European Commission

Insights into the European market for bio-based chemicals

Factsheets for 10 bio-based product categories

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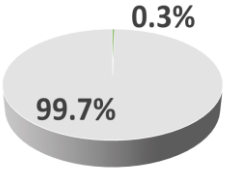
BIO-BASED PLATFORM CHEMICALS

DEFINITION

Platform chemicals are chemical building blocks and starting materials in the formulation of a broad range of products. Platform chemicals form, by definition, a large group and are very diverse in nature.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
181 kt/a	**197 kt/a**	



Import dependence: **9%**
Expected annual growth: **10%**

KEY PRODUCTS EU-28

- Bio-based platform chemicals made with bioethanol: **acetic acid** (24.5 kt/a) and **acetic anhydride** (10 kt/a).
- Other bio-based platform chemicals: **propylene glycol** (20 kt/a), **1,3-propanediol** (8 kt/a), **lactic acid** (64.5 kt/a) and **epichlorohydrin** (36 kt/a).
- Examples of bio-based platform chemicals consumed but not produced in the EU: **ethylene**, **ethylene glycol** and **sebacic acid**.

MARKET DESCRIPTION EU-28

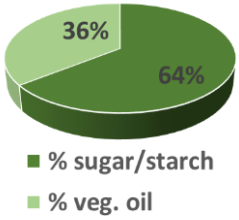
Production maturity

Low	Med	High

Importance of the EU

Low	Med	High

Feedstock use



APPLICATION SECTORS

Building blocks for chemical production

DRIVERS

- The need to reduce fossil dependence in other downstream sectors creates a market for bio-based building blocks.
- Diverse feedstock use creates flexibility in the supply chain.

CONSTRAINTS

- Large amount of investment needed for new production plants.
- Biomass availability in case of full rollout.
- Lack of legislation directly targeting greenhouse gas reduction (a CO_2 tax).

CONCLUSIONS AND OUTLOOK

The bio-based platform chemical market is still young, with a bio-based share of 0.3%. The large investments needed for conversion to a bio-based industry are a major hurdle to be overcome and the chemical industry will need time to find the funds. However, new plants are planned or under construction, which will cause rapid growth in the supply of bio-based platform chemicals.

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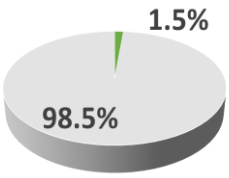
BIO-BASED SOLVENTS

DEFINITION

Solvents are compounds that are able to dissolve other substances without chemically changing them. Organic solvents can be divided into three groups: oxygenated, hydrocarbon and halogenated solvents.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
75 kt/a	**107 kt/a**	



Import dependence: **43%**
Expected annual growth: **1%**

KEY PRODUCTS EU-28

- Example of a bio-based solvent with oxygenated compounds: **ethyl acetate** (36 kt/a)
- Example of a hydrocarbon bio-solvent: **turpentine** (70 kt/a)
- Halogenated solvents have not yet reached TRL 8.
- Examples of bio-based solvents consumed but not produced in the EU: **iso-butanol**, **ethyl lactate**, **acetone**.

MARKET DESCRIPTION EU-28

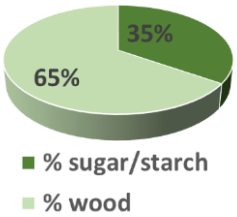
Production maturity

Low | Med | High

Importance of the EU

Low | Med | High

Feedstock use



APPLICATION SECTORS

Inks, paints, adhesives, cosmetics, thinners

DRIVERS

- The need to reduce fossil dependency.
- Increasing awareness of harmful effects of fossil-based solvents in personal care.
- Functional benefits, such as biodegradability.

CONSTRAINTS

- Perceived lack of biomass availability in case of a full rollout, due to the large volumes.
- High (production) costs.
- Lack of incentive to change.

CONCLUSIONS AND OUTLOOK

Only 3% of global bio-based solvents production takes place in the EU and 43% of the bio-based solvents consumed in the EU are imported. These figures are not expected to improve soon, with the industry dealing with more pressing problems such as VOC emissions and health and safety issues rather than greenhouse gas emission reduction. This keeps bio-based solvents limited to applications such as paints, coatings, inks, pharmaceuticals and cosmetics.

