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Fabrication, texture measurement and analysis of 3D printer filaments for drug delivery

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Aim: 3D printers have been used in a wide area for different applications, including pharmaceutical applications. Thermoplastic filaments like PLA, ABS & PVC etc., are commonly used with 3D printers. In our study, we aimed to make flexible filaments that can be used with FDM printers for the formulation of drug delivery systems. For this purpose, we made filaments with hot melt extruder and the flexibility of the fabricated filaments was evaluated with texture profile analyzer.

Preparation & Characterization: Filaments were prepared with a hot melt extruder (MiniLab II Micro Compounder, HAAKE™, Germany) with co-rotating twin screws. Different formulations were made and the characteristics of the filaments were investigated with texture profile analyzer and compared with commercially used PLA filaments. Texture analyzer was set in compression mode, and a probe was moved to the filaments at a speed of 1 mm/s. The angle was measured when the filaments were broken. Texture analyzers were made with Kollidon 12PF-PEO-PEG (6:1:1)(F1) and (6:2:2)(F2); PLA(F3) Kollidon VA64F-PEG (4:1)(F4) and; kollidon VA64F-PEG-aerosil (4:1:0.25)(F5) formulations.

Results & Discussion: PLA filaments (F3) were made and compared with other formulations in terms of compatibility with 3D printers. Lutrol F68; PEG; Kollidon 12PF-PEO (9:1) and (6:1) blends were used with hot melt extruder and each of them resulted with brittle filaments which could be broken even with a small force application. Kollidon 12PF-PEO (3:1) and Kollidon 12PF-Lutrol F68-Gliserol (9:1:0.2) formulations resulted with very soft filaments. Since the FDM printing process is based on pushing/pulling the filament continuously, brittle or very soft filaments will cause problems. The closest results to F3 obtained with F2 and followed by F1, F5 and F4. The studies show that these filaments can be a good candidate for FDM 3D printers for different drug delivery systems.

Biography

Ozgen Ozer is a Professor of Pharmaceutical Technology at Faculty of Pharmacy, Ege University. She has completed her PhD in 1992. She was a Post-doctoral Researcher at Université Paris-Sud Centre D'Etudes Pharmaceutiques, Paris-France during 1996-1997 and 1999-2000. She has published more than 80 papers in peer reviewed journals and two chapters in international books. She has given about 85 oral and poster presentations in international conferences. Her research interest focuses on dermal/transdermal delivery of drugs and cosmetics with liposomes, nanoparticles emulsions and gels.

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