

# FACTSHEET BIO-BASED ASPHALT ADDITIVES

Procurement of Innovative Products: Bio-Based Products in Procurement

## Why bio-based asphalt additives?

### What are (bio-based) asphalt additives?

Asphalt additives represent a number of substances that can be added to the asphalt binder to alter the characteristics of the final blend of asphalt for the construction of the top layer of a road. The type of additive used is depending on several factors, such as the type of road, the underground structure and climate. Additives are selected based on the requirements for the relevant road. For example, the compaction resistance, application difficulty, adhesion and mixing temperature can be influenced through the use of adhesives. In some cases, the additive is already mixed with the asphalt and cannot be bought separately. In other cases the additive is purchased and added to the bitumen mix. Asphalt additives are conventionally made from crude oil fractions but can also be made from bio-based materials including vegetable oils, such as soy and canola oil but also lignin. This factsheet provides information on bio-based asphalt additives and how to take these into account in procurement.

### Why should organisations consider bio-based asphalt additives in procurement?

Organisations could consider bio-based asphalt additives in procurement if they would benefit from one or more of the capabilities attributed to bio-based asphalt additives. Bio-based asphalt additives potentially have different capabilities as outlined below. Aspects to keep in mind are environmental impact over the life cycle of the product (this could be determined through Life Cycle Assessment in accordance with ISO 14040) and the sustainable sourcing of the input material (this could be assessed in accordance with the sustainability criteria for biobased products from EN 16751 in combination with CEN/TR 16957 - Bio-based products - Guidelines for Life Cycle Inventory (LCI) for the End-of-life phase). With this kept in mind, several potential benefits can also be attributed to bio-based asphalt additives<sup>1</sup>.

*Reduced Greenhouse Gas Emissions:* Bio-based additives could allow for a lowering of the temperature<sup>2</sup> at which the asphalt is laid during road construction. This reduces energy consumption and therefore GHG emissions. Reduced greenhouse gas emissions will in turn contribute to combating climate change.

*Avoidance of GHG Emissions:* by using bio-based products which replace petrochemical products, GHG emissions can also be avoided. Fossil feedstock need to remain in the ground to achieve the limit of a temperature increase less than 2°C<sup>3</sup> as is included in the COP 21 agreement and ratified by UN-countries including the EU.

*Improved ageing properties:* adding vegetable oil to asphalt mixtures has been found to improve the aging process of asphalt. More specifically, it reduces asphalt brittleness which in turn could reduce thermal cracking<sup>4</sup>. Improved ageing properties could result in longer lifetime of the road which will reduce the GHG emissions associated with the road.

*Improved rolling resistance:* bio-based additives such as lignin or vegetable oil could potentially reduce the rolling resistance of the asphalt. Reduced rolling resistance will reduce the fuel use, and therefore GHG emissions, of vehicles travelling on that road<sup>5</sup>.

*Improved flexibility and workability:* addition of a bio-based additive (based on vegetable oil) to asphalt has been found to improve the flexibility and workability of the asphalt<sup>6</sup>. This could lead to reduced aging of the asphalt and easier application in more difficult environments.

<sup>1</sup> These benefits can differ between products and should always be confirmed by the supplier.

<sup>2</sup> Seidel, J.C. and Haddock, J.E. 'Soy Fatty Acids as Sustainable Modifier for Asphalt Binders'. Published in 'Alternative Binders for Sustainable Asphalt Pavements', Transportation Research Circular, August 2012

<sup>3</sup> McGlade C. and Ekins, P. (2015) 'The geographical distribution of fossil fuels unused when limiting global warming to 2 °C', Nature 157.

<sup>4</sup> Bailey, H.K. and Zoorob, S.E. (2012), At the 5th E&E congress presented 'The Use of Vegetable Oil as a rejuvenator for asphalt mixtures'.

<sup>5</sup> Wageningen University (the Netherlands) is currently researching the impact of bio-based (lignin) additive to asphalt on, amongst others, the rolling resistance of the road <https://www.wur.nl/en/article/Bioasphalt.htm>

<sup>6</sup> Delfosse, F. et al., (2012) At the 5th E&E congress presented: New Technology for the Maintenance of Flexible Pavements.

## How to take into account specific capabilities of asphalt additives in procurement?

### Procedures and purchasing strategies

Procurement within the infrastructure construction materials sector often implies procurement of services or works. Asphalt additives are likely to be part of a service or works contract, for example for a road. Though the replacement of a conventional asphalt additive with a bio-based asphalt additive could have a positive impact on for example the temperature at which a road is constructed and the rolling resistance of the road, it is difficult to attribute and quantify this impact specifically to an additive. The use of additives will however impact the performance of a road with respect to construction temperature and rolling resistance of the road. For these reasons it has been decided to provide criteria for the low temperature construction and rolling resistance of a road instead of an additive. The procurement criteria are based on the EU GPP criteria for this sector (Road Design, Construction and Maintenance).

#### Example 1. Low Temperature Asphalt

The tenderer shall apply best practice and techniques for laying bituminous mixtures in order to lower the asphalt production and application temperature. The reduced laying temperature will reduce GHG emissions associated with the laying of asphalt.

Minimum Requirement: The maximum temperature for laying the bituminous mixtures of surface and binder courses shall not exceed 120°C. Only in cases of higher viscosity special bituminous mixtures, laying temperatures up to greater than 120°C but lower than 155 °C shall be allowed.

Verification: The tenderer shall provide a technical report and a workplan of the design activities, indicating the mixing and laying techniques and the maximum temperature required by these techniques, including technical data sheets on binder formulation and asphalt mix design provided by the producer(s).

#### Example 2. Rolling Resistance of the Road (award criteria)

“Rolling resistance associated to the pavement texture generally has the highest environmental impact potential, because it is directly related to the vehicle fuel consumption. A 10% reduction in rolling resistance could lead to 1-2% of improvement in fuel economy.” (EU GPP, for Road Design, Construction and Maintenance)

Minimum Requirement: Points will be awarded to those that commit to a lower rolling resistance of the road surface.

Additional information: The rolling resistance should be determined using a credible test such as the Round Robin Test or equivalent. The test method should be validated in accordance with the provisions of ISO 17025:2005 (General requirements for the competence of testing and calibration laboratories).

Verification: The tenderer shall provide the technical test report and information about the laboratory responsible for the test, specifically confirming compliance with ISO 17025:2005.

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## What bio-based asphalt additives are available?

The following databases contain information on the availability of bio-based asphalt additives:

- The 'Agrobiobase' database (France) provides one producer of bio-based asphalt additives.
- An online search resulted in 3 more producers of bio-based asphalt additives being supplied within Europe. One of these suppliers only supplies a ready asphalt mixture in which the additive is incorporated.

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## Points of attention

The following potential barriers and bottle necks have been identified by procurers, policy makers and professionals that work with bio-based products in procurement. The relevance of each of these potential barriers is discussed for the product group 'asphalt additives':

- **Level of development:** Four suppliers of bio-based asphalt additives could be found within Europe. The level of development of this market is therefore considered new.
- **Availability:** At least one of the bio-based additives suppliers seems to supply all over Europe.
- **Quality of the products:** The type of additive used is depending on several factors, such as the type of road, the underground structure and climate. Additives are normally selected based on the requirements for the relevant road.

