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Preparation of orodispersible nanofibers

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The primary objective of this study was to develop a diclofenac-loaded, orodispersible formulation produced via double-needle electrospinning. To enable the vertical arrangement of two needles, a custom needle holder was designed and fabricated using 3D printing. During the optimization of the drug-free PVP carrier system, the influence of polymer concentration on fiber morphology and average fiber diameter was systematically examined. Electrospinning was feasible for solutions containing 7.5–15 w/w% PVP. At lower concentrations, insufficient viscosity resulted in electrospraying, yielding smooth-surfaced nanoparticles. The optimized material characteristics and processing parameters were subsequently applied to fabricate drug-loaded nanofibers.

Comprehensive characterization was performed, including assessments of morphology, crystallinity, chemical interactions, encapsulation efficiency, drug distribution, in vitro disintegration, in vitro dissolution, cytocompatibility, and 6-month stability. The results demonstrated that the electrospun product formed an amorphous solid dispersion with excellent encapsulation efficiency and a homogeneous distribution of diclofenac within the nanofiber matrix. Disintegration occurred within approximately 5 s in artificial saliva and around 41 s on an artificial tongue model. Complete dissolution in artificial saliva was achieved within 10 min.

Overall, a promising formulation was developed with rapid disintegration, immediate drug release, and good stability. Additionally, a new in vitro dissolution method (“AS-to-FaSSGF”) was developed to obtain a bigger picture of drug dissolution throughout the gastrointestinal tract.

References:

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