Glossary 4.5

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In bioplastics MAGAZINE the same terms and expressions appear again and again. To avoid repeated explanations of terms such as PLA *(polylactic acid)* in various articles, we created this glossary. Its purpose is to provide an overview of relevant terminology of the bioplastics industry.

Since this glossary will not be printed in each issue you can download a pdf version from our website (bit.ly/0unBB0).

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Version 4.0 was revised using EuBP's latest version (Jan 2015).
bM ... refers to more comprehensive article previously published in bioplastics MAGAZINE

Bioplastics (as defined by European Bioplastics e.V.) is a term used to define two different kinds of plastics:

a. Plastics based on → renewable resources (the focus is the origin of the raw material used). These can be biodegradable or not.

b. → Biodegradable and → compostable plastics according to EN13432 or similar standards (the focus is the compostability of the final product; biodegradable and compostable plastics can be based on renewable (biobased) and/or non-renewable (fossil) resources).

Bioplastics may be

- based on renewable resources and biodegradable;
- based on renewable resources but not be biodegradable; and
- based on fossil resources and biodegradable.

1st Generation feedstock | Carbohydrate-rich plants such as corn or sugar cane that can also be used as food or animal feed are called food crops or 1st generation feedstock. Bred by mankind over centuries for highest energy efficiency, currently, 1st generation feedstock is the most efficient feedstock for the production of bioplastics as it requires the least amount of land to grow and produce the highest yields. [bM 04/09]

2nd Generation feedstock | refers to feedstock not suitable for food or feed. It can be either non-food crops (e.g. cellulose) or waste materials from 1st generation feedstock (e.g. waste vegetable oil). [bM 06/11]

3rd Generation feedstock | This term currently relates to biomass from algae, which – having a higher growth yield than 1st and 2nd generation feedstock – were given their own category. It also relates to bioplastics from waste streams such as CO_2 or methane. [bM 02/16]

Aerobic digestion | Aerobic means *in the presence of oxygen*. In → composting, which is an aerobic process, → microorganisms access the present oxygen from the surrounding atmosphere. They metabolize the organic material to energy, CO_2, water and cell biomass, whereby part of the energy of the organic material is released as heat. [bM 03/07, bM 02/09]

Anaerobic digestion | In anaerobic digestion, organic matter is degraded by a microbial population *in the absence of oxygen* and producing methane and carbon dioxide (= → biogas) and a solid residue that can be composted in a subsequent step without practically releasing any heat. The biogas can be treated in a Combined Heat and Power Plant (CHP), producing electricity and heat, or can be upgraded to bio-methane [14]. [bM 06/09]

Amorphous | Non-crystalline, glassy with unordered lattice

Amylopectin | Polymeric branched starch molecule with very high molecular weight (biopolymer, monomer is → glucose). [bM 05/09]

Amylose | Polymeric non-branched starch molecule with high molecular weight (biopolymer, monomer is → glucose). [bM 05/09]

Biobased | The term biobased describes the part of a material or product that is stemming from → biomass. When making a biobased-claim, the unit (→ biobased carbon content, → biobased mass content), a percentage and the measuring method should be clearly stated [1].

Biobased carbon | Carbon contained in or stemming from → biomass. A material or product made of fossil and → renewable resources contains fossil and → biobased carbon.

The biobased carbon content is measured via the ^{14}C method (radiocarbon dating method) that adheres to the technical specifications as described in [1,4,5,6].

Biobased labels | The fact that (and to what percentage) a product or a material is → biobased can be indicated by respective labels. Ideally, meaningful labels should be based on harmonised standards and a corresponding certification process by independent third-party institutions. For the property *biobased* such labels are in place by certifiers → DIN CERTCO and → TÜV Austria who both base their certifications on the technical specification as described in [4,5].

A certification and the corresponding label depicting the biobased mass content was developed by the French Association Chimie du Végétal [ACDV].

Biobased mass content | describes the amount of biobased mass contained in a material or product. This method is complementary to the ^{14}C method, and furthermore, takes other chemical elements besides the biobased carbon into account, such as oxygen, nitrogen and hydrogen. A measuring method has been developed and tested by the Association Chimie du Végétal (ACDV) [1].

