

How Is 3D Printing Waste Resin Generated?

All resin-based 3D printing technologies produce waste resin. In its liquid form, resin is classified as a hazardous material. However, during the 3D printing process, resins are transformed from a liquid to a solid by being exposed to UV light.

Here is an overview of how waste resin is produced in the three most prolific resin 3D printing technologies:

PolyJet 3D Printing Technology

PolyJet 3D printers work by inkjet printing tiny droplets of resin one layer at a time on a build platform. The UV lights attached to the print head simultaneously cure the resin, forming a single, fully cured cross section of the parts on the build platform. Once a cross section is completed the build platform is lowered in the Z-direction, and the process is repeated for the next layer until the part is completed.

PolyJet waste resin is generated in the following three ways:

1. **Interval Cleaning:** At pre-determined intervals during the print process, the print head travels to the side of the build platform and automatically jets small amounts of resin through the print head nozzles into a waste reservoir. This process clears the nozzles and, in effect, cleans the print heads. Although a very small amount of material gets wasted in each interval, this process continues, and waste accumulates over time.
2. **Material Changeover:** When an operator loads the printer with a different resin there is a purge cycle to clear the printer of the previously used resin. For example, when changing from VeroBlack to VeroWhite, the VeroBlack that is residing in the printer's heads and hoses is purged into the waste container.
3. **Expiration:** PolyJet materials have a shelf life of 12 to 14 months and will expire if left unused. Each container has an RFID tag with the expiration date. This prevents damage to the printer, since the material will coagulate and clog up the print heads.

SLA (Stereolithography) 3D Printing Technology

SLA 3D printers work by beaming a UV laser onto a vat filled with UV light-sensitive resin. When the laser hits the resin, it cures it from liquid to a solid. After parts are printed and removed from the vat, the user must pour additional resin into the vat to "top-it-off." Typical vat volumes are anywhere from .2 Liters (Formlabs Form 2) to 400+ Liters (3D Systems ProX 800 and Stratasys Neo800).

SLA waste resin is generated in the following ways:

1. **Post Processing:** When cleaning SLA parts, the parts are bathed in IPA (Isopropanol), which removes any excess uncured waste resin. Over time, the IPA becomes semi-saturated with uncured waste resin and must be disposed.
2. **Contamination:** SLA systems utilize an open vat configuration. If the vat gets contaminated with foreign debris or partially cured remnants from previous print runs, then it needs to be replaced.
3. **Expiration:** SLA resins have a shelf life of 18 to 24 months. Upon expiration, the material must be disposed of properly.



DLP (Digital Light Projection) Technology

DLP 3D printers work by using a UV light projector and flashing an image onto a vat (build tray) filled with resin. When the UV light image is projected onto the resin, the resin is partially cured from a liquid to a solid. After parts are printed and removed from the vat, the user must pour additional resin into the vat to “top-it-off.” Typical vat volumes are small which enables the user to easily change build trays.

DLP resin is generated in the following ways:

1. **Post Processing:** When cleaning DLP parts, the parts are bathed in IPA (Isopropanol), which removes any excess uncured waste resin. Over time, the IPA becomes semi-saturated with uncured waste resin and must be disposed.
2. **Expiration:** DLP resins are more unstable than SLA resins and typically have shorter shelf lives. Some of the two-part resins, such as the EPX 82 from Carbon 3D, once mixed, only last for 24 hours and must be disposed. Some Carbon 3D customers report disposing of as much as 1 gallon per month of uncured DLP resin.

