Sigma-Aldrich®
Lab & Production Materials

Protocol

TissueFab® - Bone support bioink, suitable for 3D bioprinting application

Protocol for Catalog No. 915637

Introduction

TissueFab® - Bone support bioink is a ready-to-use blend of Polycaprolactone (PCL) and Hydroxyapatite (HAp), which is optimized for printability and is designed for thermal extrusion-based 3D printing. TissueFab® - Bone support bioink is biocompatible and can be used with most extrusion-based bioprinters with temperature control. TissueFab® - Bone support bioink enables the precise fabrication of osteogenic 3D cell models and tissue constructs for research in 3D cell biology, tissue engineering, in vitro tissue models, and regenerative medicine.

Disclaimer
TissueFab® - Bone support bioink is for research use only; not suitable for human, animal, or other use. Please consult the Safety Data Sheet for information regarding hazards and safe handling practices.

Specifications

Storage	Store TissueFab® - Bone support bioink at room temperature . Protect from light by storing bottle in a foil bag or wrapping in aluminum foil.
Stability	Refer to the expiration date on the batch-specific Certificate of Analysis.

Materials

Materials supplied

The TissueFab® - Bone support bioink is supplied as follows:

Catalog Number	Quantity
915637	1 × 5g bottle (1 unit)

Materials required, but not supplied

- Cultured cells (visit our website for an up-to-date list of cell types) link: https://www.sigmaaldrich.com/life-science/cell-culture/mammalian-cell-lines.html
- Appropriate cell culture medium
- Extrusion-based 3D bioprinter with high temperature printhead (Thermoplastic print head)

Before you start: Important tips for optimal bioprinting results

Optimize printing and cell culture conditions. Optimize printing conditions (e.g., nozzle diameter, printing speed, printing pressure, temperature, cell seeding density) for the features of your 3D printer and for your application to ensure successful bioprinting. The suggestions below can guide you.

Procedure

A. Prepare ink

1. Load TissueFab® - Bone support bioink in the thermoplastic print head of the bioprinter. Push Bone support bioink with the plunger to the end of the print head. Set the print head temperature to 70-80 °C.
2. Allow the ink to melt in the print head by letting it sit at 70-80 °C for 30 minutes.

B. Print

1. When the ink has become fluid, follow the manufacturer's 3D printer instructions to print directly onto a Petri dish or into multi-well plates. Adjust the flow rate according the nozzle diameter, printing speed, printing pressure, and temperature.

Example

Printer: Cellink BIO X™ printer thermoplastic head

Temperature: 80 °C

Flow rate (speed): 1 mm/s

Nozzle: N/A

Pressure: 120-130 kPa

C. Culture cells.

After sterilizing the printed constructs, seed the cells on the constructs and culture with the appropriate cell culture medium following standard tissue culture procedures. For osteogenic differentiation of human mesenchymal stem cells OsteoMAX differentiation media (Cat # SCM121) is recommended.

Troubleshooting

1. Bioink is incubated at 37°C for 30 minutes, but it is still gel.

Possible reasons – Malfunction of incubator; bioink is crosslinked due to UV exposure.

Solution – Make sure the temperature of incubator / water bath is correct and make sure the bioink bottle is properly and evenly heated in the incubator/water bath. Do not expose the bioink to UV light before printing.

2. Air bubble is trapped in the middle of bioink in the cartridge.

Possible reason – Air bubble was created when the bioink was transferred (and/or was mixed with cells).

Solution - Warm the cartridge at 37°C for 5–10 minutes or until the bioink becomes fluid. Turn the cartridge so that the tip faces up to allow any air bubbles to exit from the tip of the cartridge. Gently tap the cartridge to help the air bubbles pass through the tip.

3. Printed structure spreads and does not hold its shape.

Possible reasons – Bioink was diluted with cell culture medium that remained in the cell pellet; bioink was not cooled sufficiently before printing; or the printing pressure is too high.

Solution – Do not dilute the bioink. Make sure the bioink has been cooled according to the instructions before printing. Adjust printing pressure to achieve sufficient flow of bioink.

4. Interrupted flow or no flow during printing.

Possible reason – Insufficient printing pressure or nozzle is partially or fully clogged.

Solution – Adjust the printing pressure to achieve sufficient flow of bioink. If the problem persists, change the nozzle.

5. Printed structure dissolves in cell culture medium.

Possible reason – Insufficient crosslinking; exposure to incorrect wavelength; malfunction of UV apparatus.

Solution – Make sure that the UV source has sufficient power output and that the printed structure is exposed to UV light according to the instructions.

Related Products

Name	Cat. No.
TissueFab® - GelAlg-Vis bioink	906913
TissueFab® - GelMA-UV bioink	905429
TissueFab® - GelMA-Vis bioink	906891
TissueFab® - Sacrificial bioink	906905