

BIOADIMIDE™ IN BIOPOLYMERS EXPANDING THE PERFORMANCE OF BIO-POLYESTERS IN DURABLE APPLICATIONS

BioAdimide™ are additive solutions specially suited to improving the hydrolysis resistance of bio-based polyester (specifically PLA) and to expanding their range of applications. The BioAdimide™ product line enables the production of renewable, bio-based polymers for durable applications with a lower environmental impact.

BioAdimide™ also allows for a greater range of process variables in terms of

- Providing melt stability during processing
- Using higher levels of re-grind material
- Enabling blending with higher melting plastics by stabilizing the bio-based polyester component

BioAdimide™ 100 is the additive of choice for superior hydrolysis stabilization of bio-based polyesters. PLA (polylactic acid) is prone to hydrolysis, but...

- Depending on the choice of BioAdimide™ – service life can be increased up to 7 times compared to the unstabilized polymer (depending on test conditions).
- This extended performance makes PLA a suitable candidate for durable application markets previously out of reach.

BioAdimide™ 500 XT improves the melt stability of bio-based polyesters

- Stabilized PLA does not degrade during processing and
- enables compounders to have consistent and easier processing.

Combining different BioAdimide™ grades gives added flexibility for adjusting your system according to your needs

- ... in processing (extrusion, injection molding, foams, fiber extrusion, thermoforming)
- ... of the application (automotive, electronics, appliances, construction, bath and office equipment).



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QUALITY PERFORMS.



BioAdimide™ in bioplastics

Expanding the performance of bio-polyester



QUALITY WORKS.

LANXESS
Energizing Chemistry

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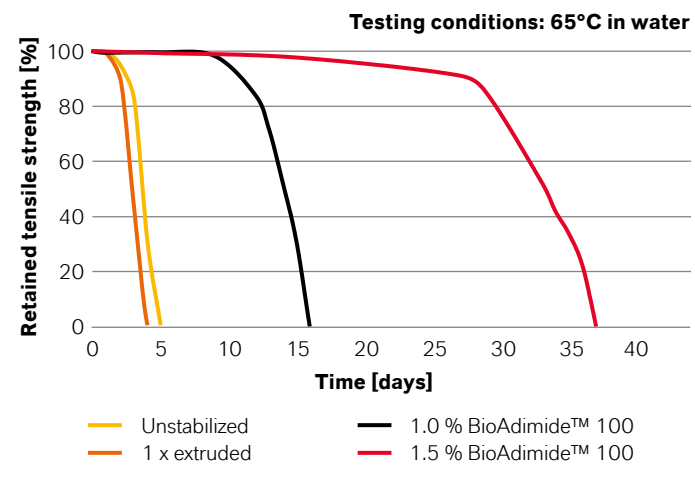
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BIOADIMIDE™ 100 CREATE THE PATH TO DURABILITY

BioAdimide™ 100 gives the best hydrolytic stability and improves the service life of PLA by 3 to 7 times (depending on the dosage and testing conditions).

Hydrolysis stabilization of PLA



BioAdimide™ 100 leads to an endcapping of the terminal carboxylic acid groups of the polyester, which are responsible for hydrolysis, and inhibits:

- Degradation of molar mass (Mn and Mw) ...
- Degradation of the polymer ...
- ... while maintaining the desired mechanical properties of the polymer.

Molar mass stabilization of PLA			
	Mn [g/mol]	Mw [g/mol]	Polydispersity
Unstabilized	42890	92310	2.15
1 x extruded	39400	89200	2.26
1.0 % BioAdimide™ 100	48570	100200	2.06
1.5 % BioAdimide™ 100	44420	96000	2.16

Testing conditions: Tetrahydrofuran, 40°C, viscosity detector, universal calibration.

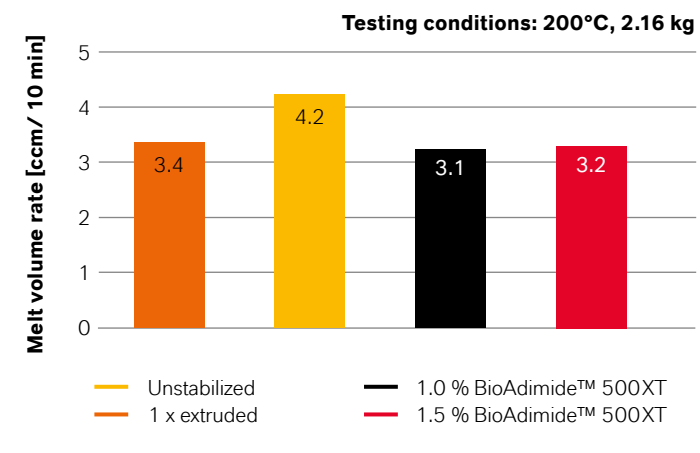
BIOADIMIDE™ 500 XT STABILIZE THE PROCESS. EXPAND THE PERFORMANCE

BioAdimide™ 500 XT increases the melt viscosity (displayed by a reduced melt volume rate – MVR) of PLA after extrusion by 20 – 30 % compared to unstabilized virgin resin.

The improved melt volume rate makes it especially suitable for:

- Extrusion
- Fibers
- Blow molding

Melt volume rate modification of PLA



BioAdimide™ 500 XT acts as a chain extender in PLA. Short and long polymer chains are re-connected without an undesirable broadening of the molar mass distribution (polydispersity) as seen with classical chain extenders.

In this way, BioAdimide™ 500 XT improves the molar mass and keeps the mechanical properties in a well-allowing defined range.

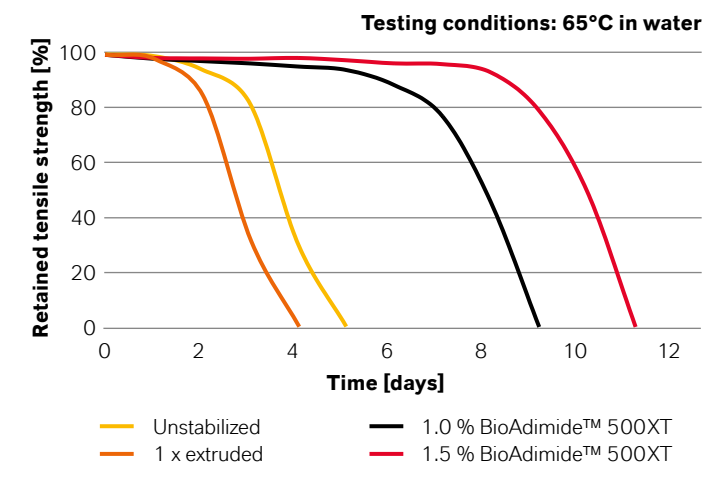
Molar mass stabilization of PLA			
	Mn [g/mol]	Mw [g/mol]	Polydispersity
Unstabilized	42890	92310	2.15
1 x extruded	39400	89200	2.26
1.0 % BioAdimide™ 500 XT	59200	108000	1.82
1.5 % BioAdimide™ 500 XT	59510	108000	1.80

Testing conditions: tetrahydrofuran, 40°C, viscosity detector, universal calibration

In addition to the processing improvement, BioAdimide™ 500 XT improves hydrolytic stability of PLA by 2 to 3 times.

BioAdimide™ 500 XT is offered as pastilles in powder, allowing for easy dosage using regular feeding equipment.

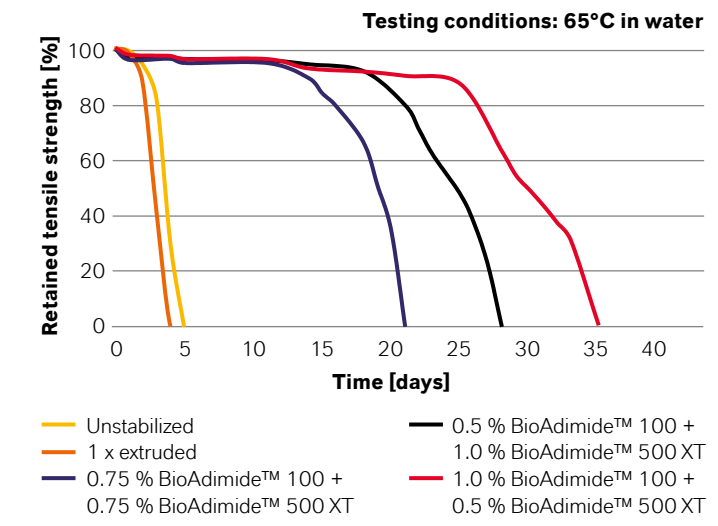
Hydrolysis stabilization of PLA



COMBINING BIOADIMIDE™ 100 AND BIOADIMIDE™ 500 XT THE FLEXIBILITY TO EXPAND YOUR APPLICATION

Combining BioAdimide™ 100 and BioAdimide™ 500 XT in different ratios, the service life of PLA can be extended by 3 to 7 times. The best performer is a ratio of 2 to 1 (BioAdimide™ 100 : BioAdimide™ 500 XT).

Hydrolysis stabilization of PLA



The combination of BioAdimide™ 100 and BioAdimide™ 500 XT allows you to meet the demand for both hydrolysis stabilization and improved processing.

Using a combination of different BioAdimide™ grades:

- The molar mass remains unchanged
 - Degradation is inhibited during processing
- Allows improved processing while leaving the molar mass distribution unchanged.

Molar mass stabilization of PLA			
	Mn [g/mol]	Mw [g/mol]	Polydispersity
Unstabilized	42890	92310	2.15
1 x extruded	39400	89200	2.26
0.75 % BioAdimide™ 100 + 0.75 % BioAdimide™ 500 XT	48240	90100	1.86
0.5 % BioAdimide™ 100 + 1.0 % BioAdimide™ 500 XT	49780	89800	1.80
1.0 % BioAdimide™ 100 + 0.5 % BioAdimide™ 500 XT	45400	89040	1.96

Testing conditions: Tetrahydrofuran, 40°C, viscosity detector, universal calibration.

