

Impact categories according to CML 2001 (per ton product)	**Biobased defoamer (96% renewable)**	**Viscosity depressant (65% renewable)**
Energy resources (non renewable) [MJ]	19,500	31,200
Energy resources (renewable) [MJ]	36,600	23,000
Euthrophication EP [kg PO_4^{3-} eq.]	6	4
Ozone layer depletion ODP [kg R11 eq.]	$3.7*10^{-5}$	$2.6*10^{-6}$
Photochemical oxidation POCP [kg Ethylene-eq.]	0.6	0.5
Global Warming GWP_{100} [kg CO_2 -Äquiv.]	**1,800**	**1,350**
Acidification AP [kg SO_2 -Äquiv.]	17	12

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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

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)

BYK Additives & Instruments

EPD®

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 operator is the Swedish Environmental Management Council. The EPD for **BYK®-1740** has been issued according to the PCR document "Basic PCR Module CPC Division 35: Other chemical products; man made fibres", Version 1.0, dated 2010-11-30.
Registration number: S-P-00000.
Date of publication: 2000-00-00, valid until 2000-00-00.
The preparation of the report according to the international EPD®system took place at Wesel, Germany, in 2011. The data that are used relate to the Europe area/Germany.

More information about the international EPD®system and the PCR modules are available from the website of the Swedish Environmental Management Council: www.erwirondec.com.

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, printing inks, and plastics industries are some of the main areas of application of BYK additives. Yet, in paper surface finishing, the production of adhesives and sealants, and construction chemistry, 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 Instruments can quantify the quality of color and gloss and the physical properties of paint, plastics, and paper products. Instruments from BYK are predominantly used for quality control. BYK Additives & Instruments is a member of ALTANA, Wesel. ALTANA develops and produces high-quality, innovative products in the sector of specialty chemicals. BYK Additives & Instruments employs around 1,300 people worldwide, 25 % of whom work in research and development departments or technical laboratories. The single value-added steps of the defoamer **BYK®-1740**, meaning development, research, and production, are located at BYK-Chemie GmbH, Wesel, Germany.

Protecting 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.

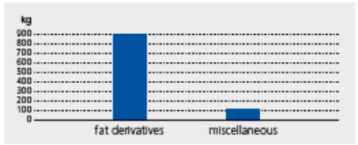
2.2 The product
BYK®-1740 is a polymer-based defoamer and only one example of the many additives of BYK's portfolio:

Additives to improve surface slip, leveling and substrate wetting	UV-absorbers
Adhesion promoters	Viscosity depressants
Defoamers and air release agents	Wax additives
Processing additives	Wetting and dispersing additives for pigments and extenders
Rheological additives	

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/or the application.

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



Components of BYK®-1740 [kg]

BYK Additives & Instruments

EPD®

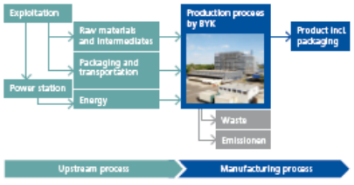
3. Environmental Performance-related Information

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.

Typical life cycle steps of a product

The life cycle of a product is divided into three parts: upstream process, manufacturing process, and downstream process. BYK-Chemie GmbH is a so-called business-to-business manufacturer and is oriented towards the cradle-to-gate approach. Cradle-to-gate means from the extraction and supply of raw materials until the end of the production process in the company's factory. Thus the underlying LCA study discusses the upstream and the manufacturing process.

As seen in the picture below, the upstream process describes the extraction and production of the raw materials used, the packaging required, the transport to the factory, and the production of the energy wares which are used in the upstream and manufacturing processes. The manufacturing process describes only the production process and the packaging used in the final product. The downstream process with usage and recycling or handling of packaging waste/ materials after use is not regarded.



Cradle-to-gate approach for the LCA study

The data are taken from PE International GmbH and its software/database GaBi 4 Professional and from BYK-Chemie GmbH. For the underlying LCA study, the following assumptions are made:

- Maximum 1 % of the total number of inputs to the unit process is disregarded because there are not enough valid data for specialty chemistry available at the moment.
- Allocation rules are based on the underlying PCR module.
- There are no significant emissions to air, land, or water which are caused by the production process. Thus, the emissions have been disregarded.
- BYK-Chemie GmbH is a batch manufacturer. Therefore, the cleaning process has not been included.

3.2 Use of resources
The **tables** below show the resources used in the upstream and manufacturing processes for the production of the additive [1 ton].

Table 1: Material resources

	unit	upstream	manu-facturing
Non-renewable resources	kg	100	0
Renewable resources	kg	900	0

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

	unit	upstream	manu-facturing
Non-renewable resources	MJ	16093,62	3396,58
Renewable resources	MJ	36489,55	66,29

Table 3: Electricity

	unit	upstream	manu-facturing
Electricity consumption	kWh	-	62,67

Table 4: Water use

	unit	upstream	manu-facturing
Water	L	-	0

Life Cycle Assessment (LCA)
EPD® (3)

BYK Additives & Instruments

EPD®

4. Potential Environmental Impact

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

Table 5: Life cycle impact assessment profile of DISPERBYK-190.

	unit	upstream	manufacturing	total
Global Warming Potential GWP100	kg CO_2-eq./t	1667,90	239,94	1907,85
Ozone Depletion Potential ODP	kg R11-eq./t	$7,52*10^{-5}$	$1,60*10^{-5}$	$9,12*10^{-5}$
Acidification Potential AP	kg SO_2-eq./t	3,06	0,58	3,63
Photochem. Ozone Creation Potential POCP	kg ethene-eq./t	0,52	0,08	0,61
Eutrophication Potential EP	kg PO_4^{3-}-eq./t	0,61	0,04	0,65

5. Verification and Validity

PCR review conducted by:	International EPD®system Vasagatan 15-17, SE-111 20 Stockholm www.environdec.com
Independent verification of the declaration and data, according to ISO 14025:	☐ Internal ☒ External
	TÜV Rheinland LGA Products GmbH Am Grauen Stein 29, 51105 Köln, Germany www.tuv.com/safety

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

6. References

- General Programme Instructions – For Environmental Product Declaration, Version 1.0, 29.02.2008, www.environdec.com.
- PCR Basic Module: CPC Division 35 – Other chemical products; man made fibres, Version 1.0, 13.11.2010, www.environdec.com.
- Guinée et al., An Operational Guide to the ISO Standards (2001), http://cml.leiden.edu/research/industrialecology/researchprojects/finished/new-dutch-lca-guide.html.
- Ökobilanzstudie für das Produkt DISPERBYK-190 (Ecobalance study for the product DISPERBYK-190), 2011.

BYK Additives & Instruments

EPD®

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Glossary

GWP_{100}	The **Global Warming Potential** is an index for the calculation of the anthropogenic part of the global greenhouse effect. The unit is indicated in kg CO_2 equivalents. Due to the fact that gases only stay for a time in the atmosphere, the GWP is calculated for a period of 100 years.
ODP	The **Ozone Depletion Potential** evaluates the reduction of the ozone layer through anthropogenic emissions. The unit of the index is indicated in R11 equivalents (CCl_3F-eq. = trichlorofluoromethane equivalents).
AP	The **Acidification Potential** is an index for the emissions of acid-forming substances whereby the acidification of soil and water results through the forming of acids by oxygen. The unit is indicated in SO_2 equivalents.
POCP	The **Photochemical Ozone Creation Potential** is an index for ozone creation in the troposphere (summer smog). The unit is indicated in ethene equivalents.
EP	The **Eutrophication Potential** is an index which describes the enrichment of nutrients in soil and water; thus it is an indicator of overfertilization. The unit is indicated in PO_4^{3} equivalents.

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Roundtable Discussion

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

2. **What do you need from it?**

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Questions?

Thank you for your attention!

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www.byk.com/greenability

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