Sustainability

FARREL POMINI Biodegradable Plastics Compounding

PLA Compounding

The energy efficient and versatile FCM™, Farrel Continuous Mixer is ideally suited to process PLA and other biodegradable plastics.

Processing Challenges

PLA presents significant processing challenges:

- Temperature sensitive
- Shear sensitive
- Volatile and moisture build-up
- Molecular weight loss

PLA Case Study: Processing on the CP550

The CP550 is a production sized and scalable FCM™, Farrel Continuous Mixer and extruder on a unitized frame.

Study Conducted in Partnership with NatureWorks, LLC.

Background:

Validate findings of an earlier study comparing the results of the FARREL POMINI CPeX® Laboratory Scale Compact Processor and 40mm twin screw extruder.

Materials: NatureWorks, LLC: Ingenio 2003D
Specialty Minerals: Fortitalc 609 Talc

Objective:

Using the CP550 Compact Processor, confirm results of PLA & talc loading levels for both molecular weight and processing temperatures; determine output rate and evaluate dispersion quality.

Parameters Evaluated:

- Loading levels
- Molecular weight
- Process temperature
- Dispersion quality
- Output rate

CP550 Configuration:

- #15/7 Standard Rotors
- Rotor Speed: 240 - 300 RPM
- Rotor Cooling: On
- Medium Compression Single Screw Extruder

Data Summary:

- The CP550 was run at 450 kg/h
- Talc loading levels were 0%, 20%, 40%, 50%, 60% and 65%
- Some of the higher loadings were also processed with 1% EBS, a common process aid for PLA.

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FARREL POMINI
continuous compounding systems

Study Data:

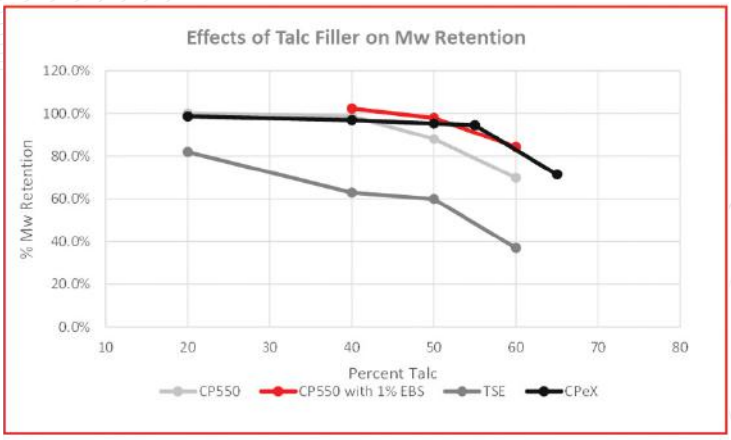

Figure 1, Effects of Talc loading level on M_w Retention

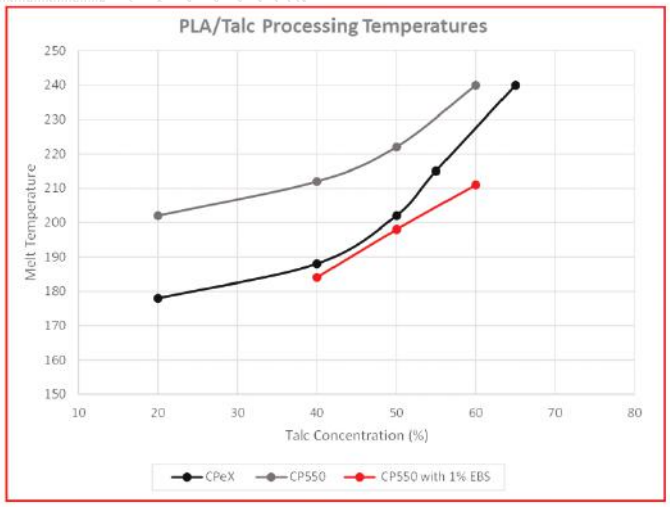

Figure 2, PLA/Talc Melt Temperature as a function of Talc concentration.

Study Results:

- The Mw retention at low talc loading levels are close to 100%, signaling negligible molecular degradation.
- At 50% and 60% loading, the Mw retentions on the CP550 are lower than the CPeX® values, but still higher than the TSE result from the previous study.
- With the addition of 1% EBS, Mw retention increased significantly:
  - At 50% filler, Mw retention increased from 88% to 98%.
  - At 60% filler, Mw retention increased from 74% to 84%.

Note: Higher fill levels lead to higher processing temperature which causes some Mw loss.

A throughput rate of 450 kg/h was achieved, which falls within the nominal production range for the CP550. However, achieving maximum production rate was not a consideration for this study and higher production rates are expected.

FARREL POMINI Continuous Mixing Technology addresses the challenges of compounding PLA by leveraging its distinctive design features, including:

- A **single-entry feed port** that reduces the contamination potential.
- A low-pressure, adiabatic, **large volume mixing chamber** enabling liberal material circulation and superior distributive mixing.
- The **6 L/D rotors** provide short residence time for minimal heat history and maximum molecular weight retention.
- The **two counter-rotating non-intermeshing rotors,** with specialized profile geometry, facilitate efficient and uniform levels of shear and excellent dispersive mixing.

The test results demonstrate the FARREL POMINI Continuous Mixing Technology is superior to twin screw extruders when processing PLA.

Scan the QRcode
to learn more or
by visiting our website:
https://www.farrel-pomini.com/applications/biodegradable-plastics/

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For more information, please contact your local Sales Engineer or call **+1 203 736.5500** to schedule time in a Customer Demonstration Facility.

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