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Isoniazid-loaded orodispersible strips: Methodical design, optimization and in vitro-in silico characterization

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Abstract:
Drug treatment remains the most effective global approach to managing and preventing tuberculosis. This work focuses on formulating and evaluating an optimized polyvinyl alcohol-polyethylene glycol based orodispersible strip containing isoniazid, a first-line anti-tubercular agent. A solvent casting method guided through a Taguchi experimental design was employed in the fabrication, optimization and characterization of the orodispersible strip. The optimized strip was physically amalgamated with a monolayer, uniformly distributed surface geometry. It was 159.2 ± 3.0 µm thick, weighed 36.9 ± 0.3 mg, had an isoniazid load of 99.5 ± 0.8%w/w, disintegration and dissolution times of 17.6 ± 0.9 s and 5.5 ± 0.1 min respectively. In vitro crystallinity, thermal measurements and in silico thermodynamic predictions confirmed the strip's intrinsic miscibility, thermodynamic stability and amorphous nature. A Korsmeyer-Peppas ($r = 0.99$; $n > 1 = 1.07$) fitted kinetics typified by an initial burst release of 49.4 ± 1.9% at 4 min and a total of 99.8 ± 3.3% at 30 min was noted. Ex vivo isoniazid permeation through porcine buccal mucosa was bi-phasic and characterized by a 50.4 ± 3.8% surge and 95.6 ± 2.9% at 5 and 120 min respectively. The strip was physicomechanically robust, environmentally stable and non-cytotoxic.