ecovio® M 2351

for certified soil-biodegradable mulch films

Processing guide

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THIS IS ecovio®

Certified compostable polymer based on renewable raw materials

ecovio® IS A HIGH-QUALITY AND VERSATILE BIOPLASTIC FROM BASF. THE PRIMARY ADVANTAGES: IT IS CERTIFIED COMPOSTABLE AND HAS BIOBASED CONTENT.

01

Characteristics

ecovio®:

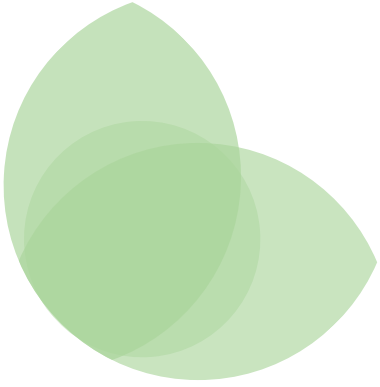
- is a finished compound
- is certified compostable and biodegradable
- has a variable biobased content
- is certified worldwide
- is printable and has excellent heat sealing properties

The main application areas for ecovio® are plastic films such as organic waste bags, fruit and vegetable bags, cling film, dual-use bags (first for shopping, then for organic waste) and agricultural films. Furthermore, compostable packaging solutions such as paper-coating and injection molding products can be produced with ecovio®.

As a wide range of applications is possible with ecovio®, solutions for Closed-Loop Systems can be implemented, e.g. for food catering in sports venues.

An innovative mix of proven ingredients

With ecovio®, BASF offers a certified compostable polymer which at the same time has a variable biobased content. The biobased portion can be adjusted to suit client requirements.



ecovio® consists of the compostable and biodegradable BASF polymer ecoflex® and polylactic acid (PLA), which is derived from corn or other sugar generating plants like manioc. In contrast to simple starch-based bioplastics, ecovio® is more resistant to mechanical stress and moisture.

Ready for use

ecovio® is a finished product that can be used as a drop-in solution with standard plastic production technologies. Additional blending is therefore not required.

High performing and certified compostable

ecovio® products are just as high-performing and strong in use as conventional plastics. The product properties were designed in such a way that the products only fully biodegrade after use.

01

Characteristics

One step ahead together

AS A LEADING PROVIDER OF HIGH-QUALITY AND HIGH-PERFORMING PLASTICS, BASF HAS BEEN RESEARCHING BIODEGRADABLE AND BIOBASED POLYMERS FOR MORE THAN A QUARTER CENTURY.

The continuous development of innovative plastic solutions and the functionality improvement of the products happen in close cooperation with internal BASF units as well as with external partners.

Certified biodegradable and biobased plastics can be the optimal solution for specific applications, e.g. certified compostable organic waste bags or soil-biodegradable mulch films. The biodegradability does not depend on the origin of the plastic – it can be fossil-based or biobased. For each application a detailed consideration of ecological compatibility, economic viability and social consequences over the entire life cycle is necessary, for example with an eco-efficiency analysis.

What is meant by bioplastics?

	not compostable	compostable
based on renewable raw materials	Bio-PE, Bio-PA, Bio-PUR, Bio-PP	PLA, PHA
on a fossil basis	PE, PP, PVC, PA, PBT	PBS

Two different groups of products fall under the term “bioplastics”: “biobased” and “compostable” plastics.

Biobased materials are partly or entirely made of renewable raw materials. Polylactic acid, polyhydroxyalkanoate (PHA), starches, cellulose, chitin and gelatin for example, belong to this group. Biobased plastics can be biodegradable – but they are not always. Biobased but not biodegradable plastics are e.g. biopolyethylene, natural fiber plastics, and composites of wood and plastic.

Compostable plastics can be biodegraded by microorganisms. Special micro-organisms give off enzymes which break down the material’s flexible polymer chains into small parts. These are then digested by the organisms together with other organic material such as, for example, organic waste. Water, carbon dioxide and biomass remain. This has been verified in several independent scientific studies. Compostable polymers can, but need not be produced from renewable raw materials. They can also be based on crude oil. The biodegradability does not depend on the raw material, rather, it depends entirely on the chemical structure of the polymer.