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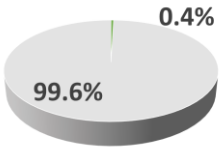
BIO-BASED POLYMERS FOR PLASTICS

DEFINITION

Plastics comprise a whole family of polymers with different properties and applications. Plastics are usually classified by the chemical structure of the polymer's backbone and side chains.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
268 kt/a	**247 kt/a**	



Import dependence: **–8%**
Expected annual growth: **4%**

KEY PRODUCTS EU-28

- The distinction is often made between biodegradable plastics and (non-biodegradable) drop-in plastics.
- Examples of biodegradable plastics: **starch used for plastics** (130 kt/a), **PHA** (2.3 kt/a) and **PLA** (7 kt/a)
- Examples of drop-in bio-plastics: **bio-PE** (0 kt/a) and **bio-PET** (0 kt/a).

MARKET DESCRIPTION EU-28

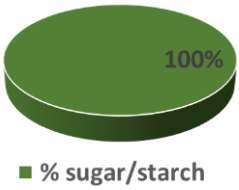
Production maturity

Low | **Med** | High

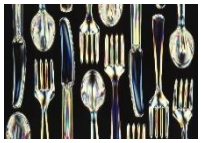
Importance of the EU

Low | Med | **High**

Feedstock use



APPLICATION SECTORS


Packaging, disposable items

DRIVERS

- Consumer demand.
- Growing awareness about environmental impact of fossil-based products.
- Pull from large brand owners.
- Widespread R&D activity.

CONSTRAINTS

- Bio-plastics production and the plastic recycling sectors are not in harmony.
- Higher cost of bio-based plastics compared with their fossil-based counterparts.
- Lack of investment and infrastructure.

CONCLUSIONS AND OUTLOOK

The environmental concerns relating to plastic use are very visible to consumers, which has resulted in a pull from major brands in the EU to move towards bio-based polymers for plastics to address sustainability issues such as biodegradability, fossil oil dependence and CO_2 emission reduction. Combined with the strong starch production in the EU, this results in net exports of bio-based polymers for plastics. The market is expected to continue to grow by 4% per year in the coming 5 years.

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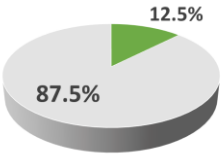
BIO-BASED PAINTS, COATINGS, INKS AND DYES

DEFINITION

Paints, coatings, inks and dyes are mixtures of several components, of which the largest volume consists of solvents and polymers.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
1,002 kt/a	**1,293 kt/a**	



Import dependence: **29%**
Expected annual growth: **2%**

KEY PRODUCTS EU-28

- The four main constituents of paints are solvents, binders, pigments and additives.
- **PUR** (39 kt/a) is a polymer that can be partly bio-based. **Alkyd resins** (432 kt/a) are bio-based polymers typically applied in paints, coatings and inks. **Ricinoleic acid** (0 kt/a) is an important bio-based additive.

MARKET DESCRIPTION EU-28

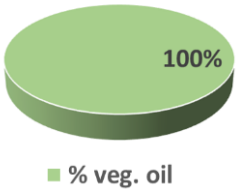
Production maturity

Low	Med	High

Importance of the EU

Low	Med	High

Feedstock use



APPLICATION SECTORS

Paints, coatings, inks and dyes

DRIVERS

- Reducing the environmental footprint to meet consumer demand.
- Functional benefits.
- Advanced small-scale technology.

CONSTRAINTS

- Investments in large-scale plants hindered by the lack of a secure sales market.
- Unwillingness to pay a green premium.
- Often lower quality than fossil-based versions.

CONCLUSIONS AND OUTLOOK

With some traditional bio-based products, such as alkyd resins, the paints, coatings, inks and dyes product category currently has a bio-based share of about 12.5%. The bio-based market is expected to grow, but not by more than a few percent. Weaknesses lie in the perceived risk of investing in this category and uncertainty about sales of the bio-based products.

