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The Review on 3-Dimensional Printing in Novel Drug Delivery System for Personalised Drug Delivery

Mr.Akshay Thombare*[1], Asst. Prof. Rajlaxmi Deolekar[2] and Mr. Anish Choudhary[3]
Student B-PHARM, Independent Reseaecher Maharashtra, India.[1]
M-PHARM[2]
Student B-PHARM, Independent Reseaecher Maharashtra, India.[3]
New Montfort Institute of Pharmacy, Ashti.
akshaythombare37438@gmail.com and anishchoudhari153@gmail.com

Abstract: *Three-dimensional (3D) printing has emerged as a transformative technology in the development of novel drug delivery systems and personalized medicines. Unlike conventional manufacturing, which relies on fixed-dose, mass-produced formulations, 3D printing enables dose flexibility, structural customization, and on-demand production tailored to individual patient needs. This review discusses the evolution of 3D printing in pharmaceuticals, explains the underlying principles of additive manufacturing, and provides an in-depth overview of major printing techniques such as fused deposition modeling, stereolithography, selective laser sintering, binder jetting, semi-solid extrusion, and inkjet printing. The materials used—including polymers, excipients, hydrogels, and active pharmaceutical ingredients—are examined with regard to their suitability for different printing processes and their impact on drug release behavior. Key applications such as polypills, controlled-release systems, microneedles, transdermal patches, and implantable devices are highlighted, emphasizing the role of 3D printing in addressing dosage precision and patient-specific therapy. The review further outlines current challenges, including regulatory uncertainty, material limitations, stability concerns, and quality-control issues. Finally, future perspectives are explored, including the integration of artificial intelligence, 4D printing, smart materials, and point-of-care manufacturing. Collectively, this review underscores the potential of 3D printing to reshape modern pharmaceutical practice and advance truly individualized drug delivery..*

Keywords: 3D printing , techniques, additive manufacturing , polypill ,novel drug delivery system , personalised drug

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