

Design and development of detachable water PLA filters using 3D printing

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The current paper describes the design and development of two detachable PLA water filters able to be attached in 5L and 500 ml bottles. The intended use of the former was the water filtration for settlements with poor or non-existent water systems, and of the latter the use for outdoor activities (i.e. camping, climbing). Polylactic Acid (PLA) was used as filament since it is synthesized by a naturally occurring L-lactic acid monomer derived from plant starch (i.e. corn, cassava, sugarcane) [1] that renders it a safe material for contact with potable water. The filters were designed using the Autodesk Fusion 360 programme, extracted in .stl format using the Cura Ultimaker programme and produced by means of the Creality Ender-3 v2 3D printer. The 5L model consisted of two ergonomically designed parts: the first part comprised of the elongated nozzle and the main filter chamber with side grooves for maximum flow while the second one was a detachable part for chamber sealing (Figure 1a). Maximum sealing was ensured by incorporating a user-removable grip that can be removed during the filtering media change process. The chamber is accessible and can be filled with the appropriate filter material through this grip. Holes were also formed in order to maintain the desired water flow. The dimensions of the 5L model were approximately 90,5mm x 57mm x 37mm (total length x nozzle diameter x filter diameter), implying a filter with large volume but at the same time with high durability. Portability and minimalism were the basic design principles for the 500ml model (500M). Being 52% smaller than the 5L one, this filter is light weighted and allows easy transport and storage. 500M filter consisted also of two parts: a nozzle and a chamber with holes (Figure 1b). The nozzle was modeled to look like a bottle cap for sports with ergonomic grooves on the sides for better grip, providing maximum flow. The dimensions of the 500M model were approximately 77mm x 32mm x 14mm (total length x nozzle diameter x filter diameter) and its minimal design renders it an excellent option for outdoor activities, allowing the user to carry it everywhere.



Figure 1: Nozzle and main filter chamber of the a) 5L filter and b) 500ml filter

References

[1] Nadagouda, Ginn and Rastogi, *Current Opinion in Chemical Engineering* **28**, 173 (2020).

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