

PRODUCTS MADE OF BIO-BASED MATERIALS

Recycling and reutilisation

Sources

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Information centre

The quantity of bio-based polymers and the various products manufactured from them are constantly on the increase. In the sense of a sustainable recycling management, the end of life of the product will also have to be sufficiently specified. The Federal Ministry of Food and Agriculture (BMEL) promotes the establishment of an information centre by KNOTEN WEIMAR GmbH, through its project executing organisation, the Agency for Renewable Resources e.V. (FNR), to deal with questions concerning recycling and reutilising of bio-based polymer products. The functions of the information centre are integrated in the activities of the FNR biopolymer network and include the provision of knowledge and information concerning recycling possibilities and usability for the manufacturers of bio-based polymer products as well as awareness training and information in the field of reutilisation for the waste management companies and the reutilising parties.

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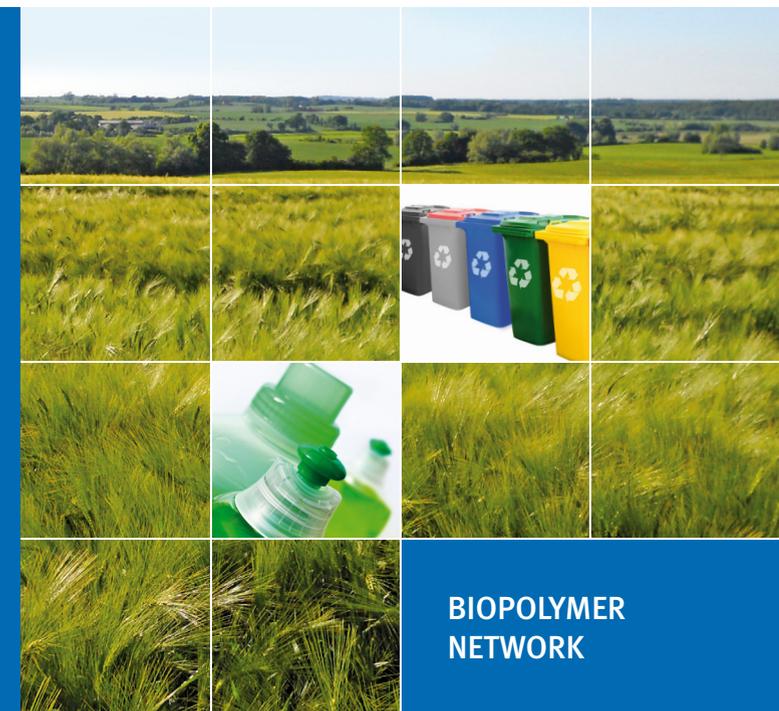
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Products made of bio-based materials

Bio-based polymers or plastics as well as natural fibre-reinforced plastic (FRP) and wood-plastic composites (WPC) rank among bio-based materials.

According to DIN SPEC 1206, bio-based polymers and plastics are technical polymers and comprise partially or completely of biomass i. e. materials of biological origin e. g. renewable resources, with the exception of fossils and geological sources [1]. But not all products made of bio-based materials consist of pure polymers. Most of them are blends or compounds of different plastics or fibres and plastics. Fibres of FRP and WPC are of annual or perennial fibre plants or of deciduous and coniferous trees and shrubs. Polyolefins are used preferable as matrix material [2].

For a transparent classification, standardised certifications for specifying the content of bio-based carbon in these polymers and products are available giving the respective labels, e.g. through Vinçotte and DIN CERTCO (figure 1). These certifications are assigned for granulates as well as for products.



Figure 1: Labels that show the proportion of bio-based carbon related to the product's total organic carbon in different ranges (examples)

Bio-based polymers can be sub-divided into Drop-in-solutions (same chemical structure), such as Bio-PE or Bio-PET, and new kinds of bio-based polymers, such as Polylactid (PLA). The areas of application for bio-based materials are manifold, among others in the area of packaging, consumer and recreation goods, automotive manufacturing, production of electrical appliances construction as well as housing.

Products from bio-based materials are given a high significance in the bio-economy strategy of the federal government as the application of renewable resources reduces the dependency on fossil resources. This potential is intended to increase through meaningful recycling.

Biological degradation vs. compostability

The term “bio-based materials” or “bio-based plastics” alone does not inevitably allow biological degradability, or does not conclude this functionality, especially the compostability which is connected to it but does not mean the same thing.