Biobased plastic | A plastic in which constitutional units are totally or partly from → biomass [3]. If this claim is used, a percentage should always be given to which extent the product/material is → biobased [1]. [bM 01/07, bM 03/10]

Biodegradable Plastics | are plastics that are completely assimilated by the → microorganisms present a defined environment as food for their energy. The carbon of the plastic must completely be converted into CO_2 during the microbial process.

The process of biodegradation depends on the environmental conditions, which influence it (e.g. location, temperature, humidity) and on the material or application itself. Consequently, the process and its outcome can vary considerably. Biodegradability is linked to the structure of the polymer chain; it does not depend on the origin of the raw materials.

There is currently no single, overarching standard to back up claims about biodegradability.

One standard, for example, is ISO or in Europe: EN 14995 Plastics - Evaluation of compostability - Test scheme and specifications. [bM 02/06, bM 01/07]

Biogas | → Anaerobic digestion

Biomass | Material of biological origin excluding material embedded in geological formations and material transformed to fossilised material. This includes organic material, e.g. trees, crops, grasses, tree litter, algae and waste of biological origin, e.g. manure [1, 2].

Biorefinery | the co-production of a spectrum of bio-based products (food, feed, materials, chemicals including monomers or building blocks for bioplastics) and energy (fuels, power, heat) from biomass. [bM 02/13]

Blend | Mixture of plastics, polymer alloy of at least two microscopically dispersed and molecularly distributed base polymers.

Bisphenol-A (BPA) | Monomer used to produce different polymers. BPA is said to cause health problems, it behaves like a hormone. Therefore, it is banned for use in children's products in many countries.

BPI | Biodegradable Products Institute, a not-for-profit association. Through their innovative compostable label program, BPI educates manufacturers, legislators and consumers about the importance of scientifically based standards for compostable materials which biodegrade in large composting facilities.

Carbon footprint | (CFPs resp. PCFs – Product Carbon Footprint): Sum of → greenhouse gas emissions and removals in a product system, expressed as CO_2 equivalent, and based on a → Life Cycle Assessment. The CO_2 equivalent of a specific amount of greenhouse gas is calculated as the mass of a given greenhouse gas multiplied by its → global warming potential [1,2,15].

Carbon neutral, CO_2 neutral | describes a product or process that has a negligible impact on total atmospheric CO_2 levels. For example, carbon neutrality means that any CO_2 released when a plant decomposes or is burnt is offset by an equal amount of CO_2 absorbed by the plant through photosynthesis when it is growing.

Carbon neutrality can also be achieved by buying sufficient carbon credits to make up the difference. The latter option is not allowed when communicating → LCAs or carbon footprints regarding a material or product [1, 2].

Carbon-neutral claims are tricky as products will not in most cases reach carbon neutrality if their complete life cycle is taken into consideration (including the end-of-life).

If an assessment of a material, however, is conducted (cradle-to-gate), carbon neutrality might be a valid claim in a B2B context. In this case, the unit assessed in the complete life cycle has to be clarified [1].

Cascade use | of → renewable resources means to first use the → biomass to produce biobased industrial products and afterwards – due to their favourable energy balance – use them for energy generation (e.g. from a biobased plastic product to → biogas production). The feedstock is used efficiently and value generation increases decisively.

Catalyst | Substance that enables and accelerates a chemical reaction.

Cellophane | Clear film based on → cellulose. [bM 01/10]

Cellulose | is the principal component of cell walls in all higher forms of plant life, at varying percentages. It is therefore the most common organic compound and also the most common polysaccharide (multi-sugar) [11]. Cellulose is a polymeric molecule with very high molecular weight (monomer is → gucose), industrial production from wood or cotton, to manufacture paper, plastics and fibres. [bM 01/10]

Cellulose ester | occurs by the esterification of cellulose with organic acids. The most important cellulose esters from a technical point of view are cellulose acetate (CA with acetic acid), cellulose propionate (CP with propionic acid) and cellulose butyrate (CB with butanoic acid). Mixed polymerisates, such as cellulose acetate propionate (CAP) can also be formed. One of the most well-known applications of cellulose aceto butyrate (CAB) is the moulded handle on the Swiss army knife [11].

