INERIS
controlling risks for sustainable development

National helpdesk
Chemicals substitution

Newsletter

Special feature

Styrenic polymers as an alternative to polycarbonate

Styrenic copolymers are polymers for which the base monomer, styrene, is copolymerized with other monomers such as acrylonitrile, butadiene, or acrylic esters.

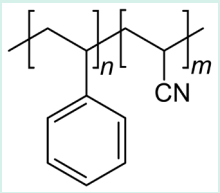
These monomers give the material **special properties**, such as impact resistance, improved thermal resistance, etc.

Some of these thermoplastic copolymers could **replace polycarbonates**, particularly for applications that require a transparent material. They are present in a wide range of products, including household appliances, sports and recreational equipment, medical devices, etc.

The following transparent styrenic copolymers may be substituted for polycarbonates:

- **SAN** (Styrène/AcryloNitrile [10-28%])

According to its manufacturers, this rigid polymer, which has high thermal and chemical resistance, is very glossy, and is used in the production of household appliances, light fixtures, food packaging, etc.

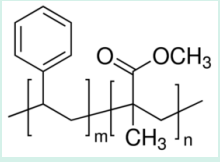


SAN is sold under various brand names: *ABSOLAN and LURAN* (INEOS), *KIBISAN SAN* (CHIMEI), *LG SAN* (LG CHEM) and *TYRIL* (TRINSEO).

- **SMMA** (Styrène Méthyl MéthAcrylate)

This material has already been featured in an *article in the « News » section of SNA-BP website*.

As a reminder, according to the RESIRENE and INEOS companies, this material combines desirable aesthetic qualities (high gloss and transparency) with excellent impact resistance (and even scratch resistance), thermal resistance, and good mechanical properties.



This polymer has applications in the medical field (injection pens), the stationery industry (pen bodies), and production of food-grade materials (food storage containers).

SMMA is sold under various brand names, such as *CET®* (Resirene) ou *NAS®* (INEOS).

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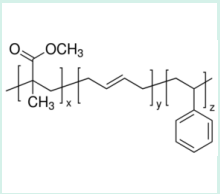
- **MBS** (Methacrylate Butadiene Styrene)

According to its manufacturers, in addition to having excellent clarity, MBS has good chemical resistance (resistance to many detergents and cleaning solutions) as well as impact resistance.

This material is safe for food-grade applications, and items made with MBS are dishwasher-safe. MBS is used in the production of medical equipment, household appliances, pens (clips), and food storage containers, among others.



The GRUPPO MAIP and INEOS companies sell MBS under their respective brand names: *KOSTRATE* et *ZYLAR*.

- **MABS** (Methyl Methacrylate Acrylonitrile Butadiene Styrene)

According to INEOS, MABS benefits from excellent impact resistance and good resistance to chemical products.

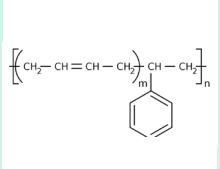
According to INEOS, one of the most interesting properties of MABS is that visual effects, such as pearlescent or sparkling effects, can be obtained by using this material. The manufacturers of MABS report a variety of applications for its use, including intravenous infusion systems for the medical sector, LCD TV screens, and even sporting goods.

MABS is available under the names *TERLUX* (the INEOS company), *POLYLAC MABS* (the CHIMEI company), and *LG MABS* (the LG CHEM company).

- **SBC** (Styrène-Butadiène Copolymer)

According to INEOS, SBC combines the qualities of transparency and impact resistance.

In addition, INEOS reports that this material can be extruded, thermoformed, and injection molded to create a wide variety of products (such as food packaging and drip chambers, among others).

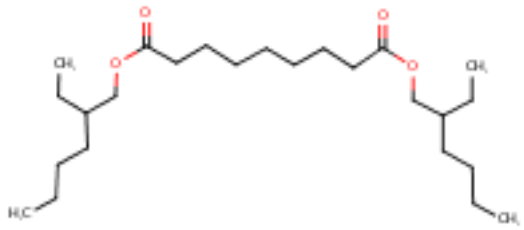


Many companies sell SBC: : INEOS (*STYROLUX*), CHIMEI (*KIBITON®* Q-Resin), BASF (*Styrolux®* 3G46).

EMERY OLEOCHEMICALS proposes EDENOL® DOZ as a substitute for phtalates that have similar properties to Dioctyl Sebacate (DOS)

Dioctyl Sebacate (DOS), a substitute for DEHP, is a derivative of sebacic acid, which is itself derived from castor oil. The availability of castor oil fluctuates because it is sensitive to climatic variations and there is a high demand for it on the market. DOS is a plasticizer for PVC, and it is often used in low-temperature applications (flooring, tarpaulins, etc).

To address the common problems with availability and pricing for DOS, the EMERY OLEOCHEMICALS company has developed EDENOL® DOZ, an azelate plasticizer (di(2-ethylhexyl) azelate), which has the same properties as DOS, and would be appropriate for use in most of its applications in PVC and synthetic rubbers (NBR[1], CR[2], CSM[3], CM): vinyl films, coated fabrics, tarps, etc.



