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Description: **Short article about the use of PEIT for aerosols**

For immediate use and publication

A New Packaging Solution for Aerosols

Break free of the design and performance constraints of aluminium and steel. Next generation plastics can provide the perfect solution for personal care and household products.

In 2019, the global aerosol market was valued at USD86 billion, and it is estimated to see compound annual growth in revenue of 6.6% over the next 7 years, largely within the personal care sector.[1] Aluminium and steel dominate in aerosol packaging, but what about plastic? New polymers offer compelling attractions when it comes to design flexibility, core performance and environmental impact. Poly(ethylene-co-isosorbide) terephthalate (PEIT), a modified form of polyethylene terephthalate (PET) containing isosorbide, a renewable feedstock for high performance materials, offers exciting possibilities for aerosol packaging and is just beginning to penetrate the market.

Why switch from metal to plastic?

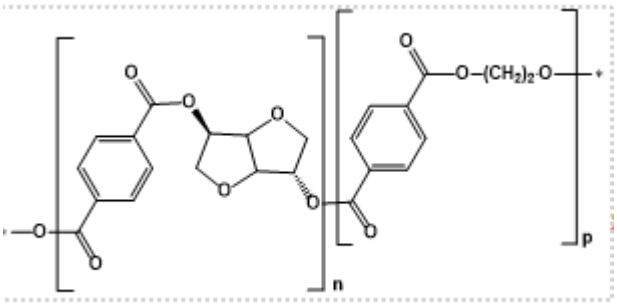
The use of plastic packaging for aerosols is growing, and there are good reasons why it should. A switch to plastic addresses primary limitations such as:

- Corrosion – plastics offer greater chemical resistance, no rusting at the base, and enable water-based formulation, potentially providing access to new markets.
- Weight – plastics enable lighter weight designs, a major advantage with respect to transport that also reduces the risk of damage from a dropped product.
- Design flexibility – plastics provide opportunities for packaging that is softer, warm to touch and/or transparent, and to realise unconventional or ergonomically superior shapes with enhanced customer appeal.
- Safety – plastics eliminate the risk of explosion due to over-pressure, allowing safe storage in the sun and reducing the risks associated with full pallent storage.

When it comes to manufacturing efficiency and economics, plastic can also be highly competitive with lower costs and the possibility of “just-in-time” production, adjacent to the filling line.

In Europe, the Aerosol Dispensing Directive (ADD)[2] currently limits the volume of plastic aerosols to 220 ml, but these guidelines were written in 1975 and are due to be updated in 2020. Advances in plastics increase the likelihood of a substantial revision with modern materials well-suited to the demands of aerosol packaging.

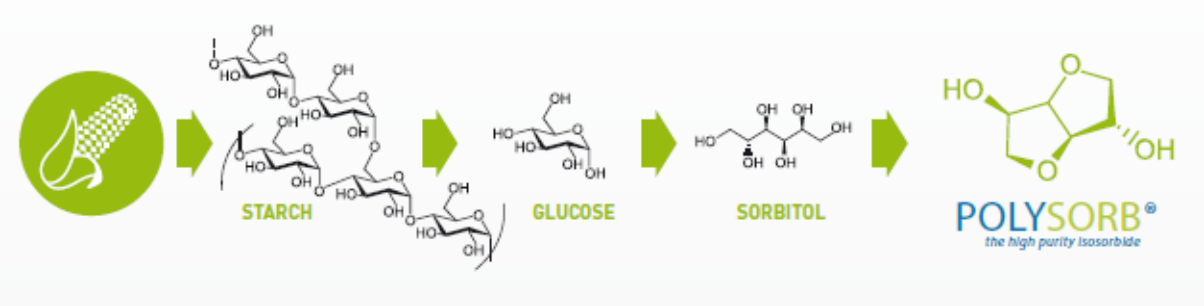
What is PEIT?



PEIT is a semi-aromatic copolyester closely similar to PET.

PET is the world's most used polymer, particularly for packaging and synthetic fibers, and is the preferred packaging material for aerosols. Indeed, a collaborative special industry group established by Petcore Europe and the European Aerosols Association (FEA) is already focusing on how best to handle an anticipated rise in PET aerosols in the household waste stream over coming years.[3] PET recycling – both mechanical and chemical – is well-established.

