

HydroPLA Hydrophilic polymer

HydroPLA is a polymer material for injection molding and extrusion. The unique feature of HydroPLA is that the molded devices are hydrophilic directly from the molding machine or the extruder. No coating or plasma processes are needed.

HydroPLA can be used for a number of applications but is developed for single use medical devices.

HydroPLA features

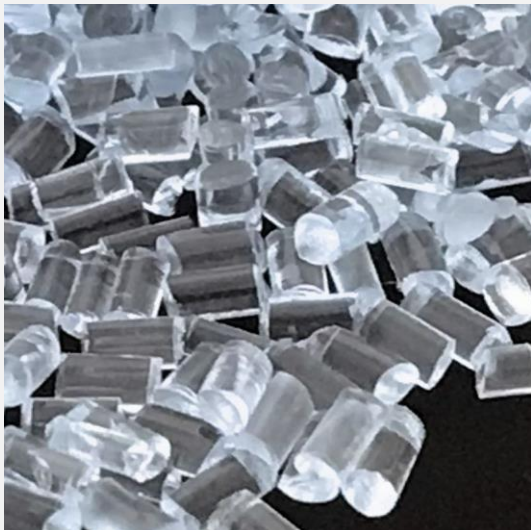
- Devices are hydrophilic directly from the molding machine.
- Maximum hydrophilicity is achieved 24 hours after moulding.
- HydroPLA is delivered in pellet form ready for use.
- HydroPLA is a biopolymer derived from annually renewable resources.
- Can be used with standard injection molding machines and standard extruders.
- Long functional life (10+ years) thus easily supporting a 2 year shelf life of a device.
- HydroPLA devices are tolerant to storage without temperature control.
- Biocompatible

Material compatibility

HydroPLA is compatible with most materials, but there are substances it is not compatible with. These include; Chlorine, Hypochlorides, Peroxides, Ozone etc. These are all very reactive substances, and these may inactivate the HydroPLA surface, so it is no longer hydrophilic.

Optical properties

HydroPLA is semi-transparent and available in two colors: Medical-Blue and Natural (faint yellow tone). For minimum color and haze follow the process guidelines and design for thin sections and rapid cooling during moulding.



HydroPLA – Medical Blue



HydroPLA - Natural

Hydrophilic characteristics

Contact angle

Depending on the process parameters and the part design, contact angle for HydroPLA is between 10° and 20°. This is enough to ensure; fast and stable capillary flow, prevention of air bubbles, printability etc.

Hydrophilic comparison

- | | | |
|----------------------------|--------|---------------------------|
| • PMMA/Acrylic | CA=73° | $\cos(73^\circ) = 0.2924$ |
| • P100 hydrophilic coating | CA=10° | $\cos(10^\circ) = 0.9848$ |
| • HydroPLA | CA=10° | $\cos(10^\circ) = 0.9848$ |

The cosine to the contact angle is a measure of how fast capillary flow will be.

Reference for cosine to the contact angle

- | | |
|----------|--|
| 0.25-0.3 | The "capillary friction" of a channel. The threshold for capillary flow. |
| 0.70 | Medium speed and highly stable capillary flow. |
| 0.90 | Fast and stable capillary flow. |
| 0.98 | Very fast flow. For some designs this may be too hydrophilic, and thus unstable. |
| 1.00 | Very fast and uncontrolled capillary flow. Very likely to trap air bubbles. |

Material properties

Physical properties

- | | |
|-----------------------|--|
| Density | 1.25 g/cm ³ |
| MFI | 44.0 g/10min (ISO 1133: 185°C / 2.16 kg) |
| Shrinkage | 0.25% to 0.35% |
| Heat distortion temp. | 55°C |

Optical properties

- | | |
|------------------|---|
| Color | Semi-transparent and faintly blue or yellow |
| Haze | Low (minimum haze is for thin sections rapidly cooled in the mould) |
| Refractive index | 1.46 |

Functional life of HydroPLA

In dry air storage

Unlike many hydrophilic treatments, a device molded in HydroPLA will maintain the hydrophilic property for a very long time. An accelerated functional life study (ASTM-F1980) has been made in normal humid air. No degradation can be measured over the effective 10 years of the study. Until we have years of real-time stability data, we recommend storing devices made in HydroPLA in a dry atmosphere.

In contact with water

When contacting water, the hydrophilic property will decay over time. How fast it decays depend on temperature and the physical conditions (flow, bubbles, physical contact etc.).

We do not recommend HydroPLA for use in devices intended for multiple uses, or for devices requiring the hydrophilic property over extended periods of time in contact with water.



Processing guidelines

HydroPLA can be processed using standard injection moulding machines and extruders.

Drying

HydroPLA is delivered dry and ready for use.

HydroPLA will absorb water from the atmosphere over time. The presence of moisture will hydrolyze PLA in the melt phase and cause discoloration and haze.

After opening a bag of HydroPLA, it should be stored dry to prevent absorption of moisture. If the material has absorbed moisture, we recommend discarding the material and continuing with a new bag of HydroPLA. If you insist on drying then use 50°C in dry air for 16 hours.

Temperature settings

Zone 1 / Rear	30°C - 50°C
Zone 2 / Center	170°C - 180°C
Zone 3 / Front	170°C - 180°C
Zone 4 / Nozzle	165°C - 175°C
Mold	20°C - 60°C

Maximum process temperature 185°C.

We recommend using the lowest possible temperature and the shortest possible residence time. Best results are achieved by high speed injection, medium pressure and long cooling time. These settings are not specifications and should be seen as a starting point for optimization.

Preventing material degradation

The hydrophilic additive is slowly inactivated at high temperature. To ensure hydrophilic devices stay within these limitations:

- **Maximum 185°C process temperature**
- **Maximum 2 minutes residence time**

The residence time is the time the material is exposed to high temperature. A big moulding machine for a small part is not recommended.

If the limitations are exceeded the hydrophilicity of devices will be significantly reduced.

Release agents

Do not use mold release agents or add anything to the HydroPLA material. Release agents are often oily substances which will leave a very thin and invisible hydrophobic residue on the molded devices. The hydrophobic residue covers the HydroPLA hydrophilic material, and the device thus becomes hydrophobic. **Do not use mold release agents!**

- **Do not use mold release agents**
- **Maximum process temperature 185°C**



Storage, disposal and safety

Storage

Store HydroPLA devices and pellets dry and in sealed plastic bags. To avoid condensation of water on the HydroPLA pellets, the material should be given time to reach room temperature before opening the plastic bags.

Disposal

HydroPLA may be included with other waste containing similar plastic materials to be discarded for destruction or reclaim in accordance with local state and federal regulations. It is the responsibility of the customer to ensure the disposal of HydroPLA is made in observance of all applicable environmental regulations.

Environmental, Health and Safety

HydroPLA in both pellet and molded part form, is biocompatible and completely safe. No safety precautions are needed but getting HydroPLA dust into eyes/lungs should be avoided. Like any other plastic material, HydroPLA will decompose slowly in nature and thus shouldn't be released in nature or other uncontrolled environments.

Warranty

The information in this datasheet is based on our experience and is, we believe to be reliable, but may not be complete. We make no guarantee or warranty, expressed or implied, regarding the information, use, handling, storage, or possession of this product, or the application of any process described herein or the results desired, since the conditions of use and handling of the product is beyond our control.

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