



## REPLACEMENT OF HIGHLY AROMATIC OILS IN TYRES

### FREQUENTLY ASKED QUESTIONS

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#### 1. Definitions

- **Extender oil**, also often referred to as "process or softening oil", is added to rubber compounds in the production process for tyres and other rubber goods to achieve an acceptable processability. The specific oil may also have an impact on certain performance characteristics of the final product.
- **Highly Aromatic** (HA) oils, also referred to as distillate aromatic extract oils (DAE), are oils with a high amount of aromatic carbon structures and are classified as carcinogenic. These oils contain an increased polycyclic aromatic hydrocarbon content and can thus also be called PAH rich oils. (reason for change: Take out PAH content as reason for DAE carcinogenic classification)
- **Poly-Aromatic-Hydrocarbons** (PAHs): a group of over 100 chemical substances of poly-aromatic structure, that are widely found throughout the environment and formed by both natural and industrial processes. Eight PAHs have been identified as carcinogenic and are regulated by EU legislation.
- **Mild Extract Solvates** (MES): mineral oils, not classified as carcinogenic, as they contain a DMSO extract IP346 inferior to 3% and consequently a reduced PAH content, typically by factor 20-50 lower than HA oils.
- **Treated Distillate Aromatic Extracts** (T-DAE): mineral oils, not classified as carcinogenic, as they contain a DMSO extract IP346 inferior to 3% and consequently a reduced PAH content, typically by factor 20-50 lower than HA oils.
- **IP346** is a standardized test method developed by the Institute of Petroleum and is applicable to the range of oils used in the tire industry. The method consists in the extraction of three to seven ring polycyclic aromatic hydrocarbons (PAH's) through a specific solvent "DMSO Dimethylsulfoxide". The thus obtained extract through IP346, includes the eight PAH's specified by EU legislation but is not limited to these. IP346 has been accepted as a suitable predictor of the carcinogenic potential for oils as used in the tire industry and is thus globally accepted by

legislators as a tool for classifying and labeling oils. Oils with an IP346 extract content below 3% are classified as non-carcinogenic

## **2. Highly aromatic oils**

### **Q1 - What are highly aromatic oils? What are they used for in tyres?**

Highly aromatic oils are derivatives of the petrochemical industry.

Aromatic oils do not have - contrary to their name - the function of conferring a pleasant smell to the tyre.

They enter into the composition of tyres because they are required to facilitate the processing of the rubber compounds. They are also an essential component for the technical performance of the tyre and in particular for its road adherence (or grip) properties.

They therefore contribute and directly play a part in the quality of the tyre and user safety.

### **Q2 - What are PAHs? Where do they come from?**

The presence of polycyclic aromatic hydrocarbons( PAHs) in the environment is primarily due to human activity but can also have a natural origin (forest fires, volcanoes and other combustion of organic materials in nature).

PAHs are produced by all combustion phenomena: waste incineration, iron and steel production, home barbecues, motor vehicle exhaust, open chimney fires, tobacco smoking, gas cooking... Cigarette smoke, for example, contains PAH, just like cooking and frying smoke.

PAHs are also present in aromatic oils produced by oil refining including in extender oils, and thus also end up as a consequence in tyres. PAHs as such are not a purposeful addition to tyres.

PAHs are present in the air, water and ground. Emissions of PAHs coming from abraded tyre particulates are minor (2%) relative to total PAH emissions in air, water and ground.

### **Q3 - Are PAHs carcinogenic?**

The European Union has classified eight PAHs as carcinogenic.

They are only harmful to human health in the case of chronic exposure (continuous and very long term), according to the EU Directive which regulates exposure.

Tests with blends of HA oil incorporated into rubber compounds show no carcinogenic effects.

As long as PAHs are physically bound in abraded tyre particles and they are not available in the environment, they have no carcinogenic effect.

### **Q4 - Are PAHs used as a direct material in tyres?**

No, PAHs are not used as direct material in the compound, but the process oils purchased for tyre production contain traces of PAHs.

### **Q5 - In which categories of tyres are highly aromatic oils used?**

In all tyre categories.

### **Q6 - What is the purpose of highly aromatic oil use?**

Highly aromatic oils are added to the rubber compound in the factory during the manufacturing process or added to purchased rubbers to improve the processability of the compounds. Additionally, the tread rubber compound achieves improved performance characteristics, mainly wet grip but also other characteristics like wear and endurance.

Q7 - How many grams of highly aromatic oil and PAH do one tyre have?

It depends on the size. For example, in the 195/65R15 tyre size – a typical passenger car tyre size - there is a content of 200 to 600g of highly aromatic oil per tyre. As a result, the PAH content in that tyre varies between 0.1g to 0.3g (supposing 500 ppm PAH as typical value in highly aromatic oil).

Q8 - There have been reports saying that highly aromatic oils in tyres are toxic. Is this true?

Certain highly aromatic oils as such are classified carcinogenic because they contain higher levels of PAHs some of which, 8 in particular, are themselves classified as carcinogenic. However, finished rubber products such as synthetic rubber and tyre compounds that were produced using aromatic oils are not categorised by the EU as carcinogenic materials

Q9 - Are highly aromatic oils dangerous once they are incorporated into the tyre and placed on the market?

Once the tyre is vulcanised in the factory and placed on the market as a finished product for sale to consumers, the product presents no danger for the user, whether during physical handling of the tyre, during its road use or at end of life of the tyre. Several studies (Pasteur Institute, Biolab) have confirmed the impossibility for aromatic oils contained in tyres or in blends to be released in their initial chemical state, under test conditions existing in nature. They are closely bound into the mass of the tyre.

Q10 - What do the PAHs become when diffused in nature?

Do they present a risk for the environment?

