WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

3D PRINTING TECHINOLOGY IN PHARMACEUTICS

Vaishnavi P.Lamture[1], Rani R.Ajgunde[2], Priynka Narvate[3], Nikhil B. Yadav[4], Siddheshwar N. Patil[5], Sumit S. More [6]

Latur college of Pharmacy, Hasegaon

ABSTRACT :

(3D) printing has been found to be a conversion technique for pharmaceuticals. This allows for the production of Taylor dosage forms with precise control over drug release, dosage and geometry. This innovative approach enables TaylorMade therapeutics that improve patient compliance and treatment effectiveness. In pharmaceutical applications, we examined a variety of 3D printing technologies, including merged separation modeling (FDM), stereolithography (SLA), and inkjet pressure. Recent advances in 3D printing technology have developed complex drug delivery systems such as multi-layer tablets, implants, and oral resolution films. These systems provide improved bioavailability, reduced side effects, and improved treatment outcomes. This review highlights the current state of 3D printing of pharmaceuticals and discusses its potential applications, challenges and future directions. The integration of 3D printing with artificial intelligence and machine learning can also be examined. This means that the paths of intelligent and adaptive drug delivery systems are paved. With 3D printing technology under development, we are ready to revolutionize the pharmaceutical industry, enable personalized medicine and improve patient care.

KEYWORDS 3D printing, personalized medicine, pharmaceutics, drug delivery systems, customized dosage forms.

INTRODUCTION

3D printing is an unparalleled method of supporting computers creating design techniques and programming to create three dimension objects by laying material on a substrate. Pharmaceutical implants, high-resolution tablets, and multiphase freedom administration have been developed.
3D (3D) untechnology. Operating system, the ability to achieve high drug contamination with highly desirable accuracy and accuracy only with powerful drugs used at high doses. Reducing material waste can save production costs and commodities in a larger class of active pharmaceutical ingredients with low solubility in aqueous, protein, narrow therapeutic index drugs.

ADVANTAGES

1. Personalized medicine with tailored dosage forms and release profiles.
2. Complex drug delivery systems with multi-drug formulations and layered delivery.
3. Improved patient compliance with child-friendly and geriatric-friendly designs.
4. Enhanced therapeutic outcomes through precise dosing and targeted delivery.
5. Flexibility in drug formulation with varied shapes, sizes, and APIs.
6. Rapid prototyping and production with on-demand manufacturing.
7. Potential cost-effectiveness through reduced waste and optimized API use.
8. Innovation in drug development with novel dosage forms and integration with emerging technologies.

TECHNIQUES

It is based on deposition (by layer) of digitally controlled material to create free geometry.
A wide range of 3D printing technologies include: -

1. Thermal ink beam pressure.
2. Inkjet pressure
3. Fusion deposition modeling
4. 3D printing
5. 3D Printer
6. Hot Melt Extrusion (HME) 7

1.THERMAL INKJET PRINTING

In thermal inkjet printing, the aqueous ink fluid is converted to vapour form through heat and expands to Design: The intended product design is digitally rendered.
Conversion of the design to a machine readable:3D design are typically converted
Raw material processing: Raw material may be proceed into granules filaments, or
binder solution to facilitate the printing process.
Printing: Raw materials are added and solidified in an automatic, layer Ã¢Â€Â“by-layer
Removable & post processing: After printing products may require drying,
sintering, polishing or other post processing steps.

2.INJECT PRESSURE

Ink beam pressure is also known as a "mask-free or "tool-free" approach, as it mainly depends on the movement of the inkjet nozzle or the movement of the accurate and fertile educational board. (DOD) Print.

3.FUSION DEPOSITION MODELLING

Second-hand Deposit Models (FDM) is a 3D printing technology that offers comprehensive possibilities for future applications, particularly in areas such as healthcare, aerospace and space. Potential future directions for FDM:
Advances in Materials Science

1. New Materials: Development of new thermoplastic materials (such as flexibility, flexibility, biocompatibility) with improved properties for specific applications.
2. Bio-based sustainable materials: The use of biodegradable and environmentally friendly materials to reduce environmental impact.

4.3D PRINTINGS

3D printing is a revolutionary technology that creates three-dimensional objects layer by layer. Here's a brief overview:

How it works:

1. Design: Create a digital model using computer-aided design (CAD) software.
2. Slicing: Slice the model into thin layers.
3. Printing: Deposit materials layer by layer, following the design specifications.

Applications:

1. Rapid prototyping: Quickly create product prototypes.
2. Custom manufacturing: Produce customized products, such as implants, prosthetics, or jewelry.
3. Aerospace and automotive: Create complex parts with reduced material waste.
4. Healthcare: Produce personalized medicine, implants, and surgical models.

Benefits:

1. Increased complexity: Create complex geometries and structures.
2. Customization: Produce tailored products for specific needs.
3. Reduced waste: Additive manufacturing reduces material waste.
4. Faster production: Rapid prototyping and production.

Types of 3D printing:

1. Fused Deposition Modeling (FDM): Uses melted plastic.
2. Stereolithography (SLA): Uses resin and light.
3. Selective Laser Sintering (SLS): Uses laser and powdered material.

