Biodegradability of 3D Engineered Polylactic Acid/Thermoplastic Polyurethane Ammunition

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Lead pollution is a serious environmental issue as elevated levels contribute to negative neurological effects within animals, as well as slowed growth and reproduction rates. Finding methods of reducing the deposition of lead via traditionally manufactured ammunition is important because after it is fired, it remains intact for extremely long periods while leaching lead into the soil and posing a potential risk to water supplies near areas of contaminated areas. Using biodegradable polylactic acid/thermoplastic polyurethane blended filament to 3D engineer and replace the materials used in the standard bullet (lead, zinc, and copper), it is possible to reduce the amount of lead tremendously. During these trials, three of each caliber (9 mm, 7.62 mm, and 50 mm) were replicated using Autodesk Fusion 360 opensource software, 3D printed using blended PLA/TPU filament, and were tested by applying simulated environmental pressures (500watt halogen light exposure 24hrs/day, 1 liter of water two times per day). This study demonstrates that 3D engineered ammunition using PLA/TPU filament may be an environmentally sustainable solution to preventing future lead pollution. Further studies will focus on biodegradability of the product within natural environments, theoretical calculations of testability to be fired, and biodegradability with mammalian tissues.

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