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3D PLA Printed Scaffolds as a Carrier for Nanocrystals †

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Abstract: Among the multiple strategies used to improve drug solubility, the formulation of nanocrystals (NCs) has become the preferred one. However, NCs are difficult to incorporate into Solid Dosage Forms (SDF) due they are powders with unfavorable flow properties for industrial processing, and their aggregation by external forces (granulation, compression) is complicated. This work aimed to vehicle NCs in an SDF using Fused Deposition Modeling (FDM) 3D printing. A nanosuspension was prepared by microsphere-assisted nano milling using a laboratory-scale mill (NanoDisp®) and a model drug. To get the Polylactic Acid (PLA) scaffolds, we designed an STL file of a solid cylinder and "sliced" it setting “zero” in all external layers in the software. The zigzag (ZZ) and gyroid (GG) infill patterns were selected due to their geometric arrangements, and infill percentages of 20, 40, and 60% were used. The loading method consists in soaking up the scaffolds in the nanosuspension and freeze-drying them, causing the adherence of dry nanocrystals on the inside of the PLA holes. As expected, the scaffold design affected the load percentage and uniformity. Scaffolds with 20%, 40%, and 60% infill have loaded on average 20±4.0%, 9±2.5%, 5±1.0% of NCs, respectively. No significant differences were observed between the GG and ZZ designs. In dissolution tests, all scaffolds showed immediate dissolution reaching values greater than 85% at 5 minutes. As observed, FDM Scaffolding represents a promising strategy to vehicleize NCs into oral SDF.

Keywords: 3D printing; drug delivery; nanocrystals.

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Conflicts of Interest

The authors declare no conflict of interest.