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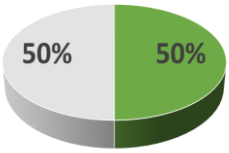
BIO-BASED SURFACTANTS

DEFINITION

Surfactants are usually amphiphilic organic compounds containing both hydrophobic groups (the tail) and hydrophilic groups (the head). Bio-based surfactants are surfactants in which at least one of the two groups is obtained from plants.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
1,500 kt/a	**1,800 kt/a**	



Import dependence: **20%**
Expected annual growth: **4%**

KEY PRODUCTS EU-28

- Many bio-based surfactants are based on vegetable oil, such as **glycolipids** (10 kt/a), **sophorolipids** (50 kt/a) and **esterquats** (130 kt/a).
- The category also contains products from sugar (**APG**, 50 kt/a) and starch (**carboxy methyl starch**, 25 kt/a).

MARKET DESCRIPTION EU-28

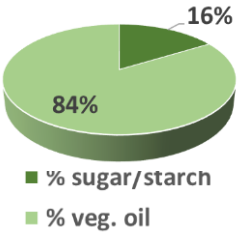
Production maturity

Low	Med	**High**

Importance of the EU

Low	**Med**	High

Feedstock use



APPLICATION SECTORS

Fabric softener, detergents, paper making

DRIVERS

- Functional benefits (low toxicity, biodegradability).
- Regulations restricting the use of fossil products (Regulation EC No 648/2004).

CONSTRAINTS

- High production cost due to the cost of substrates and the more challenging purification processes.
- Low public awareness about bio-based products.

CONCLUSIONS AND OUTLOOK

The large-scale use of bio-based oleochemicals in surfactants leads to a high bio-based share, 50%. Bio-based surfactants often have functional benefits such as lower toxicity and/or biodegradability over petrol-based surfactants. The market is further driven by legislation that favours the use of biodegradable surfactants. Bio-based surfactants form a stable, mature market, which is expected to grow at the same rate as the total surfactants market.

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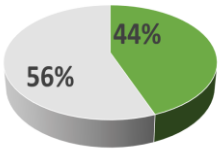
BIO-BASED COSMETICS AND PERSONAL CARE PRODUCTS

DEFINITION

Cosmetics and personal care products include bath and shower products, decorative cosmetics, deodorants, perfume, hair, skin and mouth care products, shaving products, soaps and sun protection products.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
558 kt/a	**558 kt/a**	

Import dependence: unknown
Expected annual growth: **3%**

KEY PRODUCTS EU-28

- The cosmetics industry produces a broad range of products with more than 5,000 ingredients.
- A selection of bio-based compounds used in cosmetics are **xanthan** (44 kt/a), **lauryl alcohol** (100 kt/a) and **stearyl alcohol** (100 kt/a).
- ***N*-acetyl glucosamine** (0 kt/a), **limonene** (4 kt/a) and **vanillin** (1.5 kt/a) are examples of small volume products typically – but not only – used in cosmetics.

MARKET DESCRIPTION EU-28

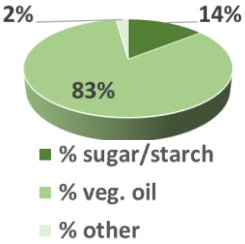
Production maturity

Low | Med | **High**

Importance of the EU

Low | Med | **High**

Feedstock use



APPLICATION SECTORS

Cosmetic and personal care products

DRIVERS

- Promotional benefit of marketing cosmetics as 'natural'.
- Growing demand or market, partly thanks to increasing consumer disposable income.

CONSTRAINTS

- 'Bio-based' is a poor marketing term.
- Cosmetics are often partly bio-based, but only 100% bio-based cosmetics are sold as 'natural', which is a good marketing term.

CONCLUSIONS AND OUTLOOK

Cosmetics have the advantage of being directly influenced by consumer demand. The desire for natural products, together with a history of bio-based products derived from fats and oils, results in a mature bio-based cosmetics market. Another advantage is that increased production costs play less of a role, with consumers willing to pay a green premium in this sector. The market is expected to continue to grow and seems to be particularly driven by consumer demand.