Tested and certified

THE COMPOSTABILITY OF ecovio® HAS BEEN CERTIFIED BY RECOGNIZED AND INDEPENDENT TEST INSTITUTES.

Certified by test institutes

Independent institutes test bioplastics in special certification procedures with respect to biodegradability, compostability, compost quality and plant compatibility.

A material needs to meet clearly defined test criteria in order to be identified as compostable.

Suitable for food

ecovio® grades comply with the requirements of the European food contact regulation[1] as well as the US Food Contact Substance Notification[2]. Therefore they are suited for food packaging.

ecovio® offers various product grades that conform to the following international standards and norms for composting, among others:

European standard EN 13432

Home composting

Soil biodegradability

American standard ASTM 6400

European standard EN 13432
Australian standard AS 4736

Italian certification CIC

Japanese standard GreenPla

Canadian standard CAN/BNQ 0017-088

[1] Commission Regulation (EU) No. 10/2011 of January 14, 2011 on materials and objects of plastic, designed to be in contact with food.

[2] According to Food Contact Substance Notification No. 178, 475 and 907 of FDA

Mulch film made of ecovio®

Biodegradation into:

- Water
- CO_2
- Biomass

“Oxo-degradable” mulch film

- **No biodegradation** (does not comply with international composting standards)
- **Disintegration to plastic fragments (PE)**
- Premature loss of mechanical properties upon **exposure to strong light**

Bio-polyethylene mulch film

- **Biodegradation impossible** (only extremely slow disintegration into plastic fragments)
- **Disposal to landfill** (prohibited in some European countries)
- **Incineration** (not appropriate due to the high content of water in organic waste)

“Oxo-degradable” plastics and bio-polyethylene plastics are not compostable

“Oxo-degradable” polyethylene films (PE) are conventional plastics which only decompose with the addition of special additives. Triggered by exposure to UV or heat, they oxidize the polymer chains and break them up into smaller fragments. To date it has not been possible to scientifically prove any biodegradability of these PE fragments after decomposition that meets the composting standards, whether or not the materials were pretreated with UV radiation or heat.

Bio-polyethylene plastics are made with renewable resources. But they too are not biodegradable. Compostability does not depend on the origin of the raw materials, but on the chemical structure of the polymer.

02

ecovio® M 2351

Compound for certified soil-biodegradable mulch films

FOR AGRICULTURAL USE, BASF OFFERS THE CERTIFIED SOIL-BIODEGRADABLE ecovio® M 2351 FOR MULCH FILMS.

The compound consists of the biodegradable co-polyester polybutylene adipate terephthalate (PBAT) ecoflex®, other biodegradable polymers made from renewable raw materials and inorganic fillers. Mulch films made of ecovio® M 2351 can remain in the soil and ploughed in after mechanical harvest: Farmers do not have to laboriously remove and recycle them. Naturally occurring soil microbes like bacteria or fungi recognize the structure of the film as food they can metabolize. The remaining end products after biodegradation are CO_2, water and biomass (mass from natural living organisms, e.g. cells).

With the registration number 9X0001, ecovio® M 2351 has been certified as the first material for soil-biodegradable mulch films in accordance with the European standard EN 17033. It also obtained the certificate “ok biodegradable soil” from TÜV Austria and “ok biodegradable soil as granule and film” from DIN Certco.

Key technical benefits:

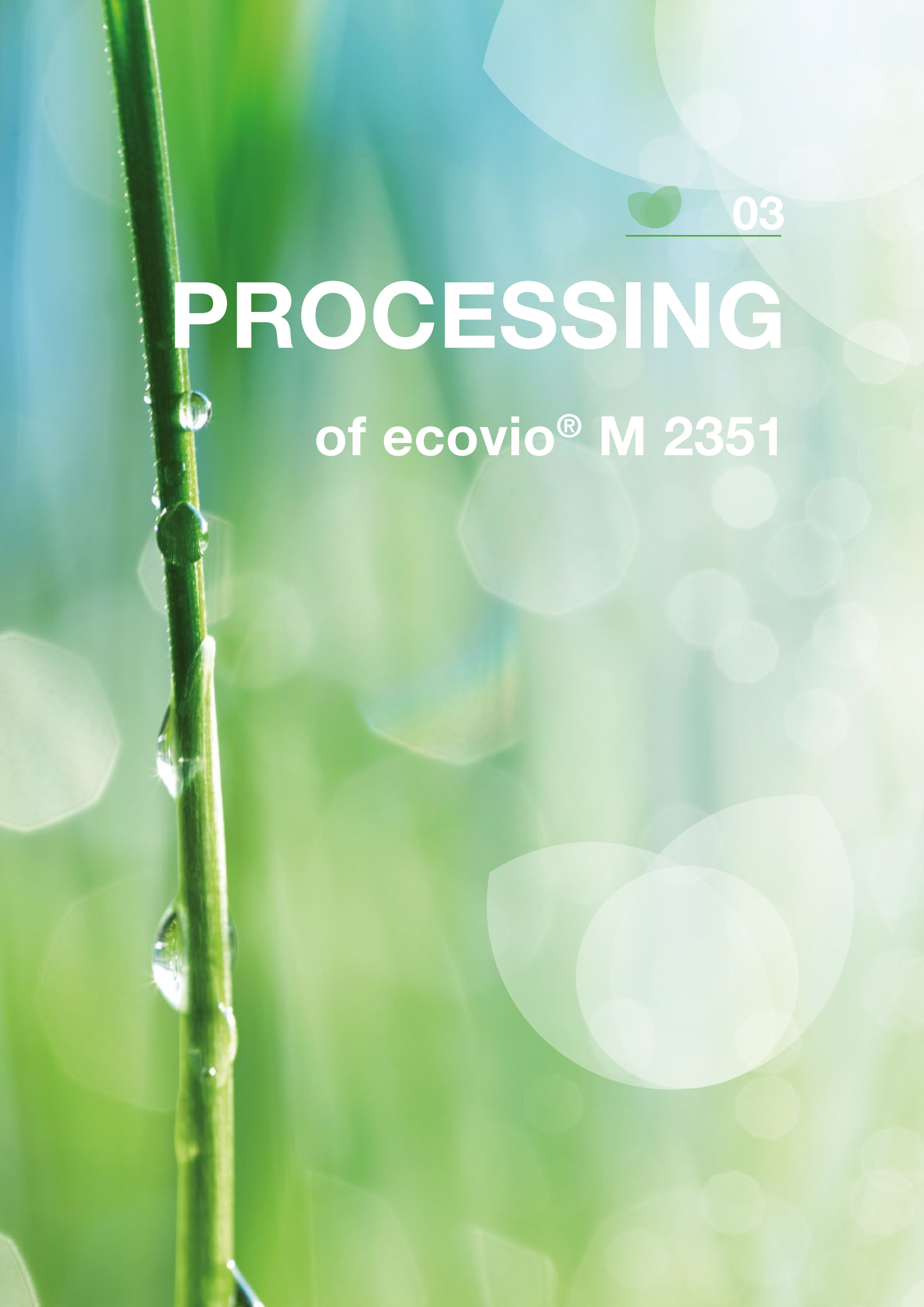
- Due to its very good mechanical properties, ecovio® M 2351 can be used to make mulch films with layer thicknesses of 8-25 and if necessary up to 50µm.
- ecovio® M 2351 is a ready-to-use compound that can be processed on conventional machines used for the extrusion of polyethylene films without any additional lubricants or antiblock agents.
- With ecovio® M 2351, black mulch films can be manufactured. Compatible masterbatches are available.

