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# Fused Deposition Modelling as the Manufacturing Method of Fully Bio-Based Water Purification Filters

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**Abstract :** We present the processing and characterisation of three-dimensional (3D) monolith filters based on polylactic acid (PLA) reinforced with various nature-derived nanospecies such as hydroxyapatite, modified cellulose fibers and chitin fibers. The nanospecies of choice were dispersed in PLA through Thermally Induced Phase Separation (TIPS) method. The biocomposites were developed via solvent-assisted blending and the obtained pellets were further single-screw extruded into 3D-printing filaments and processed into various geometries using Fused Deposition Modelling (FDM) technique. The printed prototypes included cubic, cylindrical and hour-glass shapes with diverse patterns of printing infill as well as varying pore structure including uniform and multiple level gradual pore structure. The pores and channel structure as well as overall shape of the prototypes were designed in attempt to optimize the flux and maximize the adsorption-active time. FDM is a cost and energy-efficient method, which does not require expensive tools and elaborated post-processing maintenance. Therefore, FDM offers the possibility to produce customized, highly functional water purification filters with tuned porous structures suitable for removal of wide range of common water pollutants. Moreover, as 3D printing becomes more and more available worldwide, it allows producing portable filters at the place and time where they are most needed. The study demonstrates preparation route for the PLA-based, fully biobased composite and their processing via FDM technique into water purification filters, addressing water treatment challenges on an industrial scale.

**Keywords :** fused deposition modelling, water treatment, biomaterials, 3D printing, nanocellulose, nanochitin, polylactic acid
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