Cellulose acetate CA | → Cellulose ester

CEN | Comité Européen de Normalisation (European organisation for standardization).

Certification | is a process in which materials/products undergo a string of (laboratory) tests to verify that they fulfil certain requirements. Sound certification systems should be based on (ideally harmonised) European standards or technical specifications (e.g. by → CEN, USDA, ASTM, etc.) and be performed by independent third-party laboratories. Successful certification guarantees high product safety - also on this basis, interconnected labels can be awarded that help the consumer to make an informed decision.

Compost | A soil conditioning material of decomposing organic matter which provides nutrients and enhances soil structure. [bM 06/08, 02/09]

Compostable Plastics | Plastics that are → biodegradable under → *composting* conditions: specified humidity, temperature, → microorganisms and time frame. To make accurate and specific claims about compostability, the location (home, → industrial) and time frame need to be specified [1]. Several national and international standards exist for clearer definitions, for example EN 14995 Plastics - Evaluation of compostability - Test scheme and specifications. [bM 02/06, bM 01/07]

Composting | is the controlled → aerobic, or oxygen-requiring, decomposition of organic materials by → microorganisms, under controlled conditions. It reduces the volume and mass of the raw materials while transforming them into CO_2, water and a valuable soil conditioner – compost.

When talking about composting of bioplastics, foremost → industrial composting in a managed composting facility is meant (criteria defined in EN 13432).

The main difference between industrial and home composting is, that in industrial composting facilities temperatures are much higher and kept stable, whereas in the composting pile temperatures are usually lower, and less constant as depending on factors such as weather conditions. Home composting is a way slower-paced process than industrial composting. Also, a comparatively smaller volume of waste is involved. [bM 03/07]

Compound | Plastic mixture from different raw materials (polymer and additives). [bM 04/10].

Copolymer | Plastic composed of different monomers.

Cradle-to-Gate | Describes the system boundaries of an environmental → Life Cycle Assessment (LCA) which covers all activities from the *cradle* (i.e., the extraction of raw materials, agricultural activities and forestry) up to the factory *gate*.

Cradle-to-Cradle | (sometimes abbreviated as C2C): Is an expression which communicates the concept of a closed-cycle economy, in which waste is used as raw material ('waste equals food'). Cradle-to-Cradle is not a term that is typically used in → LCA studies.

Cradle-to-Grave | Describes the system boundaries of a full → Life Cycle Assessment from manufacture (*cradle*) to use phase and disposal phase (*grave*).

Crystalline | Plastic with regularly arranged molecules in a lattice structure.

Density | Quotient from mass and volume of a material, also referred to as specific weight .

DIN | Deutsches Institut für Normung (German organisation for standardization).

DIN-CERTCO | Independent certifying organisation for the assessment on the conformity of bioplastics.

Dispersing | Fine distribution of non-miscible liquids into a homogeneous, stable mixture.

Drop-In bioplastics | are chemically identical to conventional petroleum-based plastics but made from renewable resources. Examples are bio-PE made from bio-ethanol (from e.g. sugar cane) or partly biobased PET; the monoethylene glycol made from bio-ethanol (from e.g. sugar cane). Developments to make terephthalic acid from renewable resources are underway. Other examples are polyamides (partly biobased e.g. PA 4.10 or PA 6.10 or fully biobased like PA 5.10 or PA11).

EN 13432 | European standard for the assessment of the → compostability of plastic packaging products.

Energy recovery | Recovery and exploitation of the energy potential in (plastic) waste for the production of electricity or heat in waste incineration plants (waste-to-energy).

Environmental claim | A statement, symbol or graphic that indicates one or more environmental aspect(s) of a product, component, packaging or service [16].

Enzymes | are proteins that catalyze chemical reactions.

Enzyme-mediated plastics | are not → bioplastics. Instead, a conventional non-biodegradable plastic (e.g. fossil-based PE) is enriched with small amounts of an organic additive. Microorganisms are supposed to consume these additives and the degradation process should then expand to the non-biodegradable PE and thus make the material degrade. After some time the plastic is supposed to visually disappear and to be completely converted to carbon dioxide and water. This is a theoretical concept which has not been backed up by any verifiable proof so far. Producers promote enzyme-mediated plastics as a solution to littering. As no proof for the degradation process has been provided, environmental beneficial effects are highly questionable.

