Ecological Extrusion: A Low-Cost Device to Use Plastic Waste for 3D Printing

Samuel, Tristan (School: Good Hope Country Day School)

The average US household produces 500 pounds of plastic annually, and most of it is not recycled. Only 18% of plastic waste is recycled globally, and without viable business models for recycling plastic, even much “recycled” plastic is burned or dumped. Home machines to turn plastic into 3d printer filament have been created, but inexpensive models that actually use plastic waste are few and far between. I prototyped a machine using only readily available parts and tools to test if an affordable machine could be built. Similar designs only accept easily processed, pre-made plastic pellets, so I decided to test whether it was possible to use only truly recycled plastic waste. I engineered a machine that pushes plastic shreds through a pipe using an auger bit and motor while heating them into a molten state, and finally extrudes the molten plastic through a nozzle to create 3D printer filament. Using plastic waste in a machine built for cost-effectiveness was tricky, but the idea proved viable. As most existing DIY designs do not use plastic shreds, the extruded filament lacked consistent thickness, but the plastic formed strands that could be used for 3D printing, even without using a nozzle for precise extrusion. The results showed that such a machine is possible, and costs roughly $120 compared to the $1000-$2000 commercial designs. Devices like this could enable commercially viable, small-scale plastic recycling. Improvements to this design could make the winding process easier, thickness variable, and make it even more autonomous.

Awards Won: