

VINNEX® POWDERS FOR HEAT-RESISTANT BIOPOLYESTER BLENDS

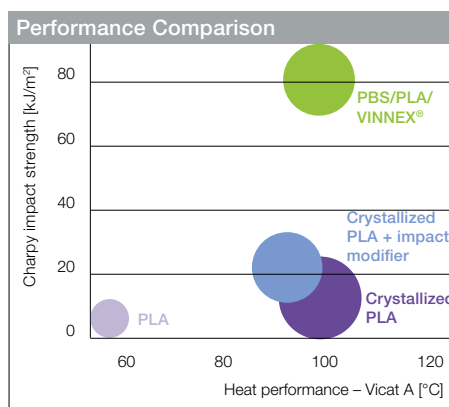
Improved Processing and Performance of Heat-Resistant Biopolyester Blends

Polylactic acid (PLA) is currently the most important biopolyester for producing biobased/biodegradable plastic materials. Nevertheless, its current mechanical and processing properties are still hampering replacement of bulk thermoplastics. The poor heat resistance of amorphous PLA makes it unsuitable for a wide range of applications.

With VINNEX®, WACKER offers additives which enable low-cost standard PLA to be blended with polybutylene succinate (PBS) to reach a heat resistance of about 100 °C. As the bio-polyesters can then be mixed in any ratio, the advantages of both components can be combined and the blend properties customized to the application at hand. The resulting blends can be readily processed on standard injection molding, extrusion and thermoforming equipment.

Improved Heat Resistance and Elimination of the Miscibility Gap

Standard amorphous PLA begins to soften at temperatures as low as approximately 60 °C. This makes the material unsuitable for a wide range of applications, such as containers for hotfilling applications and cutlery. Although crystallization of PLA can generally improve heat resistance, it entails specialized equipment and long processing times and so reduces cost-effectiveness.



Comparison of different PLA based solutions for increased heat resistance

An alternative way to increase heat resistance is to blend PLA with PBS. No specialized equipment or extended processing time is needed.

Typically the miscibility of PBS with PLA is limited to a PBS content of approximately 20%, which is not sufficient to reach a heat resistance of 100 °C. The solution is to use VINNEX®, a polyvinyl acetate-based additive system that acts as a compatibilizer to eliminate the miscibility gap. Addition of 15–20% VINNEX® additive allows polymers to be blended homogeneously in any mixing ratio, and the properties can thus be customized to the application at hand.

Long-Term Stability

VINNEX® additives significantly reduce the recrystallization tendencies of PBS and therefore ensure that the initial properties are kept constant. In tests, no change in thermal or mechanical properties of PBS/PLA blends containing VINNEX® were observed over the course of eight weeks.

Initial Guide Formulation for PBS/PLA/VINNEX® Blend

	[%]
PBS – GS Pla FZ 91 PD (Mitsubishi Chemical)	40
PLA – Ingeo 4043 D (Nature Works LLC)	30
VINNEX® 2504	14
Filler – Talc or CaCO ₃	10

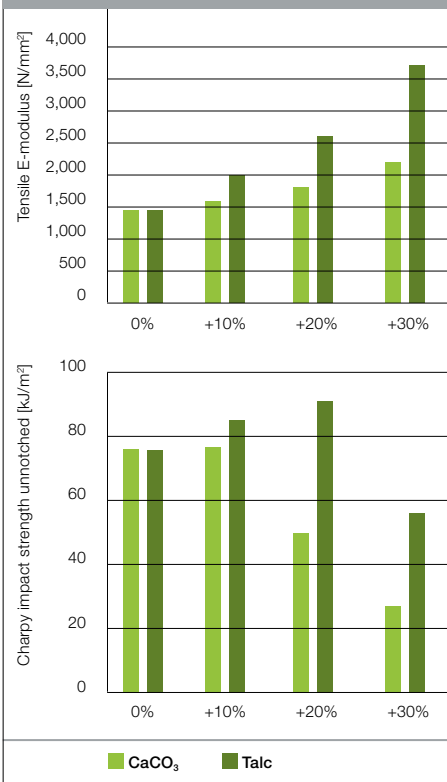
Properties of VINNEX® Powders

	VINNEX® 2504
Composition	Vinyl acetate-ethylene
Properties	Flexible
T _g [°C]	-7
Density [kg/m³]	1.23
Bulk density [kg/m³]	400–500
MFR melt index ¹	2.1
Food contact ²	Yes

¹ MFR melt index measured at 150 °C / 21.6 kg / 2 mm

² Suitable for food contact according to EU regulations for Food Contact and FDA (US Food and Drug Administration, §175.105, §175.300, §176.170 and §176.180)

Effects of Fillers on PBS/PLA/VINNEX® Blends



Improved Properties and Cost-Effectiveness with the Right Fillers

Adding fillers to PBS/PLA/VINNEX® blends can improve not only cost-effectiveness but also the physical properties of the blends. Up to 20% talc increases both the tensile E-modulus (a measure of rigidity) and the impact strength. As a result, manufacturers can achieve property profiles comparable to those of a number of standard plastics.

Enabling Thermoforming of PBS/PLA Blends



Thermoformed parts made of PLA/PBS/talc blends. Addition of VINNEX® powder enables the material to be properly thermoformed.

Improved Processing Properties

VINNEX® makes it easy to process heat-resistant biopolyester blends on traditional injection molding, extrusion and thermoforming equipment. Thanks to reduced recrystallization tendencies and improved melt strength, thermoforming of stable, three-dimensional structures is possible.

Biodegradability of Biopolyesters can be Maintained

Various blends of biopolyesters with VINNEX® have already passed the industrial composting test (ISO 14855 or EN 13432). As with every bioplastic compound, biodegradation largely depends on the formulation and has to be determined case by case. For more detailed information, please contact our technical service.

VINNEX® Can be Used in Food Contact Applications

VINNEX® 2504 can be used in food contact applications according to the EU regulations for Food Contact and the US Food and Drug administration (§175.105, §175.300, §176.170 and §176.180).

At a Glance: Advantages of PBS/PLA/VINNEX® Blends

- VINNEX® enables the production of PBS/PLA blends with a heat resistance of approx. 100 °C and customizable mechanical properties
- Addition of up to 30% talc can improve the tensile E-modulus (rigidity), impact strength and cost-effectiveness of the material
- Thermal and mechanical properties can be kept constant over time due to the reduction in PBS recrystallization tendencies
- PBS/PLA/VINNEX® blends can be easily processed on traditional injection molding, extrusion and thermoforming equipment
- Biodegradability of biopolyesters can be maintained
- VINNEX® 2504 can be used in food contact applications (EU and FDA)



Wacker Chemie AG, 81737 Munich, Germany, Phone: +49 89 6279-1741, Fax: +49 89 6279-1770
 info@wacker.com, www.wacker.com, www.wacker.com/socialmedia



The data presented in this medium are in accordance with the present state of our knowledge but do not absolve the user from carefully checking all supplies immediately on receipt. We reserve the right to alter product constants within the scope of technical progress or new developments. The recommendations made in this medium should be checked by preliminary trials because of conditions during processing over which we have no control, especially where other companies' raw materials are also being used. The information provided by us does not absolve the user from the obligation of investigating the possibility of infringement of third parties' rights and, if necessary, clarifying the position. Recommendations for use do not constitute a warranty, either express or implied, of the fitness or suitability of the product for a particular purpose.