IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

3D PRINTED THREE-LAYERED POLYMER SCAFFOLD FOR PERIODONTAL REGENERATION, METHOD FOR PREPARING THE SCAFFOLD

IITM Technology Available for Licensing

PROBLEM STATEMENT

- **Periodontitis is a prevalent** non-communicable disease affecting teeth, cementum, bone, and periodontal ligament.
- **Current treatments** include plaque elimination, controlling inflammation, and periodontal surgeries.
- **Regeneration of periodontal structure** requires quality regeneration of all three tissues, in the right quantity, and in the same architecture as native tissue.
- **3D printing technology has gained** popularity in **dentistry for creating multi-layered scaffolds**, but it does not fully mimic the native periodontal complex and does not guide fiber orientation or anchoring.
- **Various designs have been proposed for regeneration.**

TECHNOLOGY CATEGORY/ MARKET

Technology: 3d Printed Three-layered polymer scaffold for periodontal regeneration, method for preparing the scaffold
Category: Biotechnology & Genetic Engineering
Industry: Biomedical
Application: Osteochondral tissue engineering to facilitate multi tissue regenerations.
Market: The global market size is **USD 1.55 trillion in 2023** and is projected to **grow at a CAGR of 13.96%** from **2024 to 2030**.

INTELLECTUAL PROPERTY

IITM IDF Ref. 2394
Patent No: IN 552910

TRL (Technology Readiness Level)

TRL- 3, Experimental proof of concept;

Research Lab

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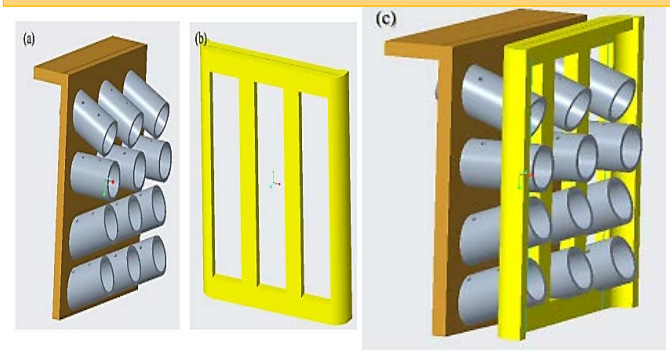
TECHNOLOGY

Fig 1 shows a 3D model depicting the different layers in scaffold (a) cross section of the scaffold(b) second scaffold (bone) layer and (c) tri-layer structure



3D Printed Three-Layer Polymer Scaffold
• First scaffold: Vertical polymer scaffold containing angular tubes.

Second scaffold: Continuous slots to glide over other end of angular tubes.

Angular tubes have wide pores for fibroblast migration.

Both scaffolds contain polymers from polylactic acid (PLA) and polyethylene terephthalate glycol (PET-G).

Printing first and second scaffolds to a platform temperature of 550C to 700C.

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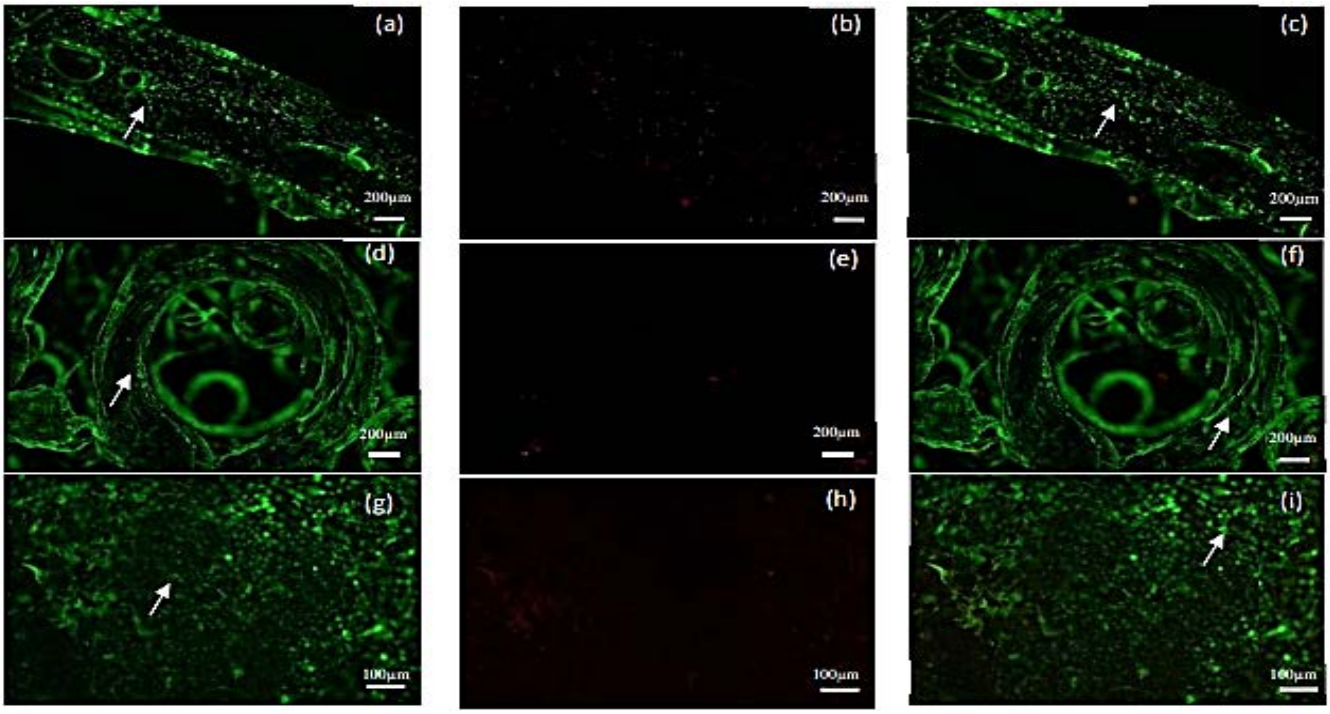
Figure 2 depicts florescence images showing L929 cells growing on PLA scaffold



Key Features / Value Proposition

Layer arrangement:

- First, Second, Third layers.

First scaffold:

- Vertical scaffold with angular tubes.
- Vertical scaffold: 6mm x 6mmx 0.3mm to 12mmx 12mmx0.6mm.
- Polymer weight: First scaffold: 255mg to 265mg;

Second scaffold:

- Continuous slots to glide over the first scaffold's angular tubes.
- Polymer weight: Second scaffold: 75mg to 85mg.
- Second scaffold: 6.5mm x 6mmx 0.3mm to 13mmx 12mmx0.6mm.

Angular tubes:

- Wide pores for fibroblast migration and population.
- Pore diameters ranging from 0.1mm to 0.2mm.
- Equal spacing of angular tubes on vertical scaffold.
- Angles: 55°-70°, 90°, 100°-120°
- Angled tubes: 2mm to 4mm, outer diameter 1mm to 2mm, inner diameter 0.8 mm to 1.6mm.

Coating:

- Collagen, poly-L-lysine, hydrogel gelatin methacryloyl (GelMA), and fibronectin.

3D Printing Method

- Step (a) printed using a 3D printer at nozzle temperature between 1950°C and 2400°C.
- Step includes coating scaffold with components from collagen, poly-L-lysine, hydrogel gelatin methacryloyl (GelMA), and fibronectin.

Technique used

- Fused deposition modeling (FDM).

Coating Scaffold with Components

- Collagen, poly-L-lysine, Hydrogel Gelatin Methacryloyl (GelMA), and fibronectin.

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