

Same Performance, Just Greener: Bio TPU ***Renewable-sourced thermoplastic polyurethanes***

When Merquinsa started its Bio TPU research & development platform based on renewable sources back in the mid 2000s, the *Green* trend was just making its appearance. Merquinsa announced a world-first breakthrough with the first TPE based on renewable sources (from 20% up to 90% according to ASTM D6866) at K 2007, after many years of difficult and challenging R&D work: Bio TPU was born!

Following soon after, Merquinsa was granted the Frost & Sullivan 2008 Global Thermoplastic Urethane (TPU) Product Innovation Green Excellence of the Year Award, recognizing Merquinsa's innovation in biopolymers, with its groundbreaking Bio TPU made from renewable carbon resources and successfully marketed globally under Pearlthane[®] and Pearlbond[®] ECO brands.



Green Excellence of the Year award (2008 Global Thermoplastic Urethane Product Innovation).

Concerns about global warming progressively increased last decade, and at K 2010, the *Green* trend was everywhere with sustainability being one the most common word among exhibitors. Merquinsa exhibited and presented several commercial Bio TPU applications from large global brands, one example is Ford Motor Company's use of sustainable materials which prompted the selection of Pearlthane[®] ECO for the Lincoln MKZ tambour console door. Other sports, footwear, automotive & industrial companies have adopted and turned to Bio TPU: Bio TPU is now a commercial reality globally.



Photo Courtesy of Ford Motor Company, Inc.



Photo courtesy of Brooks Sports Inc.

Bio TPU is used by Ford Motor Company in Automotive parts and Brooks Sports in running goods.

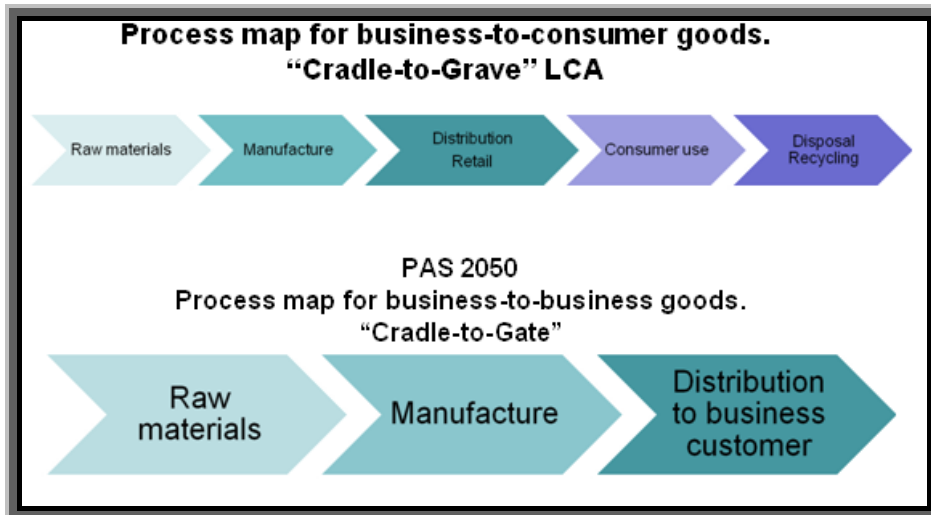
The Bio TPU product portfolio includes a wide range of hardnesses and UV-stabilized grades. See the full range of injection moulding and extrusion Renewable-sourced Bio TPU resins listed in the table below:

<i>Bio TPU grades for Injection Moulding & Extrusion applications</i>		
Product name	Renewable content according to ASTM-D6866	Special feature
Polyester-based BioTPU		
Pearlthane[®] ECO D12T80E (82 shore A)	containing 62% of renewable material	Food compliant grade (according to new Commission Regulation EU No. 10/2011, and also previous Commission Directive 2002/72/EC).
Pearlthane[®] ECO D12T85 (85 shore A)	containing 48% of renewable material	
Pearlthane[®] ECO D12T90 (91 shore A)	containing 37% of renewable material	Very low fogging, meeting the most stringent automotive fogging specifications.
Pearlthane[®] ECO D12T95 (95 shore A)	containing 33.5% of renewable material	
Pearlthane[®] ECO D12T55D (55 shore D)	containing 29% of renewable material	Very hard TPU grade also suitable for extrusion applications.
Polyether-based BioTPU		
Pearlthane[®] ECO D20N88 (86 shore A)	containing 60% of renewable material	
Pearlthane[®] ECO D20N48D (47 shore D)	containing 40% of renewable material	

Fig. 1: Fully commerciable Bio TPU grades.

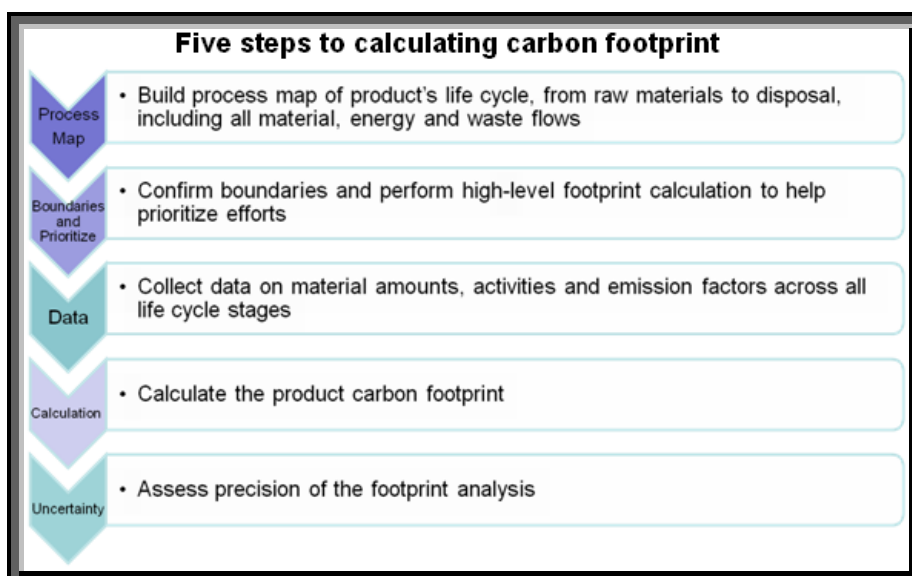
And applications continue to increase as the need for eco-friendly materials contributing to lower CO₂ emissions becomes a must in different sectors looking to innovate with lower cost solutions, while benefiting from the unique set of properties of standard thermoplastic polyurethanes. Without sacrificing performance, Bio TPU offers outstanding flexibility, transparency, abrasion and scratch resistance, while mitigating global warming.