Ethylene | Colour- and odourless gas, made e.g. from, Naphtha (petroleum) by cracking or from bio-ethanol by dehydration. The monomer of the polymer polyethylene (PE).

European Bioplastics e.V. | The industry association representing the interests of Europe's thriving bioplastics' industry. Founded in Germany in 1993 as IBAW, European Bioplastics today represents the interests of about 50 member companies throughout the European Union and worldwide. With members from the agricultural feedstock, chemical and plastics industries, as well as industrial users and recycling companies, European Bioplastics serves as both a contact platform and catalyst for advancing the aims of the growing bioplastics industry.

Extrusion | Process used to create plastic profiles (or sheet) of a fixed cross-section consisting of mixing, melting, homogenising and shaping of the plastic.

FDCA | 2,5-furandicarboxylic acid, an intermediate chemical produced from 5-HMF. The dicarboxylic acid can be used to make → PEF = polyethylene furanoate, a polyester that could be a 100% biobased alternative to PET.

Fermentation | Biochemical reactions controlled by → microorganisms or → enzymes (e.g. the transformation of sugar into lactic acid).

FSC | The Forest Stewardship Council is an independent, non-governmental, not-for-profit organization established to promote the responsible and sustainable management of the world's forests.

Gelatine | Translucent brittle solid substance, colourless or slightly yellow, nearly tasteless and odourless, extracted from the collagen inside animals' connective tissue.

Genetically modified organism (GMO) | Organisms, such as plants and animals, whose genetic material (DNA) has been altered are called genetically modified organisms (GMOs). Food and feed which contain or consist of such GMOs, or are produced from GMOs, are called genetically modified (GM) food or feed [1]. If GM crops are used in bioplastics production, the multiple-stage processing and the high heat used to create the polymer removes all traces of genetic material. This means that the final bioplastics product contains no genetic traces. The resulting bioplastics are therefore well suited to use in food packaging as it contains no genetically modified material and cannot interact with the contents.

Global Warming | is the rise in the average temperature of Earth's atmosphere and oceans since the late 19th century and its projected continuation [8]. Global warming is said to be accelerated by → greenhouse gases.

Glucose | is a monosaccharide (or simple sugar). It is the most important carbohydrate (sugar) in biology. Glucose is formed by photosynthesis or hydrolyse of many carbohydrates e.g. starch.

Greenhouse gas GHG | Gaseous constituent of the atmosphere, both natural and anthropogenic, that absorbs and emits radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds [1, 9].

Greenwashing | The act of misleading consumers regarding the environmental practices of a company, or the environmental benefits of a product or service [1, 10].

Granulate, granules | Small plastic particles (3-4 millimetres), a form in which plastic is sold and fed into machines, easy to handle and dose.

HMF (5-HMF) | 5-hydroxymethylfurfural is an organic compound derived from sugar dehydration. It is a platform chemical, a building block for 20 performance polymers and over 175 different chemical substances. The molecule consists of a furan ring which contains both aldehyde and alcohol functional groups. 5-HMF has applications in many different industries such as bioplastics, packaging, pharmaceuticals, adhesives and chemicals. One of the most promising routes is 2,5 furandicarboxylic acid (FDCA), produced as an intermediate when 5-HMF is oxidised. FDCA is used to produce PEF, which can substitute terephthalic acid in polyester, especially polyethylene terephthalate (PET). [bM 03/14, 02/16]

Home composting | → composting [bM 06/08]

Humus | In agriculture, *humus* is often used simply to mean mature → compost, or natural compost extracted from a forest or other spontaneous source for use to amend soil.

Hydrophilic | Property: *water-friendly*, soluble in water or other polar solvents (e.g. used in conjunction with a plastic which is not waterresistant and weatherproof or that absorbs water such as polyamide (PA).

Hydrophobic | Property: *water-resistant*, not soluble in water (e.g. a plastic which is water-resistant and weather-proof, or that does not absorb any water such as polyethylene (PE) or polypropylene (PP).