Technical data

Types / Solutions	ecovio®M2351
Common thickness	12
Bio component*	9 %
Certified soil-biodegradable acc. to EN 17033	✓
Properties**	
Young’s modulus MD/TD	260/130 MPa
Tensile strength MD/TD	25/20 MPa
Elongation at break MD/TD	180/380 %
Tear resistance MD/TD	730/520 Nm
Perforation resistance	200 g
Decomposition speed	
Wet strength	✓
Slip/anti-block additive	✓/✓

Slip additive master Batches: ecoflex® Batch SL05, ecoflex® Batch SL10B, ecoflex® Batch SL10C | Anti-block (AB) Master Batches: ecoflex® Batch AB1

* Bio component measured according to 14C method of ASTM D6866-12
** Typical values, not to be interpreted as specifications



03

PROCESSING

of ecovio® M 2351

Extrusion process (general)

ecovio® IS A BIOPOLYMER OPTIMIZED FOR ALL CONVENTIONAL EXTRUSION PROCESSES USED FOR THERMOPLASTICS.

Single-start three-zone screws with an L/D ratio of up to 30 are suitable for ecovio® processing. However, specific recommendations exist for the optimum processing of ecovio®.

Extruder unit

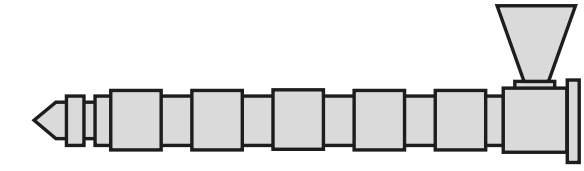
It is recommended to use a single-screw extruder not exceeding an L/D ratio of 30. A single, state of the art, standard sectioned three-zone screw is suitable for the processing of ecovio®.

Barrier screws combined with grooved intake zones as well as mixing and shear elements can also be used.

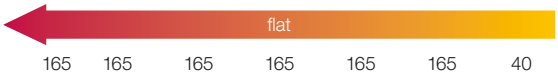
The processing temperatures here are lower than with polyolefin or styrol plastics. Depending on the PE product, the temperature can be around 35-40 °C lower.

Compared to shear-sensitive starch compounds, ecovio® exhibits a broader processing window between 160-190 °C. A flatter temperature profile or slightly increasing temperatures can be selected in contrast to other thermoplastics. These differ in various extrusion processes (see diagram).

Only wear-proof steel should be used for cylinder and screw when processing ecovio® extrusion types.



Temperature control for ecovio® M2351 [°C]



Blown film

ecovio® was developed for the processing of extrusion blown films on conventional blown film extrusion systems in thicknesses between 8-50 µ (depending on the grade). All common subsequent units (wrapping, print, cutting and welding/sealing, manufacturing machines etc.) can also be used.

Due to different flow behavior – at the exchange of other polymers – ecovio® requires precise new calibration of the extrusion tools at the respective operational spots.

State of the art blown film extrusion dies can be used to process ecovio® M 2351. A die gap of 0.8-1.2 mm is recommended.

For the processing of ecovio® M 2351 the standard PE-LD process can be used.

It is recommended to process ecovio® M 2351 with a higher blow-up ratio and corresponding film width and finally cut the film web in MD direction into several smaller rolls.