According to PAS 2050, a publically available standard adopted by several Industry Associations such as the Outdoor Industry Association (OIA) Bio TPUs generate ca 40% less Green House Gas (GHG) emissions than standard petroleum based TPUs. PAS 2050 applies a cradle-to-gate approach required for business-to-business communication of a carbon footprint per specification. It differs from a Life Cycle Analysis (LCA) which is cradle-to-grave yet utilizes similar techniques.



The Carbon Footprint via PAS 2050 is a powerful tool allowing companies to:

- Identify Green House Gas (GHG) Emissions
- Reduce GHG Emissions
- Identify Cost Saving Opportunities
- Demonstrate Environmental/Corporate Leadership
- Incorporate Emissions Impact into Decision Making Processes for Suppliers and Product Design
- Meet Customer Demands for Information on Product Carbon Footprints
- Differentiate and Meet Demands from "Green" Customers



Expressed in every day terms, the average 40 % difference per metric ton between the carbon footprint of the bio-based TPU and the standard TPU can also be expressed as:

- CO2 emissions from an average European passenger car (241 g CO2 equivalent per km) during 23,65 km.
- CO2 emissions from 13.3 barrels of oil
- CO2 emissions from 641 gallons of gasoline
- CO2 emissions from the electricity of 0.75 homes for 1 year
- Carbon sequestered annually by 1.2 acres of pine or fir forests
- Carbon sequestered annually by 146 tree seedlings grown for 10 years
- Greenhouse gas emissions avoided by recycling 1.9 tons of waste instead of landfill.

Source: Greenhouse Gas Equivalencies Calculator US Environmental Protection Agency.

In addition, Bio TPU allows part weight reduction up to 7%. From 80 Shore A up to 95 Shore A hardness, Bio TPU offers lower density, see data below on standard petroleum-based Pearlthane® vs. Renewable-sourced Pearlthane® ECO TPU grades:

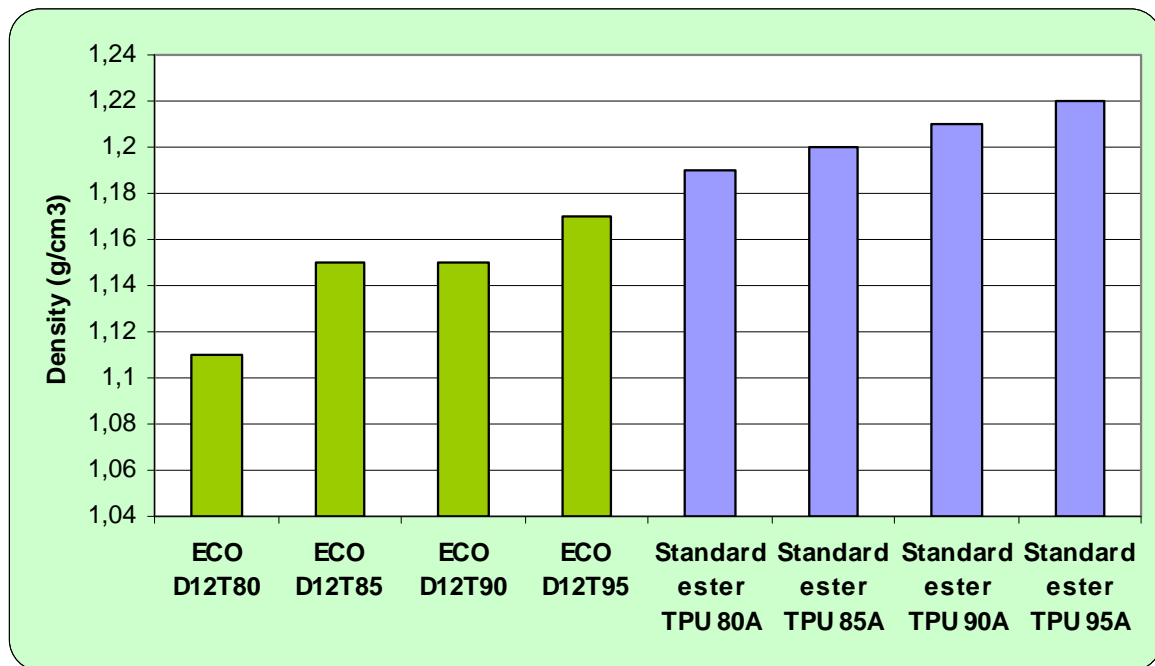


Fig. 2: Density values of Bio TPU vs. standard TPU grades.

The use of Renewable-sourced materials such as Bio TPU can offer lower cost solutions.

Same Performance, Just Greener: Bio TPU is a high performance bioplastic offering significant environmental benefits. Merquinsa will continue to lead the development & design of unique bio based molecules to address challenges ahead and new market needs for *greener* TPEs.