Plastic Shredder

SLQ Wiki Fabrication Lab 2024/03/29 07:26

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Shredder components were laser cut by external service providers according to the design files available from the https://preciousplastic.com/en/ website, with the following modifcations:

- housing material was 250 GR mild steel, rather than stainless. This meant that material costs were reduced, although painting was required to prevent corrosion.
- blades were cut from BIS 80, a high strength steel, rather than stainless. This was intended to produce cutting blades that will withstand greater stresses, and maintain an edge for longer.
- shaft was made from 28.257 hex bar (available as stock in Australia), with ends turned to 20mm. This size allowed use of a readily available coupler to attach the motor. A keyway was cut into this shaft, rather than using the grub screw of the original design.
- a transparent acrylic hopper was fabricated and mounted above the exposed shredder blades, to provide added safety and increase ease of feed. A short push stick was then used to assist feed entry to the shredder.
- the sieve screen was modified according to more recent Precious Plastics designs, with extra holes made in the shredder housing to allow the screen to be fixed in place using threaded pins, as a way to make removal and cleaning easier (see: https://preciousplastic.com/en/videos/build/upgrades/shredder-2-1.html).

Operational Observations

After being in controlled use for 12 months, the following observations arose:

- public demand was low, but steady. Users were inducted on a one-on-one basis, with direct supervision during initial operation. Currently (end 2019) users have requested access 1 -2 times per month, mainly by email contact.
- the batteries seem not to hold a charge very well. It is essential to leave the machine charging overnight, up to the time of use.
- during use the motor and gearbox get very hot. This is normal, according to advice from the suppliers. A pause is required after about 2 hr continuous use to allow things to cool down.
- the motor brushes burnt out about 12 months after commissioning. Replacements are available (about $10 a set), and spares are now kept on hand.
- during operation , a static charge builds up that causes fragments of plastic to stick to the acrylic hopper, and other surfaces. Regular brushing during operation can address this to some extent.
- cleaning between jobs is a major frustration. As the material is shredded, heat causes small pieces to stick to blades and screen, and smal pieces too large to pass through the screen remain lodged in the grinder. Brushing (from below) and vacuuming are only partially successful. Running the shredder for 5 min without adding new material seems to help clean things out, but carry over is always noticeable.
- if the input material is a rigid plastic (eg: ABS, PLA) pieces tend to fly out of the hopper during use. A cardboard hopper cover has been attached to prevent this, and should be present when jobs commence.
- the process is slow. For a soft, easily shredded material like milk bottle HDPE, about 5 - 10L of shreds can be produced per hour.

- PET bottles cause a lot of jamming, and this slows the process considerably. The thicker bottoms and tops of these bottles are especially difficult to process.
- solid pieces of rigid scrap (failed 3D prints, for example) may not be shreddable without first reducing the size (hit it with a hammer).
- portability has been useful - the shredder has been rolled out during Fun Palace, for example - and it has been of great interest to the public.

Suggestions for Future Improvements

- redesign and rebuild as necessary to allow easy cleaning between jobs. This will be essential as usage increases. Hinging the screen is a likely solution.
- given the cost of manufacture, and wide skill set required for the build, members of the public wanting to have their own machine have been advised to consider buying an off-the-shelf solution. Many small-scale options can be found on Ali Express for about $2000.
- comparison with re-purposing an existing machine would be worth exploring, A garden shredder might do the job,for example, for a much lower cost.
- the motor seems underpowered. While this is constrained by using a 24V system, upgrading to 240V, and installing a 2kW motor would overcome many of the jamming and overheating problems.