Biological degradability includes the property of a substance to be able to decompose to carbon dioxide, water, biomass and minerals with the help of micro-organisms in the presence of atmospheric oxygen (under aerobic conditions) or to carbon dioxide, methane, biomass and minerals in the absence of oxygen (anaerobic conditions), in which the time period is not defined. The compostability of biologically degradable synthetic products on the other hand includes the ability to completely decompose biologically (to disintegrate) without limitations in a composting process (specified aerobic conditions) in a specific period of time. [3]

Standards such as DIN EN 13432 or AS 5810 are available for the certification of products made of compostable materials in an industrial composting plant or for home composting on the basis of which labels of DIN CERTCO, Vinçotte or European Bioplastics e.V. for example are given (figure 2).

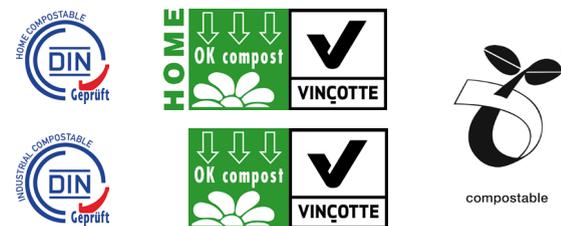


Figure 2: Labels that indicate the compostability under different conditions (examples)

Legal determining factors

The basis for EU-wide proper waste management is found in the Directive 2008/98/EC on waste (Waste Framework Directive). The regulation for the priority in which waste is to be handled basically is given in article 4:

1. Prevention
2. Preparations for re-use
3. Recycling (basic or raw material)
4. Other recovery, e. g. energy recovery
5. Disposal

At EU level, apart from Directive 2008/98/EC on waste, for the disposal of polymer products, the Directive 94/62/EC on packaging and packaging waste, Directive 2000/53/EC on end-of-life vehicles (ELV Directive), Directive 2012/19/EU on waste electrical and electronic equipment (WEEE) are also relevant. Once a directive adopted at European level, it is then transposed by Member States into their internal law. The directives oblige the Member States to achieve a certain result but leaves them free to choose how to do so. Thus, the translation into national law can differ.

In Germany, the basis for proper waste management is found in the Closed Cycle Management Act (KrWG). Apart from that for the disposal of products made of bio-based material, the packaging ordinance (VerpackV), the bio-waste ordinance (BioAbfV), the end-of-life vehicle directive (AltfahrzeugV), Electrical and Electronic Equipment Act (ElektroG), the wood waste ordinance (AltholzV; if any, relevant for FRP and WPC, because a specific allocation for waste management does not exist yet for FRP and WPC [4]) and the Commercial Waste Ordinance (GewAbfV) are also relevant in Germany.

Disposal in the post-consumer sector in Germany

Within the post-consumer sector, waste is to be considered among other from households incl. business and bulky waste, household like commercial waste and end-of-life vehicle. It is waste that is recycled, utilised or disposed of by the systems of the public bodies

responsible for waste management as well as taking back systems of the private sector. The treatment options for the disposal of bio-based polymer products and the measures for waste management practiced to date are:

- Collection of packaging via dual systems (yellow bin or sack) and deposit systems (single and dual-use deposit systems) in the consensus with VerpackV and with the possibility of reuse, recycling of basic and raw materials, energy recovery or disposal with impurities: The transitional regulation § 16 of VerpackV regarding to biodegradable and certified compostable plastic packaging and one-way beverage packaging expired on 31.12.2014. Modern sorting plants are principally able to sort out bio-based synthetic products; however a retrofit or modification will be necessary for separate handling of additional new waste fractions such as PLA. This however, will only be economical if the material to be sorted from the total waste flow constitutes a specific minimum quantity. Drop-in-solutions, e.g. Bio-PET, can be classified under the existing material flow to be recycled.
- Collection of certified compostable, bio-based polymers in consensus with BioAbfV via bio-bins with the alternative of raw-material recycling (composting) as well as if any energetic utilisation (in a biogas plant) or the disposal together with impurities: Packaging made of compostable plastics from predominantly renewable resources are no biowaste according to § 2 number 1 as laid down in schedule 1 number 1 sub-paragraph a of BioAbfV.
- Taking-back-systems (end-of-life vehicles and electro-waste) with the total spectrum of options from recycling to disposal.
- Collection of bulky waste as mono charges as well as the spectrum of options from recycling to disposal: Retailers of FRPs and WPCs recommend the disposal of substantial quantities via recycling centres, often followed by an energy recovery.
- Collection of residual waste and disposal (mechanical-biological/thermal): It is recommended to dispose of small quantities of FRPs and WPCs (clippings) via the residues waste.

It is assumed that in the future recycling of bio-based products will offer an ecological and economic use by saving new input material. For this reason, various research projects are currently being carried out to improve the technical conditions.