

TERM PROJECT

on

”3D Bioprinting”

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Contents

1	ACKNOWLEDGEMENT	3
2	ABSTRACT	4
3	KEYWORD	4
4	INTRODUCTION	4
5	PRINCIPLE OF 3D BIOPRINTING	4
6	WHAT IS BIOINKS ?	4
7	STAGES OF 3D BIOPRINTING	5
8	TYPES OF BIOPRINTER	6
9	APPLICATION OF BIOPRINTING	7
10	limitation of 3D bioprinting	7
11	conclusion	8
12	REFERENCE	9

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2 ABSTRACT

In this term project report i have focused on stages of bioprinting , types of bioprinting but very few , limitation and application of bioprinting.

3 KEYWORD

3D bioprinting , bioinks , pre bioprinting , bioprinting , post bioprinting , inkjet based bioprinting , laser assisted bioprinting , extrusion based bioprinting , applications and limitations.

4 INTRODUCTION

3D bioprinting is a mind boggling technology that emerged in the 21st century, the idea of lab grown tissue could mean the end of testing drug on animals and humans, and it could be the solution for organ shortage and can end the desperate state of organ donation. clinical trials today are more expensive and lengthy but with bioprinting tissue, new products can be assessed and brought to market more quickly, all without harming test subjects.

5 PRINCIPLE OF 3D BIOPRINTING

The principle of 3D printing is based on the precise placement of biological components, biochemical, and living cell in a layer by layer fashion with the spatial control of the placement of functional constituents onto the fabricated 3D structure. the process of 3D bioprinting is based on three distinct approaches; biomimicry or biomimetics, autonomous self assembly, and mini-tissue building blocks.

6 WHAT IS BIOINKS ?

A bioink is a hydrogel biomaterial that is suitable for bioprinting with mammalian cells and it provides temporary support to the cell while they produce their own extracellular matrix and advance in 3D.

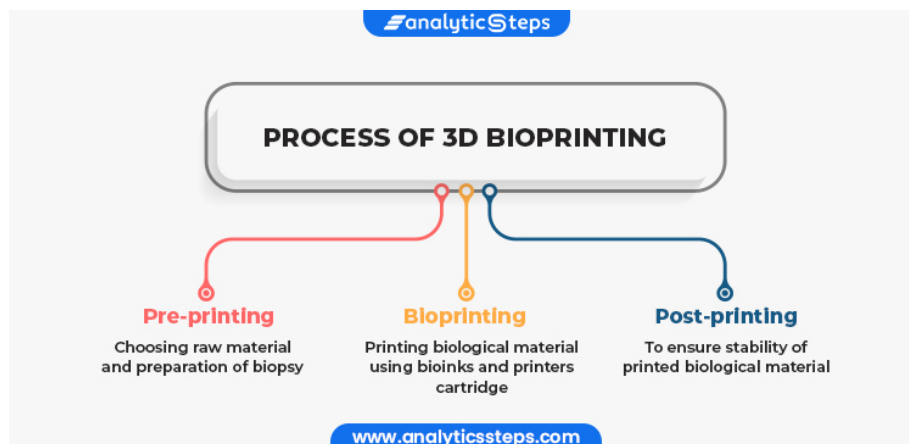
printing technology as well as development of new bio-inks have made it possible to print complex 3D tissue structures. The bioinks used in the bioprinting process should have the following properties;

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7 STAGES OF 3D BIOPRINTING

In general 3D bioprinting includes three steps;

- **Pre-bioprinting:** Includes the generation of Computer Aided Design (CAD) of a tissue or organ of interest. A blueprint of tissue and organ can be generated using medical imaging techniques, such as computer tomography (CT) or magnetic resonance imaging (MRI). Then the blueprint is converted into a heterogeneous model describing material and cell composition and distribution. The 3D bioprinting is recreated by reducing the particular prototype to a series of 2D layers.
- **Bioprinting :** The printing process is the simultaneous deposition of cells and biomaterials using computer-aided precision deposition techniques in a layer-by-layer fashion.
- **post-bioprinting:** The post-processing is the incubation of the printed tissue construct in a bioreactor.