PET is a copolymer of ethylene glycol and terephthalic acid. The manufacture of PEIT additionally incorporates isosorbide as a third monomer via the bulk polymerisation of ethylene glycol, terephthalic acid, and isosorbide. While ethylene glycol and terephthalic acid are still mainly from petrochemicals, isosorbide is a plant derived monomer, produced from annually renewable feedstocks. Plant-based starches are hydrolyzed to glucose that is converted to sorbitol, which is converted to isosorbide by hydrogenation (see below illustration).



Over the last couple of decades, companies such as Roquette (Lestrem, France), the global leader in isosorbide production and supply, have refined isosorbide processing technology to the point of industrial-scale manufacture. Roquette operates the world's first industrial scale plant supplying material of unsurpassed quality and stability. Sustainable, non-toxic and available in different grades, with one tailored specifically to the requirements of the polyester market, the resulting isosorbide has a very low carbon footprint of just 0.09 kg CO_2/kg of product.*

In summary, incorporating isosorbide into PET improves the environmental credentials of virgin polyester. Equally exciting is the potential isosorbide offers to enhance PET properties.

How are its properties different from PET?

Isosorbide is:

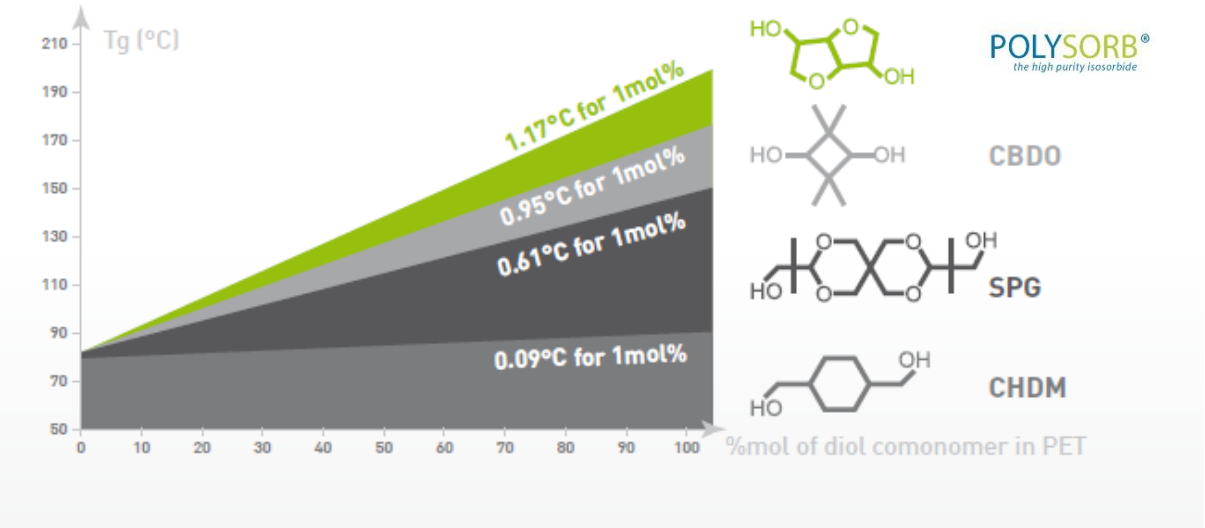
- Non-toxic
- Non-endocrine disruptor
- Available at very high (>99.5%) purity.

These characteristics make it suitable for food, cosmetics/personal care, and pharmaceutical applications. PEIT is a glass-like, heat-resistant, hot-fillable copolyester that can be used as either a recyclable or reusable plastic within these sectors. It offers:

- High gloss
- Good optical properties
- High impact resistance
- Enhanced chemical resistance.

However, the key characteristics driving interest in PEIT for aerosol packaging include a high glass transition temperature, T_g, and compatibility with existing PET recycling practices.

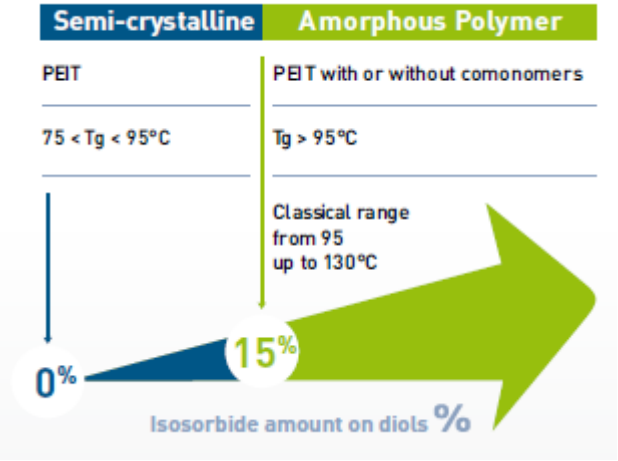
A higher glass transition temperature…



High purity isosorbide increases the glass transition temperature, T_g, of speciality copolyesters more effectively than alternative diols [CBDO - 2,2,4,4-Tetramethyl-1,3-cyclobutanediol, SPG – Spiroglycol, and CHDM – Cyclohexanedimethanol].

