



Environmentally friendly plasticizer

Abstract

The client is looking for a more environmentally friendly alternative to fossil fuel based plasticisers used in the tyre industry (estimated market size of 2.8 million tonnes annually). They are looking for a new solution with significant laboratory testing proving the essential properties are still present.

Mandatory requirements

The solution should respond to the following essential objectives and constraints:

1. Better environmental impact and image than current solutions.
2. Must conform to end-of-life tyre toxicity regulations.
3. Must be able to be incorporated into the tyre manufacturing process
4. Should contribute to the performance of the tyre.
5. Compatibility with tyre rubber and no risk of exudation either with usage or aging of the tyre.

1) Image and environmental impact

The solution should be perceived as more environmentally friendly than current solutions and should demonstrate:

- A smaller carbon footprint for the entire life cycle
- A reduction in water consumption
- A reduction in soil pollution
- A reduction in use of natural resources



- Any other criteria that can communicate a more environmentally friendly image

2) Must conform to end-of-life tyre toxicity regulations.

Reach 1907/2006/CE, annex XVIII, Entry 50, concerning raw materials used for rubber and tyres manufactured and/or sold in Europe:

- Must have a benzo(a)pyrene content of less than 1ppm m/m
- Must have less than 10ppm m/m of the seven other carcinogenic molecules listed
- Must have a DMSO poly-aromatic molecule extraction of less than 3% mass (method IP346).

3) Must be able to be incorporated into the tyre manufacturing process

The product should be able to be dissolved or homogenised easily into the tyre manufacturing process. It should either be a compatible form, or be able to be easily converted.

4) Should contribute to the performance of the tyre

Plasticisers are used to help tyres perform in different conditions (hot/cold), and allow optimisation of a combination of several performance criteria:

- Grip
- Fuel consumption (rolling resistance)
- Noise

The solution should at least conform to the expectations required for a passenger car radial tyre and be sufficiently uniform to guarantee regularity in the final product and between final products.

5) Compatibility with tyre rubber and no risk of exudation either with usage or aging of the tyre.

The product must be compatible and stable with natural rubber (rubber tree, dandelion, guayule) or synthetic (SBR, BR) used in tyres. The physical and chemical parameters that influence the compatibility are:

- Molecular weight (the higher it is, the more stable the plasticizer is)



- The aromatic content (the rubber used is aromatic, and a certain polarity is needed for the chemical compatibility and mixing cohesion)
- Aniline point (derived from the composition CA/CP/CN and of a size and type of molecules)

Primary objective is compatibility, optimisation is secondary. Note, there is not necessarily a 'target' for either the aniline point or the aromatic content; aniline point cannot be calculated without density, viscosity, and other parameters, and the desired aromatic content will depend on the aromatic. It is even possible that another type of molecule other than an aromatic could increase the compatibility between the plasticiser and the natural rubber.

Optional requirements

A typical personal car radial tyre has around 560g of plasticizer which costs between \$700 and \$1500 per tonne, corresponding to around \$0.40-\$0.85 per tyre. The new solution should be around this figure, and should not cost more than 20% more.

The price is largely affected by the volume of raw materials purchased and the chemical processes that convert them into the plasticiser. Due to this uncertainty, this criterion will not automatically disqualify solutions if it is unfulfilled. Experts should note that the solution should be able to be used for other applications, but that tyres are the most important market.

Non desirable solutions

The solution must be new:

- Not covered by a patent owned by a tyre producer
- Not currently used in tyre production

The client, who is already looking for a solution in patent searches, reserves the right to reject a solution that is already known.



Solution format

The solvers should create a solution of the form:

- Description of a raw materials and their sources
- Description of chemical process
- Justification of properties with experimental results explaining:
 - Types of tyres that could benefit from the solution
 - Effect of using solution on the end product (tyre) and manufacturing process
- If possible with economic impact

The Client may seek further testing to measure the impact on the functional characteristics of the tyre.

Intellectual Property

The solution authors are not required to own the Intellectual Property themselves, but they are required to provide details of how it can be obtained. The award of the prize money does not cover the cost of the intellectual property; this will be negotiated outside of this challenge between the Client and the owner of the solution.

Deadline: 31/10/2015

Prize

Full Prize: €10,000

Solution that responds to all criteria, is applicable not just in the tyre industry, and is justified as economically feasible.

Partial Prize: €5,000

Winning solution that fulfils some but not all of the requirements.

