Reducing fuel consumption and emissions by reducing a vehicle’s weight is a central objective and major challenge for the automotive industry. A number of bioplastics materials are well suited to contributing towards this goal. Biobased plastics (e.g. biobased polyamides, biobased polyesters, etc.) are already successfully being used by leading automotive brands around the world today with the aim of reducing their products’ environmental impact.

This fact sheet presents an overview of available bioplastic materials, general benefits of bioplastics, bioplastics market development, and bioplastic performance in the automotive sector.

**What are bioplastics?**

Bioplastics comprise a range of materials with differing properties. European Bioplastics defines bioplastics as either biobased, biodegradable or both. This results in three main material groups:

1. Biobased or partially biobased, non-biodegradable (i.e. durable) plastics such as a. mass commodity plastics e.g. biobased polyethylene (PE), or polyethylene terephthalate (PET) b. biobased technical performance polymers e.g. Polytrimethylene terephthalate (PTT) or thermoplastic copolyester elastomers (TPC-ET) or bio-based polyamides

2. Plastics that are both biobased and biodegradable e.g. polylactic acid (PLA), polyhydroxyalkanoates (PHA) and polybutylenes succinate (PBS)

3. Biodegradable plastics based on fossil resources e.g. polybutylene adipate-co-terephthalate (PBAT). Several different bioplastics are being adopted in the automotive market, including biobased polyamides, PTT and biobased polyolefines to starch-blends and PLA-blends.
Benefits of biobased plastics

*Saving scarce resources, counting on regrowable feedstock*

Biobased plastics help reduce the dependency on limited fossil resources which are expected to increase in price significantly over the coming decades. Renewable resources are gradually substituting dwindling fossil resources. These renewable resources are predominantly land-efficient annual crops, such as corn and sugar beets, castor (oil), switchgrass or perennial cultures, such as cassava and sugar cane. The latest developments in second-generation products use cellulose as feedstock basis.

*Reduced dependence on volatile energy markets*

Biobased plastics are not as affected by oil price volatility in the way that petroleum-based materials are.

*Reducing emissions, tackling climate change*

Biobased plastics are able to contribute towards reducing GHG emissions or even become carbon neutral. Plants absorb atmospheric carbon dioxide as they grow. Using this biomass to create biobased plastic products constitutes a temporary removal of greenhouse gases (CO₂) from the atmosphere. This carbon fixation can be extended for a further period of time if the material is recycled.

*Closing the loop, increasing resource efficiency*

Another major benefit is that biobased plastics can ‘close the loop’ and thus increase resource efficiency. This potential is realised by establishing use cascades. Renewable resources are firstly used to produce materials and products before being recycled mechanically, where possible. Finally, these resources are used for energy recovery.

Products that are biobased and biodegradable can be organically recycled at the end of a product life cycle to create water, CO₂, and biomass during a composting process. In this way the CO₂ recycling loop is closed by biodegradation.

Detailed Life Cycle Assessment (LCA) data are available for most biobased and/or biodegradable plastics and need to be taken account of when considering end-of-life options.
Bioplastic market grows continuously

Bioplastics are used in a growing number of markets, including the packaging, consumer electronics, toys, furniture, handheld devices, fibres and automotive sectors.

Increasing demand for more sustainable solutions is reflected in growing bioplastic production capacities. In 2013, capacities amounted to approximately 1.6 million tonnes per year. Market data collected by European Bioplastics in cooperation with the IfBB - Institute of Bioplastics and Bio-composites (Germany) and the nova-Institute (Germany) forecasts production capacities to multiply by 2018 – to 6.7 million tonnes.

Technical applications within the automotive sector are one of the most important upcoming growth markets for bioplastics. Volumes are expected to grow from around 85,000 tonnes to 340,000 tonnes over the next five years.

The automotive industry – counting on renewable alternatives

‘Lightweighting’ is a hot topic for the automotive industry and the main reason why plastics have continuously been used to substitute heavier materials such as metals. Beyond the benefits of reduced weight, the future lies in choosing the most resource efficient plastics, i.e. bioplastics. This helps minimising the environmental impact of car production by further reducing CO₂ emissions and energy use. Besides these evident advantages, e.g. biobased performance polymers (biobased polyesters/biobased polyamides) feature all the performance criteria important to high quality car components.

“Although still in its infancy, the use of biobased materials in the automotive industry has been gradually accelerating over the last few years. (...) biobased plastics are now closer to meeting or exceeding performance and cost parameters of conventional plastics than ever before.” (Center of Automotive Research, The Biobased Materials Automotive Value Chain, 2012)

Major converters and car brands adopt bioplastic solutions

A front-runner in adopting bioplastics is Japanese car manufacturer Toyota which uses bioplastics such as biobased polyesters, biobased PET, and PLA-blends in its production process. Toyota has set the target of replacing 20 percent by weight of all oil-based plastics for cars with bioplastics by 2015. The Toyota SAI and Toyota Prius models already feature a number of bioplastic applications such as headliners, sun visors, or floor mats. Up to 60 percent of the interior fabrics are made of biobased polyesters, which provide mechanical properties equal to or even better than PBT.

Compared to PBT biobased polyesters

- provide a higher stiffness
- feature very good dimensional stability and lower warpage
- feature better thermal shock resistance
- provide good electrical properties
- are easier to process
- provide a better surface gloss²

Italian manufacturer Fiat is another major player in the automotive industry relying on biobased plastics. “The use of bioplastics allows us to increase the eco-friendly profile of our products, assuring same or better performance, possibly at same cost.”³

As an example, the Fiat used castor oil-derived long chain polyamides to replace their fossil based equivalent in more than one million vehicles; the company plans to further increase this number.⁴ Fiat is also looking to increase the amount of bio-fillers it uses to reinforce some of the plastics and elastomers used in production. In 2011, the use of castor oil-based long chain polyamide in some fuel lines won Fiat and DuPont the Society of Plastics Engineers’ Automotive Innovation Award in the environmental category.⁵

Besides biobased polyesters and polyamides, biobased PBS converted into a high performance natural fibre composite is another upcoming relevant material for the automotive market.

Biobased PBS is made of bio-succinic acid and 1,4-butanediol (BDO). It features an interesting thermal-mechanical
balance of properties close to that of a polyolefin; it is easy to process and has good affinity with cellulosic fibers. Since biobased BDO will also be available shortly, biobased PBS will soon be 100 percent sourced from renewable feedstock.

Faurecia and Mitsubishi Chemical have announced a joint programme to develop a bioplastic based on biobased PBS that can be used in mass-production for automotive interior parts, such as door panels, trim and strip, structural instrument panels and console inserts, air ducts, as well as door panel inserts.

The project builds on several years of research and development carried out jointly with US-based BioAmber, who will be supplying the bio-succinic acid to Faurecia and Mitsubishi Chemical. The resulting bioplastic will be a natural fibre composite called BioMat.

Nicolas Pechnyk, Vice President Engineering, Faurecia Interior Systems, explains: “This strategic agreement with Mitsubishi Chemical will make Faurecia the first automotive equipment supplier to mass produce a 100 percent biobased plastic. We are confident about the future of this technology as a substitute for petroleum-based plastic components; indeed, it is one of the main cornerstones of our strategic, initiative ‘bio-attitude’.”6

Bioplastics have reached maturity as a suitable material for a large number of automotive applications, offering high-performance and a unique potential for reducing a product’s environmental impact. It is therefore no surprise that the automotive market is one of the fastest growing application fields for the bioplastics industry.