Di(2-éthylhexyl) azélate (CAS n° 103-24-2)

EDENOL® DOZ is a bio-based oleic acid derivative obtained from natural fats and oils. EMERY OLEOCHEMICALS indicates that EDENOL® DOZ, like DOS, meets US FDA CFR 21[4] requirements for food contact.

According to EMERY OLEOCHEMICALS, the physiochemical characteristics (viscosity, density, and pour point) of DOS and EDENOL® DOZ are identical. In addition, the properties of PVC with DOS versus PVC with DOZ are very similar (i.e. tensile strength, elongation at break, cold break temperature, chemical resistance, and shore hardness).

According to its manufacturer, switching from DOS to EDENOL® DOZ requires little to no change in formulation.

Sources

http://www.emeryoleo.com/emery_oleochemicals_announces_new_high_performance_plasticiz...-p-140.php

New technology has been developed for thermal paper.

The DOW and KOEHLER companies have developed BLUE 4EST™ multi-layer thermal paper to cover the same applications as conventional thermal papers (used in receipts, labels, etc.) without the use of chemical developers such as BPA or BPS.

Unlike common thermal papers, the appearance of the image is caused by a physical reaction rather than a chemical reaction. This thermal paper is composed of three layers: an opaque coating of ROPAQUE™ NT-2900 polymer on the surface, over a colored undercoat layer and a paper base layer.

The ROPAQUE™ NT-2900 polymer contains hollow particles that create pockets of air in the coating to hide the underlying color layer. When heat is applied to the surface of the paper, it causes the hollow spheres to burst. The opaque coating then becomes transparent in these spots, and the underlying color layer becomes visible.

According to the DOW company, prints made on BLUE 4EST™ paper are light-resistant, meaning they can be stored for longer periods than conventional thermal papers.

According to its designers, BLUE 4EST™ thermal paper is compatible with any thermal printer.

Sources

http://www.dow.com/en-us/news/press-releases/dow-receives-11th-us-epa-presidential-green-chemistry-challenge-award

https://www.koehlerpaper.com/en/papier/thermal/Blue4est.php

European researchers have developed limonene-based polycarbonates

Researchers from the University of Bayreuth, as well as teams from ICREA (the Catalan Institute of Research and Advanced Studies), in collaboration with ICIQ (the Institute of Chemical Research of Catalonia), developed bio-based polycarbonates made with limonene and carbon dioxide (CO_2).

One of the advantages of these polycarbonates is the fact that limonene is substituted for bisphenol A as a monomer. Limonene can also be synthesized from orange or lemon peels, or from biowaste generated by the production of orange juice.

According to their designers, these bioplastics have better thermal properties than polycarbonates made with bisphenol A. For example, the glass transition temperature of the polycarbonate developed by the Catalan researchers is higher than that of a conventional polycarbonate. This improved heat resistance allows us to visualize new applications for the material that we could not previously achieve with conventional polycarbonates.

SAccording to researchers at the University of Bayreuth, it is possible to graft different groups onto the structure of their polycarbonate, PLimC (Poly(Limonene Carbonate)), giving it new properties (hydrophilic, antibacterial, etc.), or changing it into another type of polymer (e.g. in synthetic rubber).

Thanks to its heat resistance and transparency, PLimC can be used in a variety of applications: interior coatings for food storage containers, molded parts for interior and exterior trim pieces for cars, foams for thermal insulation, adhesives.

However, PLimC is not currently used for industrial applications. Last July, the Catalan team, ICREA, was negotiating with a plastic producer for the industrial production of their biomaterial.

Sources

http://www.iciq.org/when-life-gives-you-lemons-make-bio-plastics/

http://www.advancedsciencenews.com/plastic-made-orange-peel-co2/

Hauenstein, O. et al., «Bio-based polycarbonate as synthetic toolbox», Nature Communications, doi : 10.1038/ncomms11862 (2016)

https://www.nature.com/articles/ncomms11862.pdf

[1] *Butadiene nitrile rubber*
[2] *Chloroprene rubber*
[3] *Polyethylene-chlorosulfone rubber*
[4] *Food and Drug Administration*

Coming soon

ENOVA 2018 in Lyon (France) from 7/02 to 8/02/18

The ENOVA salon (fair of innovation in electronics, measurement, vision and optics) will be held in Lyon from 07 to 08 February 2018. During these two days, will come together manufacturers, suppliers or wholesalers of the sectors of electronic, measurement and optic.

http://www.enova-event.com/

Salon PACKAGING INNOVATIONS 2018, in Birmingham (United-kingdom) from 28/02 to 1st/03/18

The «Packaging Innovations» meeting will be held in conjunction with the "Empack" and "Label & Print".

On the occasion of this salon, international manufacturers present their latest trends and innovations in printing material, sustainable packaging, materials, design, machinery, equipment...

http://www.easyfairs.com/packaging-innovations-birmingham-2018/packaging-innovations-birmingham-2018/

Internationale convention CABLES 2018 in Cologne (Germany) from 6/03 to 8/03/18

This event is dedicated to cable producers, suppliers of raw materials, manufacturers of additives or equipment.

https://www.ami.international/events/event?Code=C860