

Three-Dimensional Printed Technology: In Pharmaceuticals

Yash Kothari*

Student, NDMVP's College of Pharmacy, Nashik, Maharashtra.

Date Of Submission: 05-05-2021

Date Of Acceptance: 20-05-2021

ABSTRACT: This review article is all about, processes which are used in the three-dimensional printing technology, it is a processing method, where consecutive layers of various materials are solidified or adsorbed to form a three-dimensional structure. For example, in ink-jet printing, the aqueous ink is converted to vapour by providing heat source. It uses computer aided drafting technology to produce a 3D substance by layering material on to the top of a substrate. There are number of 3D printing technologies have been evolved to manufacture a novel solid dosage forms, which are one of the most famous and renowned products today in the market.

KEYWORDS: 3D Printing Technology, Computer Aided Drafting (CAD), Solid Freeform Fabrication (SFF).

I. INTRODUCTION

(3D) Three-dimensional printing is unique technique which uses computer aided drafting technology and programming (CAD) to produce 3D objects by layering material onto a substrate or any substance. 3D printing drugs is a new idea which is used to design and develop medicine which suits to individual's needs. In today's world, 3D printing is one of the fastest developing branches of technology, science, art and it still widens the applications.

[1,5]. The term 3D printing was defined by International Standard Organization (ISO) as: "fabrication of objects through the deposition of a material using a print head, nozzle, or another printer technology" therefore, this process is also called as Additive Manufacturing (AM), Solid Freeform Fabrication (SFF), or Rapid Prototyping (RP).

[2]. Nowadays, 3DP could be extended throughout the drug formulation process, ranging from preclinical & clinical trials, to medical care. [3]. When compared to the formulation process of any pharmaceutical product, it has a lot of advantages like ability to achieve more drug-loading with much desired accuracy and precision especially for potent drugs given in small doses;

high production rates because of its fast-operating systems; reduction of material wastage which can save in the cost of production; as well as drug with narrow therapeutic index. [4]. Various types of drug delivery systems such as oral controlled release systems, microchip, micro pills, drug implants, multiphase release dosage forms and fast dissolving tablets have been formed using three-dimensional (3D) printing technology.

Hence, it is expected that 3D printing technology would offer some new approaches for developing novel pharmaceutical dosage forms.

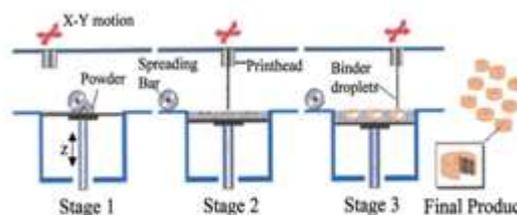


Figure 1 : 3DP TECHNIQUE

Techniques Used in 3D Printing:

- Ink-Jet Printing.
- Zip-Dose Printing.
- Fused Deposition Modelling (FDM).
- Pressure Assisted Syringe.
- Stereolithography.

1. Ink-Jet Printing:

[6]. In Thermal inkjet printing, the aqueous ink is converted to vapour by providing heat and it expands to push the drop of the ink out of the nozzle.

[7]. It is used to prepare the drug-loaded liposomes, and drug-loaded [8]. microspheres which are Biodegradable patterning microelectrode arrays loading and coating of drug eluting stents.

It is an efficient and widely used practical method for producing films.

Application of 3D Printing:

- 3D printing can be used in a wide range of fields like Industrial design, Aerospace, Medical, Tissue engineering, Pharmaceuticals & also in Food technology.
- It is mostly used in manufacturing of drug delivery system with sophisticated structures.
- Another use of this 3D printing technology is it can be used in personalized medicines.
- In health care industry it is used to make Dental Implants.
- It also helps in organ printing, in Biomaterials to produce cells which helps in creating a tissue like structure.

Future Prospect of 3D Printing:

New advancements in 3D printing may open a whole new set of chances for pharmaceutical industry & research.

- ✓ It will be use to make a novel dosage form.
- ✓ It will be use to achieve various new drug release profiles.
- ✓ It will be use to make a new excipient.
- ✓ It will be use to avoid incompatibility problems in various drugs and excipients.

As the technique is new, there is a lack of regulation, security and safety concerns of 3D printing.

So, the above problems can be overcome in upcoming future.

II. CONCLUSION

3D printing has established as an innovative platform for the fabrication of drug products and medical devices. This technique has shown great flexibility in producing various dosage forms for personalized Medicines to patients. It will only grow further and shape the future of Pharmaceutical, healthcare and Medical Industry.

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