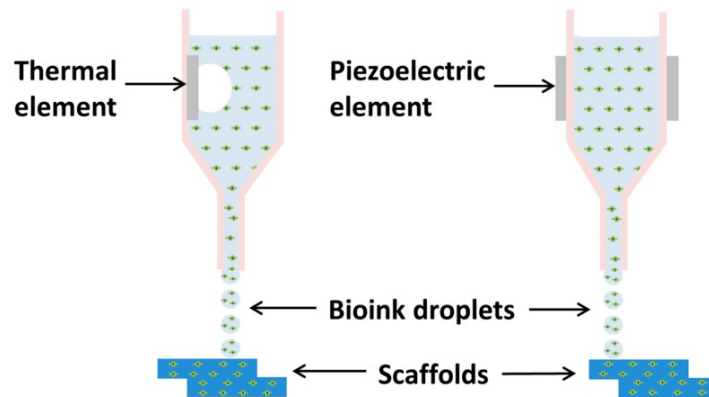


8 TYPES OF BIOPRINTER

Bioprinting technologies are mainly divided into three categories:

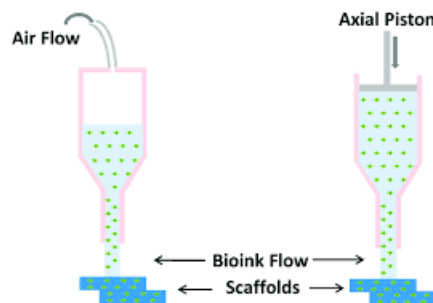
- Inkjet Based Bioprinting

Inkjet-based bioprinting is a non-contact printing technique in which droplets of dilute solutions are dispensed, driven by thermal, piezoelectric, or microvalve processes.



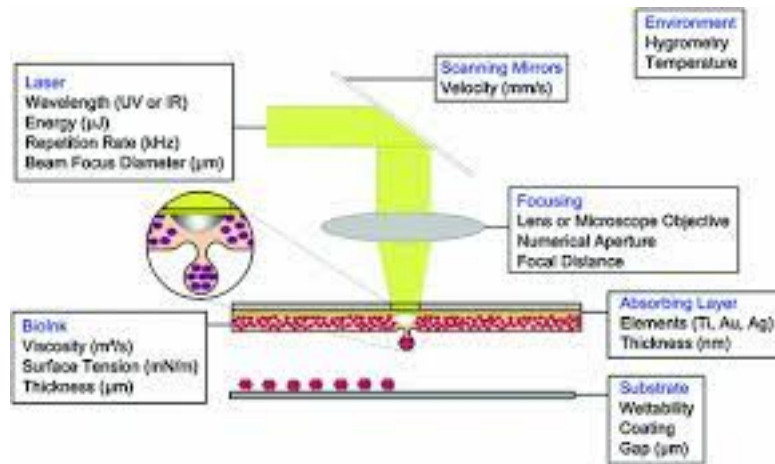
- Extrusion Based Bioprinting

Rapid prototyping (RP), also known as solid freeform fabrication, refer to a series of techniques that manufacture objects through sequential delivery of energy and/or material in a layer-by-layer manner per computer aided design (CAD) data.



- Laser Assisted Bioprinting

Laser-assisted bioprinting (LAB) uses a laser as the energy source to deposit biomaterials onto a substrate.



9 APPLICATION OF BIOPRINTING

- DRUG FORMULATIONS

Avoid the inherently time-consuming, labour-intensive and dose-inflexible conventional pharmaceutical manufacturing processes and conduct research and development of personalized therapeutic drug formulations by printing tablets or drug delivery devices with alternating sizes and shapes to realize varying release kinetics.

- bioprinting cancer research

These technologies hold great potential for applications in cancer research. Bioprinted cancer models represent a significant improvement over previous 2D models by mimicking 3D complexity and facilitating physiologically relevant cell-cell and cell-matrix interactions.

10 limitation of 3D bioprinting

- One of the most important challenges in 3D bioprinting is to find suitable printing materials with excellent printability, biocompatibility, desired mechanical and degradation properties for tissue constructs.
- Approval from FDA ; specific guidance from FDA does not yet

exist for 3D printing in the drug or biologic domains

11 conclusion

Currently, 3D bioprinting is capable to generate patient-specialized bone, cartilage, blood vascular network, hepatic unit and other simple components/tissues, yet pure cell-based functional organs are still desired.

12 REFERENCE

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