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Design, Formulation and Characterization of Lipid Inks Containing Ricobendazole Applying a 3D Printing Technique by Fusion Solidification (MESO-PP) Adjusted to a Mathematical Model to Describe the Release of the Drug †

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Abstract: 3D printing (I3D) allows obtaining systems that are not achievable with current conventional methods, one of them, sustained release gastro-retentive systems. This work aimed to design, through I3D MESO-PP (Melting solidification printing process), a series of gastro-retentive systems using ricobendazole (RBZ) as a model drug and Gelucire (G) as carrier polymers. Solid oblong (IS) prints were designed and formulated with 4 different inks, all 25% loaded with RBZ, using a combination of G50-13 and G43-01. The proportions of G50-13: G43-01 of Inks 1, 2, 3, and 4 were 4:1, 2:1, 1:1, 1:2, respectively. Dissolution studies demonstrated the influence of ink on the buoyancy and kinetics of the RBZ release process. Inks 1, 2, 3, and 4 presented float times of 102 ± 14 min; 182 ± 30 min; 240 ± 25 min, and 475 ± 25 min (molded inks, without the air gap that printing produces, could not float on their own), $t_{80\%}$56.2, 74.1, 157.7 and 473 min and a release rate (RR) at 10 and 60 min about 0.528-2.973, 0.467-1.569, 0.363-0.503, and 0.201-0.180 %/min, respectively. The XRD, FTIR, HSM, and SEM studies showed that RBZ, in all inks, remained suspended and homogeneously distributed without physicochemical changes. It can be concluded that MESO-PP is allowed to obtain floating IS with different release profiles as a function of the G proportions.

Keywords: 3D printing; gastro-floating; sustained release; lipid carrier; ricobendazole; dissolution kinetics; mathematical models.

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Conflicts of Interest

The authors declare no conflict of interest.