Industrial composting | is an established process with commonly agreed-upon requirements (e.g. temperature, time frame) for transforming biodegradable waste into stable, sanitised products to be used in agriculture. The criteria for industrial compostability of packaging have been defined in the EN 13432. Materials and products complying with this standard can be certified and subsequently labelled accordingly [1,7]. [bM 06/08, 02/09]

ISO | International Organization for Standardization

JBPA | Japan Bioplastics Association

Land use | The surface required to grow sufficient feedstock for today's bioplastic production is less than 0.01 % of the global agricultural area of 5 billion hectares. It is not yet foreseeable to what extent an increased use of food residues, non-food crops or cellulosic biomass (see also → 1st/2nd/3rd generation feedstock) in bioplastics production might lead to an even further reduced land use in the future. [bM 04/09, 01/14]

LCA(Life Cycle Assessment) | is the compilation and evaluation of the input, output and the potential environmental impact of a product system throughout its life cycle [17]. It is sometimes also referred to as life cycle analysis, ecobalance or cradle-to-grave analysis. [bM 01/09]

Littering | is the (illegal) act of leaving waste such as cigarette butts, paper, tins, bottles, cups, plates, cutlery, or bags lying in an open or public place.

Marine litter | Following the European Commission's definition, "marine litter consists of items that have been deliberately discarded, unintentionally lost, or transported by winds and rivers, into the sea and on beaches. It mainly consists of plastics, wood, metals, glass, rubber, clothing and paper". Marine debris originates from a variety of sources. Shipping and fishing activities are the predominant sea-based, ineffectively managed landfills as well as public littering the mainland-based sources. Marine litter can pose a threat to living organisms, especially due to ingestion or entanglement.

Currently, there is no international standard available, which appropriately describes the biodegradation of plastics in the marine environment. However, several standardisation projects are in progress at ISO and ASTM level. Furthermore, the European project OPEN BIO addresses the marine biodegradation of biobased products. [bM 02/16]

Mass balance | describes the relationship between input and output of a specific substance within a system in which the output from the system cannot exceed the input into the system.

First attempts were made by plastic raw material producers to claim their products *renewable* (plastics) based on a certain input of biomass in a huge and complex chemical plant, then mathematically allocating this biomass input to the produced plastic.

These approaches are at least controversially disputed. [bM 04/14, 05/14, 01/15]

Microorganism | Living organisms of microscopic sizes, such as bacteria, fungi or yeast.

Molecule | A group of at least two atoms held together by covalent chemical bonds.

Monomer | Molecules that are linked by polymerization to form chains of molecules and then plastics.

Mulch film | Foil to cover the bottom of farmland.

Organic recycling | means the treatment of separately collected organic waste by anaerobic digestion and/or composting.

Oxo-degradable / Oxo-fragmentable | materials and products that do not biodegrade! The underlying technology of oxo-degradability or oxo-fragmentation is based on special additives, which, if incorporated into standard resins, are purported to accelerate the fragmentation of products made thereof. Oxo-degradable or oxo-fragmentable materials do not meet accepted industry standards on compostability such as EN 13432. [bM 01/09, 05/09]

PBAT | Polybutylene adipate terephthalate, is an aliphatic-aromatic copolyester that has the properties of conventional polyethylene but is fully biodegradable under industrial composting. PBAT is made from fossil petroleum with first attempts being made to produce it partly from renewable resources. [bM 06/09]

PBS | Polybutylene succinate, a 100% biodegradable polymer, made from (e.g. bio-BDO) and succinic acid, which can also be produced biobased. [bM 03/12]

PC | Polycarbonate, thermoplastic polyester, petroleum-based and not degradable, used e.g. for baby bottles or CDs. Criticized for its BPA (→ Bisphenol-A) content.

PCL | Polycaprolactone, a synthetic (fossil-based), biodegradable bioplastic, e.g. used as a blend component.