In the environment, PAHs degrade more or less quickly according to the specific conditions of the environment. This degradation takes place naturally under the joint action of chemical oxidizers, ultraviolet light and microorganisms.

Everybody should be concerned by exposure to or ingestion of PAHs present in water, the air or in food. However, PAHs in tyre debris are not extracted by water or other materials that are normally present in the environment.

In November 2003, the Scientific Committee on Toxicity, Ecotoxicity and the Environment (CSTEE) concluded that tyre debris contributes marginally to total PAH emissions (2%) and that PAHs in tyres will insignificantly reduce overall concentrations in the environment<sup>1</sup>.

Q11 – What is the contribution of PAHs in tyre emissions versus other sources?

PAH from tire debris only represents 2% of the total PAH emissions in the air.

Making a direct source-to-source comparison illustrates the proportions on a concrete example. Typically in air emission measurement PAH emissions are

expressed in BaP concentration. BaP is one of the eight regulated PAH's and is chemically detected as a representative species.

Tire wear contributes with 0.015 ng/m<sup>3</sup> of BaP concentration in air. This is a value determined most recently by the German Environmental Agency in Berlin.

Smoke of one cigarette generates 22 ng BaP. Entering a medium size room of 15 m<sup>2</sup> where somebody smokes one cigarette, the exposure to BaP in the air is at concentration of 0.66 ng/m<sup>3</sup>.

This is an air concentration 44 times higher than the one from tire wear.

This is an example to illustrate the proportionality. The tire industry sticks to its precautionary approach and will replace the highly aromatic oils.

ng = nanogram = 1 millionth of 1 milligram

1 We also want to remind that the handling of tyres presents absolutely no danger for consumers.

### **3. REPLACEMENT OF HIGHLY AROMATIC OILS IN TYRES**

#### 3. Substitution

Q12 - Is it true that alternative oils are being developed?

Alternative extender oils are under investigation and the tyre industry is actively involved. According to petroleum companies in Europe, there are mainly two alternative oils available: MES and TDAE. There are, however, still problems with availability of these oils, depending on the geographic area in question.

Moreover, to date, the use of these alternative oils is technically possible in some tire segments, but in some others the industry has still to invest substantial development to compensate for the loss of performance, mainly wet skid performance. This means that some extensive testing is still required before broad use is possible.

Q13 - Which type of influence do these new oils have on tyre performance?

This is under active investigation but technical adjustments are definitely needed in order to safeguard tyre performance. At this stage, we have concerns regarding both wet grip and tyre durability. Breaking distance of cars and road safety can be negatively affected.

Q14 – How are alternative oils defined?

Mineral oils will have to comply with EU Directive provisions for products of this kind. In addition thresholds are defined for the total of the 8PAH's regulated by the EU and for Benzo (a) Pyrene, (BaP).

### **4. Industry plans**

Q15 - - Is there any plan to switch from aromatic oil to alternative oil?

In 1995, BLIC set up a working group to consider technical specifications / solutions for replacing highly aromatic oils in all tyre segments while maintaining tyre performance, safety whilst improving its environmental impact. All European tyre manufacturers were involved.

- As a first step, criteria were established (see Q14) on what was regarded as a "toxic substance"
- BLIC members have ever since been monitoring independently the levels of cancer cases in their plants and conducting various lab tests (such as modified Ames test for mutagenicity), and no cancer was detected.
- BLIC started discussions with oil producers to identify alternatives meeting the BLIC oil technical specifications and the following BLIC requirements:
  - availability in sufficiently large quantities
  - sourcing from various suppliers.
- BLIC initiated discussions some years ago with the elastomer producers and obtained technical agreement on a new spec definition (oil extended elastomers).
- BLIC members have been running tests since 1996 with HA oil-free tyres and have switched several tire segments to HA oil-free tyres ((mainly truck tyres and passenger winter tyres)

TDAE and MES were raised as candidate alternatives but there are still concerns regarding overall availability. Moreover, there are still concerns in BLIC about the safety of tyres made with the test alternative oils, since same grip and wear levels are not always achievable and especially for some categories of summer tyres.

The European tyre producers publicly announced in June 2003 to pursue a precautionary approach and committed to phase out use of the PAH-rich extender oils. This substitution started several years ago, is a very complicated process and cannot be completed before December 2009.

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### **5. Legal situation in Europe**

#### Q16- What is the legal situation in Europe?

So far, there is no country in Europe where a ban on HA oil use in tyres has been imposed.

On 13 February 2004, the European Commission adopted a proposal aimed at banning the use and marketing of PAH-rich extender oils used in tyre production from 31 December 2008.

As per the co decision procedure, the proposal will now be submitted to the other EU institutions.

#### Q17- What does BLIC think about this proposal?

BLIC supports the European directive but remains concerned about the timing of December 2008 of the Commission proposal.

A transition from PAH-rich oils to alternative oils (including oil extended polymer production) is a great challenge for industry especially as the grip performance of tyres, and therefore the breaking distance of cars and road safety, can be negatively affected. This entails significant efforts including chemical re-engineering, extended laboratory tests and complete tyre tests and homologation, and important changes to the manufacturing process. A shortening of the timeline by one year is highly critical to industry, for these reasons.

The European tyre industry will not be able to eliminate entirely use of PAH-rich extender oils in tyres before December 2009, and hopes that the Commission's proposal will evolve to reflect the challenges ahead for both the oil and the tyre industry. The European tyre producers need a European directive enforceable and controllable in its application.

Q18- Are there test methods available for a proper implementation of the proposed Directive?

Not yet. A pre-condition for proper implementation of this proposed directive demands measuring methods and measuring instrument of the relevant PAHs in the oil and the identification of the PAH-rich oil in tyre compound, which are not available yet.  
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17 March 2004