HyStem® Hydrogel UV QuickSet Kit for Bioprinting Applications

DESCRIPTION

The following guidelines were developed for a modified Bioforce Nano eNabler™ and exact requirements and parameters will vary between platforms and applications. While other platforms have not been evaluated, any system capable of liquid handling and amenable to UV exposure should be easily adaptable for the HyStem® Hydrogel UV QuickSet matrix.

- High relative humidity (>90%) is required in the printing chamber to prevent desiccation of printed constructs.
- If printing live cells, verify that the surface patterning tool or print head is large enough to accommodate cells (approximately 50-100 µm).
- Where possible, UV/ozone treatment of printing tools to enhance hydrophilic nature of the printing channel materials can improve consistency in printing.
- The matrix is a clear liquid with minimally increased viscosity compared to water at room temperature. Upon exposure to 365nm UV light, rapid polymerization occurs resulting in a viscoelastic solid. A 4W handheld UV lamp held approximately 2 cm from the surface of the gel is sufficient to polymerize a gel in as little as 15 seconds.
- Conducting a small pilot study to determine the appropriate exposure time for a given application is strongly recommended as matrix stiffness is directly correlated to exposure time and can impact survivability, proliferation, and differentiation. Please contact our Technical Support group for more specific recommendations.

Note: The HyStem® Hydrogel UV QuickSet Kit has not been thoroughly evaluated for thick, multilayer constructs.

REQUIRED MATERIALS

- HyStem® Hydrogel UV QuickSet Kit, 2.5 mL (Cat. No. GS1007) or 7.5 mL (Cat. No. GS1008)
- DG Water, 10 mL (Cat. No. GS240 or 20 mL (Cat. No. GS241)

EXPERIMENTAL PROTOCOL

The following procedure describes the standard recommended formulation for bioprinting and photolithography applications. Depending on the required matrix properties, it is possible to customize the matrix by altering component concentrations or by including additional growth factors and extracellular matrix proteins. Please contact our Technical Support group for more information.

1. Allow the Glycosil®, Gelin-S®, UVlink™, and PEGcure vials to come to room temperature.
2. Under aseptic conditions, using a syringe add 10 mL of DI Water to the large PEGcure vial. To dissolve, either place on an incubating shaker or alternate between a water bath and vortexing. Complete dissolution may take up to 1 hour.
3. Under aseptic conditions, using a syringe add 1.0 mL of dissolved PEGcure to the Glycosil vial. Repeat for the Gelin-S vial.
4. Place both vials horizontally on a rocker or shaker. It will take approximately 40 minutes for the solids to fully dissolve. Warm the solutions to ~37°C and/or gently vortex to speed the dissolutions. Once dissolved, solutions will be clear and slightly viscous.
5. Under aseptic conditions, using a syringe add 0.5 mL of dissolved PEGcure to the UVlink vial. Invert several times to dissolve.
6. As soon as possible, but within 2 hours of making the solutions, mix equal volumes of Glycosil and Gelin-S. Add UVlink to the Glycosil and Gelin-S solution in a 1:4 volume ratio (0.5 mL UVlink to 2.0 mL of the Glycosil and Gelin-S). To mix, pipette up and down.
7. If encapsulating cells, resuspend the cell pellet in Glycosil, Gelin-S, and UVlink solution. Pipette up and down to mix. The hydrogel and cell mix will be referred to as the Printing Matrix in the following steps of this protocol.
8. The Printing Matrix will remain a minimally-viscous liquid until exposed to 365nm UV light. For longer procedures (> 15 min) it is recommended to protect the Printing Matrix from excessive ambient light and periodically agitate the Printing Matrix to keep cells evenly distributed.
9. At this point, the matrix is ready to be loaded into the printing reservoir being utilized within the given system. Solutions should be transferred slowly and carefully to avoid introducing bubbles. Slower flow rates can also help ensure homogeneity while printing.
10. After printing is complete, expose the liquid construct to 365nm UV light to solidify. Cure time will depend on the formulation of the Printing Matrix and the UV light output, but the gels should be solid and resistant to dilution after approximately 30 seconds in most systems.
11. Once cured, constructs can be transferred to buffer or cell growth media, as needed.

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