PE | Polyethylene, thermoplastic polymerised from ethylene. Can be made from renewable resources (sugar cane via bio-ethanol). [bM 05/10]

PEF | Polyethylene furanoate, a polyester made from monoethylene glycol (MEG) and → FDCA (2,5-furandicarboxylic acid, an intermediate chemical produced from 5-HMF). It can be a 100% biobased alternative for PET. PEF also has improved product characteristics, such as better structural strength and improved barrier behaviour, which will allow for the use of PEF bottles in additional applications. [bM 03/11, 04/12]

PET | Polyethylenterephthalate, transparent polyester used for bottles and film. The polyester is made from monoethylene glycol (MEG), that can be renewably sourced from bio-ethanol (sugar cane) and (until now fossil) terephthalic acid. [bM 04/14]

PGA | Polyglycolic acid or polyglycolide is a biodegradable, thermoplastic polymer and the simplest linear, aliphatic polyester. Beside its use in the biomedical field, PGA has been introduced as a barrier resin. [bM 03/09]

PHA | Polyhydroxyalkanoates (PHA) are a family of biodegradable polyesters. As in many mammals, including humans, that hold energy reserves in the form of body fat some bacteria hold intracellular reserves in form of of polyhydroxyalkanoates. Here the micro-organisms store a particularly high level of energy reserves (up to 80% of their body weight)

for when their sources of nutrition become scarce. By *farming* this type of bacteria, and feeding them on sugar or starch (mostly from maize), or at times on plant oils or other nutrients rich in carbonates, it is possible to obtain PHA's on an industrial scale [11]. The most common types of PHA are PHB (Polyhydroxybutyrate, PHBV and PHBH. Depending on the bacteria and their *food*, PHAs with different mechanical properties, from rubbery soft trough stiff and hard as ABS, can be produced. Some PHAs are even biodegradable in soil or in marine environment.

PLA | Polylactide or polylactic acid (PLA), a biodegradable, thermoplastic, linear aliphatic polyester based on lactic acid, a natural acid, is mainly produced by fermentation of sugar or starch with the help of micro-organisms. Lactic acid comes in two isomer forms, i.e. as laevorotatory D(-)lactic acid and as dextrorotary L(+)lactic acid.

Modified PLA types can be produced by the use of the right additives or by certain combinations of L- and D- lactides (stereocomplexing), which then have the required rigidity for use at higher temperatures [13]. [bM 01/09, 01/12]

Plastics | Materials with large molecular chains of natural or fossil raw materials, produced by chemical or biochemical reactions.

PPC | Polypropylene carbonate, a bioplastic made by copolymerizing CO_2 with propylene oxide (PO). [bM 04/12]

PTT | Polytrimethylterephthalate (PTT), partially biobased polyester, is similarly produced to PET using terephthalic acid or dimethyl terephthalate and a diol. In this case it is a biobased 1,3 propanediol, also known as bio-PDO. [bM 01/13, 04/20]

Renewable resources | Agricultural raw materials, which are not used as food or feed, but as raw material for industrial products or to generate energy. The use of renewable resources by industry saves fossil resources and reduces the amount of → greenhouse gas emissions. Biobased plastics are predominantly made of annual crops such as corn, cereals, and sugar beets or perennial cultures such as cassava and sugar cane.

Resource efficiency | Use of limited natural resources in a sustainable way while minimising impacts on the environment. A resource-efficient economy creates more output or value with lesser input.

Seedling logo | The compostability label or logo *Seedling* is connected to the standard EN 13432/EN 14995 and a certification process managed by the independent institutions → DIN CERTCO and → TÜV Austria. Bioplastics products carrying the Seedling fulfil the criteria laid down in the EN 13432 regarding industrial compostability. [bM 01/06, 02/10]

Saccharides or carbohydrates | Saccharides or carbohydrates are names for the sugar-family. Saccharins are monomer or polymer sugar units. For example, there are known mono-, di- and polysaccharides. → glucose is a monosaccaride. They are important for the diet and produced biology in plants.

Semi-finished products | Pplastic in form of sheet, film, rods or the like to be further processed into finished products.

Sorbitol | Sugar alcohol, obtained by reduction of glucose changing the aldehyde group to an additional hydroxyl group. It is used as a plasticiser for bioplastics based on starch.