The T_g of a polymer is a critical parameter since it defines the temperature above which the thermal properties of the material begin to change and more "rubbery" behavior establishes; below their T_g, polymers are more glass-like. An important limitation of PET as an aerosol packaging material is that it does not have the thermal resistance required to meet the criteria laid out in FEA Standard 647.[4] The incorporation of isosorbide directly addresses this limitation by increasing T_g. It is more effective that any other alternative diol in this regard as well as being the only bio-based molecule.

…with no loss of recyclability



Semi-crystalline PEIT meets the T_g specification for aerosol packaging and can be mechanically recycled into existing PET streams.

Meeting a T_g of ~90°C, as required for aerosol packaging, requires less than 15% isosorbide incorporation, i.e., the substitution of less than 15% of the ethylene glycol in conventional PET. This means that the resulting PEIT is semicrystalline and can be mechanically recycled with existing PET waste streams. Recycled materials containing up to 50% modified PET fulfill all the European PET Bottle Platform (EPBP) Testing Protocols for assessing PET recycling compatibility.[5] PEIT can also carry the Resin Identification Code #1, as reserved for PET, based on the requirements of ASTM Standard 7611-7611M (Standard Practice for Coding Plastic Manufactured Articles for Resin Identification).[6]

Looking ahead

Commercial products from companies such as Plastipak, Alpla and Airopack showcase the multiple benefits of switching from metal to PET aerosol packaging and illustrate what is already available. Lighter, lower cost, and with a reduced carbon footprint, these solutions point to a bright future for plastic aerosols. Easily recycled through existing waste streams, they also offer distinctive features such as transparency. PEIT has the potential to further enhance the plastic aerosol product portfolio by providing better technical performance, notably a higher T_g, with no loss of recyclability. For those looking to exploit the growing demands for plastic aerosols, isosorbide is a high performance monomer that demands a closer look.

For more information on high purity POLYSORB® isosorbide from Roquette, click here.

Quotes to be used alongside article if required:

"The ability of isosorbide to increase the T_g of PET is critical for this application and it is more effective than any other replacement diol in this regard. Unlike PET, PEIT meets the thermal resistance requirements laid out in the FEA standards for aerosols - a major gain."

"Whether you're the end user or a supplier, elimination of the risk of explosion is a major gain with plastic aerosols. They can be stored safely in the sun or in a car and the the worst case scenario with a full pallet is a fire, rather than a potentially energetic explosion."

Please attribute quotes to Dr René Saint-Loup, Performance Materials and Cosmetic ingredients Technical Team Manager, Roquette.

[*]Internal comparative study based on life cycle analysis methodology, peer-reviewed by an external auditor.

[1]Aerosol Market Size, Share & Trends Analysis Report By Application (Personal Care, Household, Automotive & Industrial, Foods, Paints), By Material, By Type, By region, And Segment Forecasts, 2020 – 2027. https://www.grandviewresearch.com/industry-analysis/aerosol-market

[2]Directive 75/324/EEC – aerosol dispensers. Available to read at: https://osha.europa.eu/en/legislation/directives/40

[3]Plastic Aerosol Recycling Special Industry Group. https://www.petcore-europe.org/working-groups/plastic-aerosol-recycling-special-industry-group.html

[4] FEA Standard 647: Plastic Aerosol Dispensers – Technical Requirements. Available to download at: https://www.aerosol.org/mediaroom/fea-647-and-fea-650-are-now-available/

[5] "How we do a Recycling Evaluation !" https://www.epbp.org/page/5/layout-link-2-test-procedures

[6] ASTM D7611/D7611M – 20 Standard Practice for Coding Plastic Manufactured Articles for Resin Identification. Details and available to purchase: https://www.astm.org/Standards/D7611.htm