Design and Preparation of Immediate-Release Mucoadhesive Bupropion Hydrochloride Buccal Thin Films Using LCD 3D Printing Technology

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Abstract

Oromucosal drug delivery represents an attractive alternative administration route, because it avoids hepatic first-pass metabolism and improves patient compliance, particularly amongst individuals who experience swallowing difficulties. In this work, liquid crystal display (LCD) 3D printing was employed, as an additive manufacturing approach for fabricating mucoadhesive buccal thin films, of different dimensions, containing bupropion hydrochloride (BUP•HCl). Poly(ethylene oxide) (Polyox 10N) was incorporated to enhance mucoadhesion, PEG200, being a plasticizer, to provide flexibility, and PEGDA700, as a crosslinking agent, to stabilize the printed structures. Solid-state characterization using differential scanning calorimetry and X-ray diffraction confirmed that BUP•HCl was present in an amorphous form within the printed films.

The swelling behavior of the films ranged from 0.9 to 1.3, while adhesive performance was influenced by the formulations' composition, yielding peak adhesive force values between 0.37 and 0.52 Nmm and cohesiveness values of 8 to 9 mm associated with the poly (ethylene oxide) content. The dissolution testing in simulated saliva demonstrated immediate drug release from all formulations, whereas ex vivo permeation studies, using porcine buccal tissue, showed approximately 52% drug permeation within 120 minutes. Overall, these findings highlight LCD 3D printing as an efficient, precise, and versatile platform for producing personalized pharmaceutical dosage forms.

Keywords

LCD 3D printing, buccal films, mucoadhesion, immediate drug release, dissolution profile.