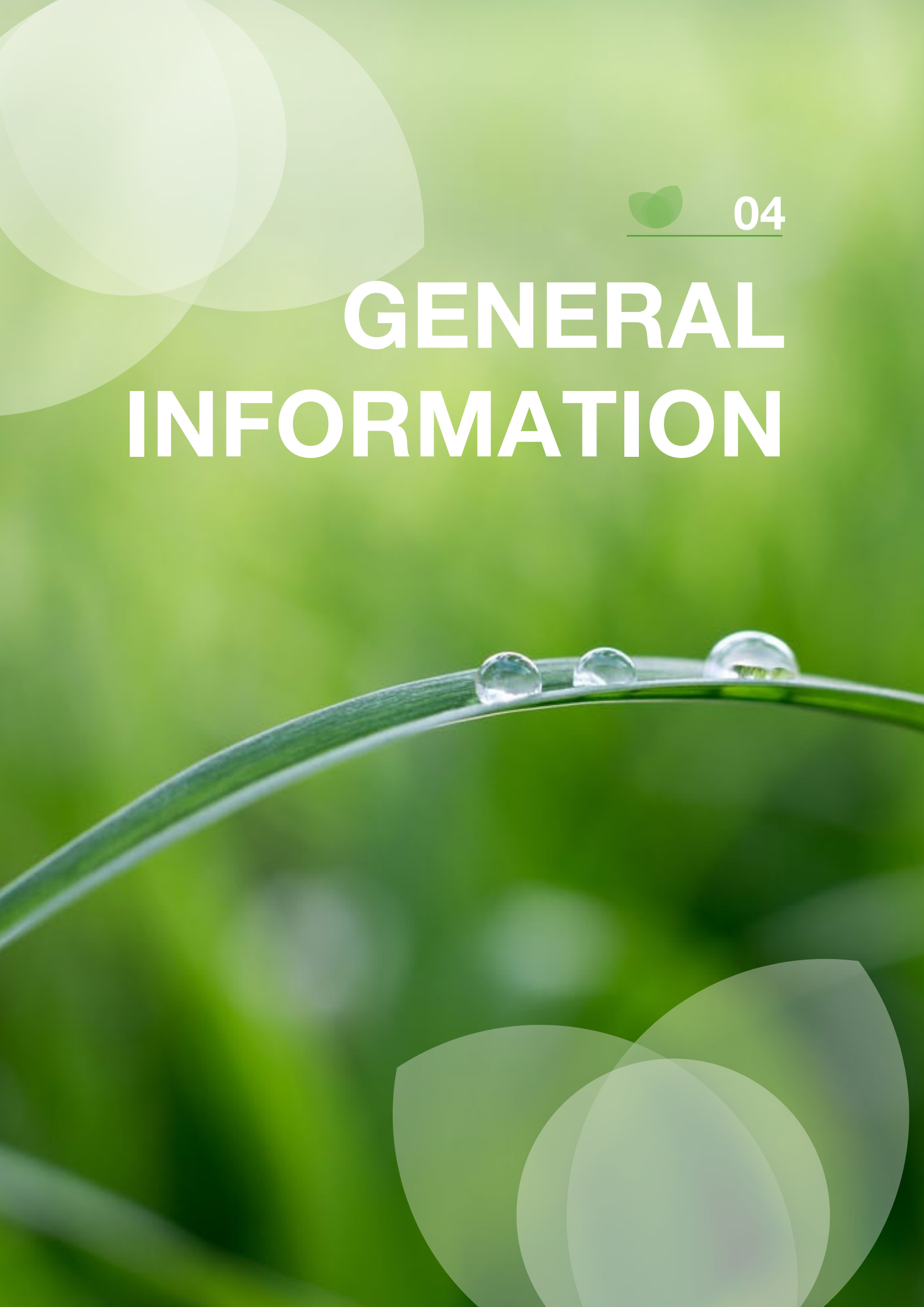
If the mulch film is cut at the edges to achieve the final width, the remaining material can be re-used both as granulate or compacted film up to a level of 5-15 %.

ecovio® M 2351 already has the necessary slip and anti-blocking agents. Additional additivation is not needed.

For mulch film, we currently offer our ecoflex® masterbatch black.

04

GENERAL INFORMATION



Printing and coloration

We recommend to add always 12 % of BASF masterbatch black which was developed especially for mulch films made of ecovio® M2351.

It is possible to print on mulch film made of ecovio® M2351.

Safety precautions

Safety instructions for processing

Pure ecovio® melts are thermally stable up to 240 °C (depending on individual grades) and do not pose any risks due to the molecular deterioration or the development of gases and vapors. However, as is the case with all thermoplastic polymers, ecovio® disintegrates under excessive thermal load, e. g. during overheating or cleaning with pyrolysis. Gaseous decomposition products are generated in this case. When processing ecovio®, we recommend to ensure sufficient ventilation. With the appropriate processing of ecovio® and the use of sufficient suction at the nozzle, health impairments are not anticipated.

