

General Knowledge and Practices for Utilizing PolyEarthylene™ Products

The information provided in this production guide is intended as an accumulation of the best knowledge and practices for utilizing PolyEarthylene™ biopolymer products. Our resins are biobased and designed to decompose on a highly accelerated basis depending on the grade, application and part geometry. The goal of this guide is to supply users with necessary processing and safety precautions as it relates to PolyEarthylene. We encourage all customers to take a moment of their time to read through the information provided. It is our belief that the material below will highlight and showcase several key points about our biopolymer resins that can lead to better understanding of our products. This document will focus on five distinct aspects of PolyEarthylene:

1. General Understanding of PolyEarthylene Resins
2. Safety Procedures and Precautions for Using PolyEarthylene Resins
3. Management, Storage, and/or Disposal of PolyEarthylene Resins
4. Conversion of PolyEarthylene Resins on Industrial Lines
5. Processing Changes and Troubleshooting

We encourage all users to practice good manufacturing processes and abide by all standard safety protocols. Material safety data sheets and technical data sheets for most products can be found on our website at www.verdebioresins.com or by contacting your sales representative.

1.0 General Understanding of PolyEarthylene™ Resins

As awareness for environmental health and safety continues to grow; consumers, environmental groups and key CPG players have made global commitments for a greener future. Many Fortune 500 companies have made sustainability pledges to start building a circular economy for plastics. As such, PolyEarthylene can become the standard for a true circular economy.

Our proprietary technology converts sustainable materials into a portfolio of PolyEarthylene polyolefins that are biobased, landfill degradable, thermally stable, FDA compliant, and/or recyclable. PolyEarthylene bioresins are landfill degradable and designed to decompose on a customizable rate due to the naturally occurring microorganisms present in landfill environments. This provides Verde customers with the option for true end-of-life solutions.

Additionally, PolyEarthylene offers a balance of strength and mechanical properties that are consistent with its petroleum-based counterparts. PolyEarthylene offers a unique alternative to environmental concerns while maintaining the benefits of fossil polyolefins including, but not limited to:

- Suitable for single use and durable goods applications
- FDA Title 21 food contact compliant
- Shelf life stable similar to typical polyolefins
- Single pellet solution to replace traditional plastics
- Processing temperatures & cycle times similar to polyolefins
- Generally curbside recyclable under PE/PP recycling codes
- Industrial Recyclable minimizing waste similar to polyolefins

2.0 Safety Procedures and Precautions for Using PolyEarthylene™ Resins

PolyEarthylene is a highly customizable thermoplastic polyolefin material sold in the form of pellets. This material is processed in a molten state, so all typical safety precautions involving high temperatures and melted thermoplastics should be followed.

- Molten PolyEarthylene is generally of lower viscosity and sticks easily to all surfaces, including that of skin and gloves. Be aware of this when cleaning, collecting, or dumping molten material.
- No respiratory protection is needed for most cases; however, the use of ventilation can keep airborne levels below exposure guidelines.
- During processing and handling, wear proper plastic protection equipment (PPE) such as safety glasses, gloves, and hearing protection.
- At ambient temperatures, PolyEarthylene is considered non-hazardous. However, when handling the resin at room temperature always avoid skin and eye contact. At molten temperatures there is a severe risk of damaging the skin and eyes on contact. Molten PolyEarthylene waste should be allowed to cool before placed into any waste container to minimize fire risks.
- Since this material is highly specialized, refer to any documentation such as a material safety data sheet for specific concerns regarding the grade in use.
- PolyEarthylene is a product that can produce static during processing. Be sure to keep all equipment grounded. Also consider using anti-static clothing such as gloves when handling the material.
- Train operators and maintenance personnel on the hazards of processing polyolefins. Be sure that all equipment and procedures have the necessary precautions for protecting against these hazards.

3.0 Extended Shutdowns

If a polymer will not be flowing through the system for longer than 1 hour, but the temperatures will remain at the melting point of the polymer or higher this will be considered an extended shutdown.

- Under normal conditions, PolyEarthylene will undergo a residence time of just a few minutes or even seconds. No sort of decomposition is to be expected under these conditions, but the same cannot be said for extended periods of time. It is not recommended to leave PolyEarthylene in the equipment while

temperatures are hot. If the equipment is to be left at operating temperatures, purge any PolyEarthylene out of the system beforehand.

- PolyEarthylene is a material that requires careful maintenance. Equipment may need to be shut down to clean out any residue that remains stuck to prevent contamination of any product.
- Be sure to keep away any equipment that can produce a spark or flame until the area and equipment have been successfully cleared.
- During operations it is common for systems to be stopped for maintenance. If this time is shorter than 1 hour and PolyEarthylene is left during this time, purging is always going to be necessary to start back up. Upon restarting, expect the material to have thermally degraded and resulting in a drop in viscosity and molecular weight. Be sure that all personnel have proper awareness and are following safety precautions. Thermally degraded PolyEarthylene can change color. It is recommended to purge machine until the resin returns to the standard color.

