HyperPhase DuoTab - A Dual-Drug Biphasic Release System for Personalized Hypertension Management

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Hypertension affects over 1 billion individuals globally, and long-term treatment is frequently compromised by poor medication adherence, fixed-dose inflexibility, and polypharmacy complexity. To address this issue, this research project developed a dual-drug biphasic oral delivery system intended to combine Amlodipine for immediate blood pressure control and Valsartan for sustained therapeutic maintenance within a single dosage form. A layered tablet architecture was engineered using fused deposition modeling-based three-dimensional printing to structurally incorporate two distinct compartments corresponding to immediate and sustained release phases. The outer compartment was designed to enable rapid exposure consistent with immediate antihypertensive action, while the inner core was structurally configured to support prolonged release behavior. Mechanical strength testing and dimensional stability assessments were conducted to evaluate structural integrity and reproducibility. As a result, the prototypes showed consistent structural formation, within 0.1 millimeters of the intended design. Hardness testing confirmed strong mechanical stability suitable for handling, and the friability testing showed minimal mass loss (<0.05%), indicating good resistance to chipping. Clear layer separation was maintained, supporting the feasibility of a sequential release design. These findings demonstrate that additive manufacturing enables precise fabrication of customizable dual-phase tablet platforms, potentially addressing challenges in dose inflexibility and polypharmacy complexity in hypertension management.

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