How to seal 3D prints for an aquarium

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Abstract. Coat the print in a sealant its maker calls fish safe once cured, such as Pond Armor Pond Shield (24 hours to cure), and use natural PLA or PETG with no added color.

Keywords: waterproofing, pla, petg

Table 1. Coatings whose makers state fish or aquarium safety

Coating	Type	What the maker states	Mix and working time	Cure before water	Surfaces the maker names
Pond Armor Pond Shield	Two-part epoxy, clear or colored	Safe for fish and aquatic plants once fully cured; suits fresh and saltwater aquariums	Sets up in about an hour at 72 °F	24 hours; 12 more in cooler temperatures	“Some plastics”, PVC and ABS pipe; not polyethylene or polypropylene
Smooth-On Habitat Cast N Coat	Filled two-part epoxy, tan; brushable once thickened	On Smooth-On’s aquarium-safe list; safe for elements near aquatic life	1A:1B, 85 minutes	16 hours at room temperature	PVC, acrylic, “many metals, plastics and foams”

1 How do you seal 3D prints for an aquarium?

Print in natural PLA or PETG and sand it. Then brush on a coating whose maker states it is fish safe once cured, such as Pond Armor Pond Shield. Coat every surface and wait for the full cure: 24 hours, 12 more in cool weather, with no tacky spots. Smooth-On’s XTC-3D print coating is not on its aquarium-safe list.

1.1 Coatings whose makers state fish or aquarium safety

Figures come from the Pond Armor FAQ and application notes, Smooth-On’s aquarium-safe FAQ and the Habitat Cast N Coat technical bulletin. Neither maker names PLA or PETG as a surface, so test adhesion on a scrap print first.

1.2 Step by step

1. **Pick natural filament.** For PLA (polylactic acid) or PETG (glycol-modified PET), Prusa Research advises asking the maker about additives or using natural filament with no added coloring.
2. **Print with a stainless steel nozzle if you can.** Prusa warns that brass nozzles, and even its hardened steel ones, may carry lead from the alloy. Its food-grade guide says the same methods apply to aquarium accessories.
3. **Rough up the surface.** Pond Armor wants the surface to feel like 60-grit sandpaper. Sand, then wipe with 90% + isopropyl alcohol or denatured alcohol.
4. **Mix small batches.** With Pond Shield, mix only what you can brush on within an hour and pour it out of the cup at once, because heat in the cup shortens pot life. Pond Armor says it cures when applied above 50 °F.
5. **Coat every surface, inside caves and holes too.** Pond Shield needs a finished film of at least 10 mils, about three sheets of paper. A rough surface, such as a print’s layer lines, takes two coats of about 5 mils each.
6. **Recoat on time.** A second coat of Pond Shield within 10 hours needs no sanding. After 12 hours, scuff the first coat with 60-grit paper.
7. **Wait out the full cure at room temperature.** Prusa warns that every epoxy resin is toxic in liquid form and that under-cured resin may stay toxic. Smooth-On’s aquarium test used samples cured as their bulletins direct. Skip heat to speed things up on PLA, which softens above 60 °C according to the Prusa Knowledge Base.
8. **Inspect under strong light.** Pond Armor’s method: look at the surface at an angle in direct light for cracks, voids, thin areas and bare spots. Scuff any flaw with 60-grit paper and touch it up, then run the check at the bottom of this page.

1.3 Why seal a print at all

Layer lines hold dirt and microbes. Prusa Research found that the gaps between FFF (fused filament fabrication) layers become a breeding ground for bacteria and fungi. In its 14-day milk test, an untreated cup grew the largest bacterial colonies and an epoxy-coated cup grew none. Prusa names aquarium accessories as a case where you coat the surface to stop algae building up.

The plastic is a second concern. Oskui and colleagues (Environmental Science & Technology Letters) found parts from a fused deposition printer, the melted-plastic kind, measurably

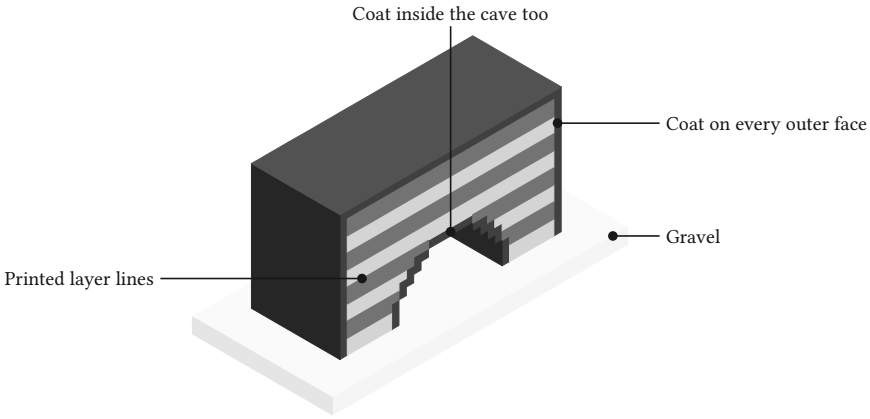


Figure 1. The coating goes over every surface, inside the cave too, so no bare layer line is left for dirt and algae to build up in.

toxic to zebrafish embryos. Parts from a resin printer were far more toxic. That was a lab test on embryos, not a tank.

1.4 What the makers do not claim

- **Filament makers.** Bambu Lab certifies every ingredient of PLA Pure to EU 10/2011, the food-contact regulation. It also says those certifications cover the filament, not a specific printed object. Its launch post says nothing about fish.
- **XTC-3D.** Smooth-On's brush-on print coating, the one on the epoxy sealing page, is absent from its aquarium-safe list.
- **Potable-water epoxies.** NSF/ANSI 61 drinking-water certification comes with a minimum tank size: 50 gallons for Progressive Epoxy Polymers' LiquaTile 1172, and 1,000 or more for older potable epoxies, per the maker. Its page makes no claim about fish.
- **Bonding to PLA or PETG.** Pond Armor lists only "some plastics" beyond PVC and ABS pipe, and says no coating holds long term on polyethylene or polypropylene liners.

1.5 Does PLA last in a heated tank?

For a year at least, on the evidence so far. Think Fish puts most tropical fish in water of 22 to 28 °C and recommends 24 to 26 °C for most species. Karamanlioglu and Robson (Polymer Degradation and Stability, 2013) saw no change in PLA tensile strength or molecular weight after a year at 25 or 37 °C. They named temperature the key factor in breakdown.

Their samples were packaging coupons, not prints. The warmer-water figures are on how long PLA lasts in water.

1.6 How to check it before it goes in the tank

1. Press the coating with a gloved finger on every face. Any tacky spot means the cure is not finished, and Pond Armor says not to fill until none remain.
2. Recheck the inside of caves and holes under a bright light at an angle.
3. Copy Smooth-On's approach on a small scale. Test a bucket of tank water with your usual aquarium test kit, then put the cured part in and retest at intervals. A reading that moves points at the part.
4. If the coat peels at a corner or edge, the bond to the plastic failed. Strip it, sand again and recoat, or try another coating from the table.

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