4.0 Management, Storage, and/or Disposal of PolyEarthylene™ Resins

- PolyEarthylene should remain stored in an environment that will prevent as much moisture buildup as possible.
- The product should be stored inside a cool room, in an area away from direct sunlight, and at a temperature below 122°F (50°C).
- The best practice is to keep the original PolyEarthylene pellets in the original sealed container prior to use. Heat seal bag after it has been opened for future use.
- Production of PolyEarthylene can produce static, so consider storing it in an anti-static bag or storage unit if necessary.
- Like any other thermoplastic waste, molten PolyEarthylene should be allowed to cool before storing or disposing.

5.0 Conversion to PolyEarthylene™ Resins on Industrial Lines

Each polymer processing line is designed for specific materials and applications. PolyEarthylene is designed to directly replace traditional polyolefins. Refer to any documentation such as technical data sheets or material safety data sheets to obtain specific properties.

- Before beginning production, it is essential for equipment to be purged.
- If PolyEarthylene material has burned inside the equipment and becomes difficult to remove, a rigid material such as polystyrene shows a lot of success in removing it. However, a deep cleaning of the equipment utilizing disassembly, and tools may be necessary.
- If an additive or pigment is used during processing, be sure that the base PolyEarthylene looks clear before adding to it.
- Moisture level, processing temperature, and shrinkage are all critical design parameters of PolyEarthylene applications.

- PolyEarthylene generally has a higher density than its polyolefin counterparts, so products will most likely also have a heavier weight. Be sure not to exceed any loading capacities and that personnel are aware of the heavier lift loads.
- Assure that moisture levels of the PolyEarthylene is below 0.05% before processing. Any level higher than this would require drying before processing as the higher moisture can create product defects.
- When utilizing a mold for any purpose such as injection molding or blow molding, proper cooling at the mold is essential to create quality parts.

6.0 Processing Changes and Troubleshooting

- Generally, the viscosity of PolyEarthylene varies with temperature. Always make sure temperatures are within a margin of error of 15°F.
- The quality of the melt exiting the die and nozzle are a very telling sign that the product will yield quality results.
- Refer to any documentation such as technical data sheets and material safety data sheets for specific recommendations regarding troubleshooting of certain PolyEarthylene grades.
- Contact your Verde sales representative for any questions regarding PolyEarthylene.

Safety and Handling Considerations

Material Safety Data Sheets (MSDS) are provided by Verde Bioresins to help customers know about the safety of handling PolyEarthylene. Disposal, handling, and health concerns are all covered by these documents. MSDS's are regularly reviewed and updated, so be sure to obtain the most recently uploaded version when using any of our products.

Hazards and Handling Precautions

PolyEarthylene is a safe material with a low degree of toxicity. At room temperatures skin and eye contact should not create a high cause for concern but take care to not ingest under any condition. Take caution when storing, handling or disposing of resins. Pellets can become a slipping hazard on the floor.

Follow all safety precautions according to the standard PPE use. Proper gloves with thermal protection to be used when exposed to molten plastic, and static protection should be used for handling the final product. Be aware of the viscosity of the molten material as it sticks well to most surfaces including that of gloves. Ensure all personnel minimize the time in contact with molten material.

Ventilation or vacuuming in the facility should do well enough for most applications and conditions. If exposure is causing discomfort on the eyes, improve the fume exhaustion. If the problem persists, utilize a full-face respirator.

Combustibility

PolyEarthylene, like other polyolefins, is very flammable. Smoke will begin to produce when it burns, and toxic fumes may begin to be released. Do not continue to run machinery and equipment and do not allow dust to build up.

Disposal

Do not dump PolyEarthylene into any sewer, body of water, or the ground. Unusable or molten material should be allowed to cool before disposing in proper waste containers. Still usable material that has not been contaminated can be recycled back into the process. Otherwise, follow proper disposal methods approved by Federal, State/Provincial, and local laws and regulations. While PolyEarthylene is landfill degradable, it is recommended to dispose of through proper government municipalities to ensure it arrives at the landfill.

Environmental Concerns

Under no circumstance should plastic be discarded into the environment. Lost PolyEarthylene pellets should not have a great impact on the environment due to their degradable nature but must always be prevented as best as possible. Ingestion of PolyEarthylene pellets by wildlife may cause adverse effects.

Additional Concerns

For any additional information please contact Verde Bioresins, Inc. via our [website](#) or contact your customer service representative.



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