Extrusion-based 3D printed atenolol tablets with hydroxyethylcellulose hydrogels

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3D printing is an emerging technology that is progressively gaining the attention of the pharmaceutical industry [1]. One of the greatest challenges of using 3D printing for making pharmaceutical formulations is the election of the material to be used as ink [2]. Thus, the purpose of this study was to determine the adequacy of using hydroxyethylcellulose (HEC) as excipient and its capacity of incorporating the Active Pharmaceutical Ingredient (API), atenolol, for 3D printing. In this study, HEC hydrogels were prepared at different concentrations. The obtained inks were rheologically characterized and their printing properties determined. Then, the structure and morphology of the printed 3D-tablets were studied. The ink that showed the best properties was selected for incorporating the API. Then, the previously mentioned printability and rheological characteristics were studied again for this new atenolol-containing ink. The experimental results demonstrated that inks with HEC concentrations between 10% and 20% (w/v) had similar rheological and printable properties (Figure 1A). Thus, the HEC 10% ink was selected. It was proved that the incorporation of the API into this hydrogel did not modified neither the rheological profile nor the printing properties of the ink (Figure 1B). Importantly, the printed 3D-tablets replicated the shape and size of the digital design (Figure 2). In conclusion, the HEC 10% hydrogel is the ink more suitable for being used as 3D-ink as it presents good printing and rheological properties while containing the lowest quantity of excipient. Once the API was incorporated, the 3D-printed tablets presented proper morphological characteristics, which makes us think that this excipient could be a good candidate for 3D printing purposes in the development of new advanced pharmaceutical systems.

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References

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[2] Warsi MH., et al., Current Pharmaceutical Design, (2018), 4949 – 4956

Figures

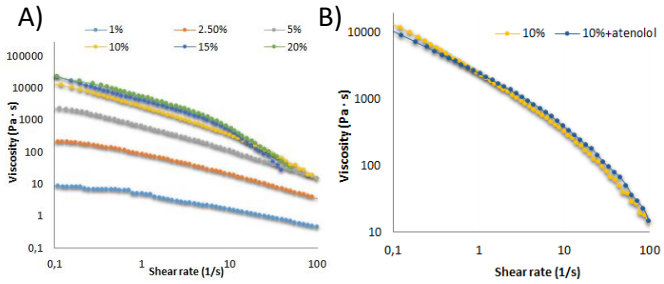

Figure 1: Viscosity measurements of A) HEC inks; B) Atenolol containing HEC ink.

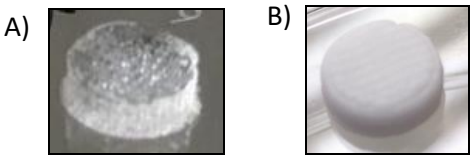

Figure 2: 3D-printed tables using A) HEC inks; B) Atenolol containing HEC ink.