Harmful, acrid vapors may occur in case of improper processing conditions, e. g. high temperature and/or excessive holding times. In case of such a failure, which can also become evident due to incineration streaks on the extrudates, the extruder has to be purged clear e. g. with ecoflex®, suitable cleaning batches or a slightly flowing PE-LD (MVR ~ 4).

Quick cooling of the damaged material, e. g. in a water bath, reduces the unpleasant odor.

Information regarding toxicology

ecovio® grades are not considered dangerous substance. With proper processing methods and good ventilation of the premises, no health impediments have emerged in persons employed with the processing of ecovio®.

Regulations regarding food production and distribution

All grades of the ecovio® product range comply in their composition with the currently valid law for plastics with direct food contact in Europe and the USA. The conformity of these products is furthermore ensured by the production according to GMP (Good Manufacturing Practices). If detailed information regarding the legal status of a certain ecovio® type is required, please contact BASF (plastics.safety@basf.com) directly, specifying the specific application together with temperatures. BASF gladly issues a current conformity confirmation relating to the currently applicable regulations.

04

General information

Quality assurance

ecovio® is manufactured as standard material in a continued production process according to the current version of DIN DIN EN ISO 9001. The volume flow index (MVR) at 190 °C according to ISO 1133 was defined as specific parameter for quality control.

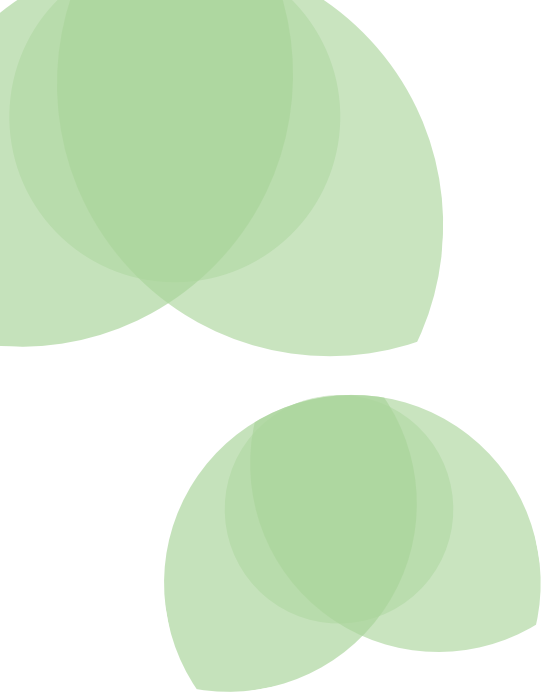
Upon request, a certification of the MVR value with each batch number can be supplied. Other data provided in our documentation are typical values, which are not a component of the product specifications of ecovio®.

Delivery, storage and aging

ecovio® is supplied in 1,000 kg big bags. Transport and storage temperatures should not exceed 60 °C. Unopened packaging should be stored at room temperature (23 °C) for a period not exceeding one year.

Packaging of finished mulch film rolls

It is recommended to pack finished mulch film rolls made of ecovio® M2351 into not-transparent polyethylene film. Each roll should be packed separately to protect the mulch film from UV light and humidity.



Note

The data contained in this publication are based on our current knowledge and experience. In view of the many factors that may affect processing and application of our product, these data do not relieve processors from carrying out own investigations and tests; neither do these data imply any guarantee of certain properties, nor the suitability of the product for specific purposes. Any descriptions, drawings, photographs, data, proportions, weights etc. given herein may change without prior information and do not constitute the agreed contractual quality of the product. It is the responsibility of the recipient of our products to ensure that any proprietary rights and existing laws and legislation are observed. (February 2022)

More information on ecovio®:
www.ecovio.basf.com

Please visit our websites:
www.plastics.basf.com

Request of brochures:
plas.com@basf.com

If you have technical questions on the products, please contact:
biopolymers@basf.com

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