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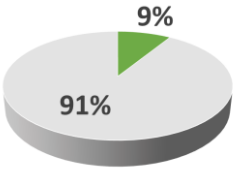
BIO-BASED ADHESIVES

DEFINITION

Adhesives are substances applied to one surface or both surfaces of two separate items to bind them together and prevent their separation.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
237 kt/a	**320 kt/a**	



Import dependence: **35%**
Expected annual growth: **10%**

KEY PRODUCTS EU-28

- Adhesives commonly consist of a polymer, sometimes in the form of a monomer, and a solvent.
- Examples of bio-based polymers in solvents: **methacrylates** (10 kt/a), **furfuryl alcohol** (40 kt/a), **epoxy resins** (4 kt/a) and **tall oil rosin** (141 kt/a).

MARKET DESCRIPTION EU-28

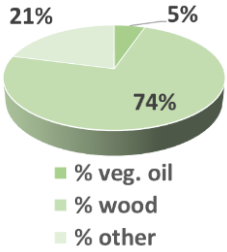
Production maturity

Low	**Med**	High

Importance of the EU

Low	Med	**High**

Feedstock use



APPLICATION SECTORS

Glues, paints, coatings, foundry industry, etc.

DRIVERS

- Growing awareness of the impact of fossil-based adhesives.
- Widespread R&D activity.
- Increasing number of bio-based applications.
- Regulations stimulating demand.

CONSTRAINTS

- Difficulties in maintaining consistent quality.
- Low interest of customers in bio-based adhesives as part of other products.
- Not a very 'circular' type of product (limited recycling possibilities).

CONCLUSIONS AND OUTLOOK

The EU produces a large volume of adhesives, accounting for 35% of global production. The EU's contribution to the bio-based adhesives market is even more pronounced, with 54% of the 441 kt/a global adhesive production coming from the EU. The industry expects that this market will continue to grow even further, with an increasing number of applications.

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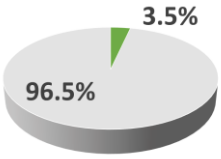
BIO-BASED LUBRICANTS

DEFINITION

Lubricants are substances, usually organic, introduced to reduce friction between surfaces in mutual contact, which ultimately reduces the heat generated when the surfaces move.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
237 kt/a	**220 kt/a**	



Import dependence: **–8%**
Expected annual growth: **1%**

KEY PRODUCTS EU-28

- Many lubricants are already produced with bio-based components, especially fatty acids, fatty alcohols and glycerol.
- Examples of bio-based lubricants are **iso-alkanes** (0 kt/a), **tall oil fatty acids** (2 kt/a), **fatty acid methyl esters** (116 kt/a) and **fatty acid PEG esters** (50 kt/a).

MARKET DESCRIPTION EU-28

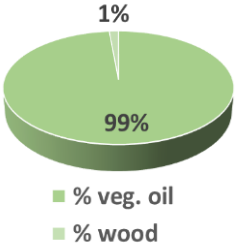
Production maturity

Low | Med | **High**

Importance of the EU

Low | Med | **High**

Feedstock use



APPLICATION SECTORS

Lubricants for chainsaws, engines, textiles, etc.

DRIVERS

- Growing automotive industry increases demand.
- Mainly based on the well-developed oils and fats platform
- Regulations stimulating use.

CONSTRAINTS

- Low awareness due to its applications.
- Difficult of obtaining desired properties (odour free, stable to oxidation, range of viscosities).
- More efficient use of lubricants and electric cars could decrease future demand.

CONCLUSIONS AND OUTLOOK

Owing to regulations on total-loss lubricants (e.g. Commission Decision 2011/381/EU), bio-based lubricants already have a mature market, which is found mostly in the Nordic countries. In these countries, total-loss lubricants are used, for example, for chainsaws. Further market growth will depend on the introduction of stimulating legislation in other sectors, for example for engine lubricants. Otherwise, the bio-based lubricant market is not expected to grow much.