4.HOT MELT EXTRUSION

HME involves melting a material (usually a thermoplastic) and forcing it through a die to create a specific shape or product. The material is heated above its melting point, mixed, and then extruded through a die to form the desired product.
HME is a versatile technology with a variety of applications.
The ability to create complex formulations and products makes it an attractive option for a wide range of industries

Need for 3D Printing:

The use of 3D printing in pharmaceutical science can offer many benefits, including cost-effectiveness. Increased productivity. Democratization cooperation in design, manufacturing and strengthening. Traditional methods are not cheaper than 3D printing techniques, as traditional methods are many processes for manufacturing (such as mixing, milling, drying or wetting granules, compression or shape) Traditional methods for the production

of medicinal products use a variety of processes such as grinding, grinding, grinding, grinding, wetting, compression, compression patient compression, wetting, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, moisture, smears, etc. Consumption. However, 3D
Printing technology is much more grazing than traditional drug production methods, as it lacks various processes such as traditional production. In addition to speed, other properties such as resolution, accuracy, reliability, and reproducibility of 3D printing technology.

Future outlook

New possibilities in 3D printing can open up completely new opportunities for pharmaceutical research and organic technology applications. New future 3D printing approaches will explore research into several drugs, drug dosage forms incompatibility, biomolecule failure, and research into research into research into research into a number of drugs, drug dosage forms incompatibility, biomolecule failure, and many more, including the various new forms of dose, optimized drug release profiles, and the development of new auxiliary substances. 3D Printing
Personalized medicines can add a completely new dimension of possibilities.
For drug demand, specific drugs, provisions, and alternatives to traditional connected pharmacies can be implemented for patients with limited durability or for limited patients Future.

CONCLUSION

3D printings has revolutionized the pharmaceutical field by creating personalized, tailored dosage forms that meet the needs of individual patients. This technology offers unprecedented flexibility in drug design and allows precise control of dosage, expression profiles and geometry. Although 3D printing develops, it has great potential to improve patient outcomes, improve medication compliance and tighten clinical research. While challenges exist such as regulatory frameworks, quality control, and scalability, continuous research and development are ready to address these issues. The integration of 3D printing into emerging technologies such as artificial intelligence and machine learning further expands possibilities. As the pharmaceutical industry continues to use 3D printing, changing the way drug therapy is developed, manufactured and delivered will ultimately improve patient care and outcomes.

REFERENCES

1.Marzuka S. K., Kulsum J. U.; (2016). 3D Printing: a new avenue in pharmaceuticals; World journal of pharmaceutics research: 5: 1686-1701.
2. Ursan ID, Chiu L, Pierce A. Three-dimensional drug printing: A structured review. J Am Pharm Assoc. 2013;53(2):136-44.
3. Kazi MS, Kulsum JU. 3D printing: A new avenue in pharmaceuticals. World J
Pharm Res. 2016;5(5):1686-701.
4. Gross BC, Erkal JL, Lockwood SY, Chen C, Spence DM. Evaluation of 3D printing and its potential impact on biotechnology and the chemical sciences. Anal
Chem. 2014;86(7):3240-53.
5. Katstra WE, Palazzolo RD, Rowe CW, Giritlioglu B, Teung P, Cima MJ. Oral dosage forms fabricated by Three Dimensional Printing™. J Drug Deliv Sci Technol.
2000;66(1):1-9.
6. Prasad LK, Smyth H. 3D Printing technologies for drug delivery: A review. Drug
Dev Ind Pharm. 2016;42(7):1019-31.
6. Helena D. Applications of 3D printing in healthcare. J Thorac Cardiovasc Surg.
2016;13(3):283-93.
8. Andrea AK, García-Piña M, Dolores RS. Personalised 3D Printed Medicines:
Which Techniques and Polymers Are More Successful?. Bioengineering.
2017;4(4):79.
8. Wang J, Goyanes A, Gaisford S, Basit AW. Stereolithographic (SLA) 3D printing
of oral modified-release dosage forms. Int J Pharm. 2016;503(1-2):207-12.
9. Lankapalli S, Jaswitha M, Manikanta V, Bhavya B. 3D printing in pharmaceutical
technology: A review. International Research Journal of Pharmacy. 2019;10(2):8-
10. Norman J, Madurawe R, Moore C, Khan MA, Khairuzzaman A. (2017). A new chapter in pharmaceutical
manufacturing: 3D-printed drug products. Advanced Drug Delivery Reviews. 108:39-50.
11. Maulvi FA, Shah JM, Solanki BS, Patel AS, Soni TG, Shah DO, : (2017). Application of 3D printing technology in the
development of Novel Drug Delivery System,; International journal of Drug Development & Research; 9: 44-9.
12. M. Singh, et al.; Inkjet Printing- Process & its Applications; Advanced materials; 2010, P-673-685.
13. M. A. Alhanan, T. C. Okwuosa, M. Sadia, K. W. Wan, W. Ahmed, B. Arafat; (2016) Emergence of 3D printed dosageforms: Opportuniyies & challenges; pharmaceutical research; 33(8); P-1817-1832.
14.. S. H. Lim, S. M. Y. Chia, L. Kang, et al.; (2016). Three Dimensional Printing of Carbamazepine sustained –released
scaffold; Journal of pharmaceutical Science; 105(7), P.2155-2163.
15.Goyanes, H. Chang, D. Sedought, et al.;(2015). Fabrication of Controlled release Budesonide tablets via
desktop(FDM) 3D printing; International journal of pharmaceutics; 496(2), P-414-420.

16.. Marzuka S. K., Kulsum J. U.; (2016). 3D Printing: a new avenue in pharmaceuticals; World journal of pharmaceutics research: 5: 1686-1701.