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Chapter 1: 3 D printing in drug manufacturing

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Abstract: The three-dimensional (3D) printed drug was first approved by the Food and Drug Administration in 2015, there has been a growing interest in 3D printing for drug manufacturing. There are multiple 3D printing methods – including selective laser sintering, binder deposition, stereolithography, inkjet printing, extrusion-based printing, and fused deposition modeling – which are compatible with printing drug products, in addition to both polymer filaments and hydrogels as materials for drug carriers. We see the adaptability of 3D printing as a revolutionary force in the pharmaceutical industry. Release characteristics of drugs may be controlled by complex 3D printed geometries and architectures. Precise and unique doses can be engineered and fabricated via 3D printing according to individual prescriptions. On-demand printing of drug products can be implemented for drugs with limited shelf life or for patient-specific medications, offering an alternative to traditional compounding pharmacies. For these reasons, 3D printing for drug manufacturing is the future of pharmaceuticals, making personalized medicine possible while also transforming pharmacies.

Keywords: Drug, 3-D Printing, Pharmaceutical, Manufacturing, Technology

1.1 Introduction

Three-dimensional (3D) printing is an additive manufacturing method whereby successive layers of material are deposited/solidified to form a 3D structure. This technology has been applied in numerous fields, representing the large variety of possible applications, including the consumer goods industry [1], aerospace research [2,3], regenerative medicine [4,5], medical device development [6–9] and the automotive industry [10]. An emerging application of 3D printing is for drug manufacturing [11, 12]. Interest in 3D printing of pharmaceutical products has been growing since the Food and Drug Administration (FDA) approved the first 3D printed drug in 2015[1,11]. Several methods and materials have since been investigated and demonstrated to serve this purpose [1,13–14]. Selective laser sintering (SLS) is the most analogous method to the common drug manufacturing process of powder pressing, in that it relies on loose powder that becomes joined into a solid object. Another powder-