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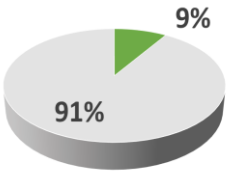
BIO-BASED PLASTICISERS

DEFINITION

Plasticisers or dispersants are additives that increase the plasticity or decrease the viscosity of a material.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
67 kt/a	**117 kt/a**	



Import dependence: **74%**
Expected annual growth: **3%**

KEY PRODUCTS EU-28

- **Succinic acid** (23 kt/a) is one of the most commonly used bio-based additives.
- **ESBO** is another commonly used bio-based plasticiser, but it is not produced in the EU.
- Another example of a bio-based plasticiser is **azelaic acid** (12.8 kt/a).

MARKET DESCRIPTION EU-28

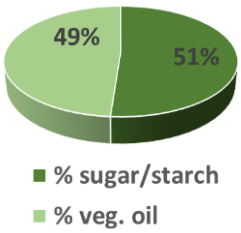
Production maturity

Low	Med	High

Importance of the EU

Low	Med	High

Feedstock use



APPLICATION SECTORS

Plastics production

DRIVERS

- Restrictions on the use of certain phthalates as part of REACH.
- Biodegradable plasticisers are important for application in biodegradable plastics.
- Greater safety.

CONSTRAINTS

- High production cost, due to feedstock, compared with the costs of phthalate-based plasticisers.
- Continuous changes in environmental guidelines.

CONCLUSIONS AND OUTLOOK

Thanks to a decrease in the use of certain toxic phthalate-based plasticisers in toys and childcare articles, there has been an increasing demand for bio-based alternatives. However, the higher costs of these plasticisers limit the market potential. Production takes place mostly outside the EU, with only 8% of bio-based plasticisers being produced within the EU's borders. This results in the EU having a high import dependence in relation to these products.

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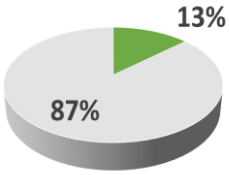
BIO-BASED MAN-MADE FIBRES

DEFINITION

Man-made fibres are polymers that are spun into fibres for various applications, which include a huge number of consumer and industrial products.

MARKET INDICATORS EU-28

Bio-based production:	Bio-based consumption:	Bio-based share in production:
600 kt/a	**630 kt/a**	13%



Import dependence: **5%**
Expected annual growth: **3%**

KEY PRODUCTS EU-28

- Examples of traditional bio-based fibres are **rayon** (600 kt/a) and **cellulose acetate** (165 kt/a).
- **Polyamide-11** (23 kt/a) and **polyamide-4,10** (1 kt/a) are dedicated bio-based fibres.
- **Polytrimethylene terephthalate** (**PTT**, 0 kt/a) is a drop-in bio-based fibre.

MARKET DESCRIPTION EU-28

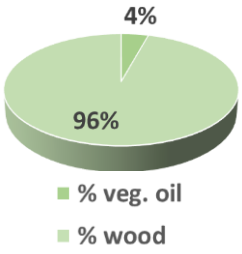
Production maturity

Low | **Med** | High

Importance of the EU

Low | **Med** | High

Feedstock use



APPLICATION SECTORS

Textiles, carpets, moulding, cables, pipes, etc.

DRIVERS

- Promotional benefit of a natural product.
- Promotional benefit when marketed as a biodegradable product.
- Growing demand and market.
- High EU environmental standards.

CONSTRAINTS

- Lower standards outside the EU.
- The distinction between traditional and novel bio-based man-made fibres, for example in relation to funding schemes, divides the industry.

CONCLUSIONS AND OUTLOOK

Both total and bio-based man-made fibre production takes place mainly outside the EU, i.e. only 2% of the global output of 36 Mt/a is produced in the EU. The market is very mixed, with some very mature products, such as rayon and cellulose acetate, and some newer products, such as polyamide-4,10 and PTT. Not all of these products are covered by funding schemes that are designed to promote a bio-based economy.

European Commission
Joint Research Centre

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