Starch | Natural polymer (carbohydrate) consisting of → amylose and → amylopectin, gained from maize, potatoes, wheat, tapioca etc. When glucose is connected to polymer-chains in a definite way the result (product) is called starch. Each molecule is based on 300 -12000-glucose units. Depending on the connection, there are two types known → amylose and → amylopectin. [bM 05/09]

Starch derivatives | are based on the chemical structure of → starch. The chemical structure can be changed by introducing new functional groups without changing the → starch polymer. The product has different chemical qualities. Mostly the hydrophilic character is not the same.

Starch-ester | One characteristic of every starch-chain is a free hydroxyl group. When every hydroxyl group is connected with an acid the product is starch-ester with different chemical properties.

Starch propionate and starch butyrate | can be synthesised by treating the → starch with propane or butanoic acid. The product structure is still based on → starch. Every based → glucose fragment is connected with a propionate or butyrate ester group. The product is more hydrophobic than → starch.

Sustainable | An attempt to provide the best outcomes for the human and natural environments both now and into the indefinite future. One famous definition of sustainability is the one created by the Brundtland Commission, led by the former Norwegian Prime Minister G. H. Brundtland. It defined sustainable development as development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs.' Sustainability relates to the continuity of economic, social, institutional and environmental aspects of human society, as well as the non-human environment.

Sustainable sourcing | of renewable feedstock for biobased plastics is a prerequisite for more sustainable products. Impacts such as the deforestation of protected habitats or social and environmental damage arising from poor agricultural practices must be avoided. Corresponding certification schemes, such as ISCC PLUS, WLC or Bon-Sucro, are an appropriate tool to ensure the sustainable sourcing of biomass for all applications around the globe.

Sustainability | as defined by European Bioplastics, has three dimensions: economic, social and environmental. This has been known as "the triple bottom line of sustainability". This means that sustainable development involves the simultaneous pursuit of economic prosperity, environmental protection and social equity. In other words, businesses have to expand their responsibility to include these environmental and social dimensions. Sustainability is about making products useful to markets and, at the same time, having societal benefits and lower environmental impact than the alternatives currently available. It also implies a commitment to continuous improvement that should result in a further reduction of the environmental footprint of today's products, processes and raw materials used.

Thermoplastics | Plastics which soften or melt when heated and solidify when cooled (solid at room temperature).

Thermoplastic Starch | (TPS) → starch that was modified (cooked, complexed) to make it a plastic resin.

Thermoset | Plastics (resins) which do not soften or melt when heated. Examples are epoxy resins or unsaturated polyester resins.

TÜV Austria Belgium | Independent certifying organisation for the assessment on the conformity of bioplastics (formerly Vinçotte).

Vinçotte | → TÜV Austria Belgium

WPC | Wood Plastic Composite. Composite materials made of wood fibre/flour and plastics (mostly polypropylene).

Yard Waste | Grass clippings, leaves, trimmings, garden residue.

References:

[1] Environmental Communication Guide, European Bioplastics, Berlin, Germany, 2012

[2] ISO 14067. Carbon footprint of products - Requirements and guidelines for quantification and communication

[3] CEN TR 15932, Plastics - Recommendation for terminology and characterisation of biopolymers and bioplastics, 2010

[4] CEN/TS 16137, Plastics - Determination of bio-based carbon content, 2011

[5] ASTM D6866, Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis

[6] SPI: Understanding Biobased Carbon Content, 2012

[7] EN 13432, Requirements for packaging recoverable through composting and biodegradation. Test scheme and evaluation criteria for the final acceptance of packaging, 2000

[8] Wikipedia

[9] ISO 14064 Greenhouse gases -- Part 1: Specification with guidance..., 2006

[10] Terrachoice, 2010, www.terrachoice.com

[11] Thielen, M.: Bioplastics: Basics. Applications. Markets, Polymedia Publisher, 2012

[12] Lörcks, J.: Biokunststoffe, Broschüre der FNR, 2005

[13] de Vos, S.: Improving heat-resistance of PLA using poly(D-lactide), bioplastics MAGAZINE, Vol. 3, Issue 02/2008

[14] de Wilde, B.: Anaerobic Digestion, bioplastics MAGAZINE, Vol 4., Issue 06/2009

[15] ISO 14067 onb Corbon Footprint of Products

[16] ISO 14021 on Self-declared Environmental claims

[17] ISO 14044 on Life Cycle Assessment