Multimaterial chaotic printing of reinforced and prevascularized hydrogel filaments: Fabrication of mechanical robust constructs for long-term muscle tissue culture

Supplementary Material

Andrea Cavero-Arrivasplata[1,2,3,#], David Hyram Hernández-Medina[1,3,#], Irving Isaí Rendón-Moreno[1,4], Diego Alonso Quevedo-Moreno[1,4], Dariush Ebrahimibagha[3], Sanal Kozhiparambil Chandran[6],
Julio Ernesto Valdivia Silva[2], Claudia Maribel Luna-Aguirre[1,3,4], Mario Moisés Álvarez[1,3,4,5*], Grissel Trujillo-de Santiago[1,3,4,5*].

1) Centro de Biotecnología-FEMSA, Tecnologico de Monterrey, Monterrey, NL 64849, México
2) Departamento de Bioingeniería, Universidad de Ingeniería y Tecnología de Lima, Lima, Peru, 15063.
3) Expedition-FEMSA, Tecnológico de Monterrey, Monterrey, NL 64849, México
4) Departamento de Macatrónica, Tecnológico de Monterrey, Monterrey, Nuevo León, México, 64849
5) Forma Foods, Research and Development Unit, Tecnológico de Monterrey, Monterrey, Nuevo León, México, 64849
6) Facultad de Ciencias Químicas, Universidad Autónoma de Nuevo León, San Nicolás de los Garza, Nuevo León, México, 66455

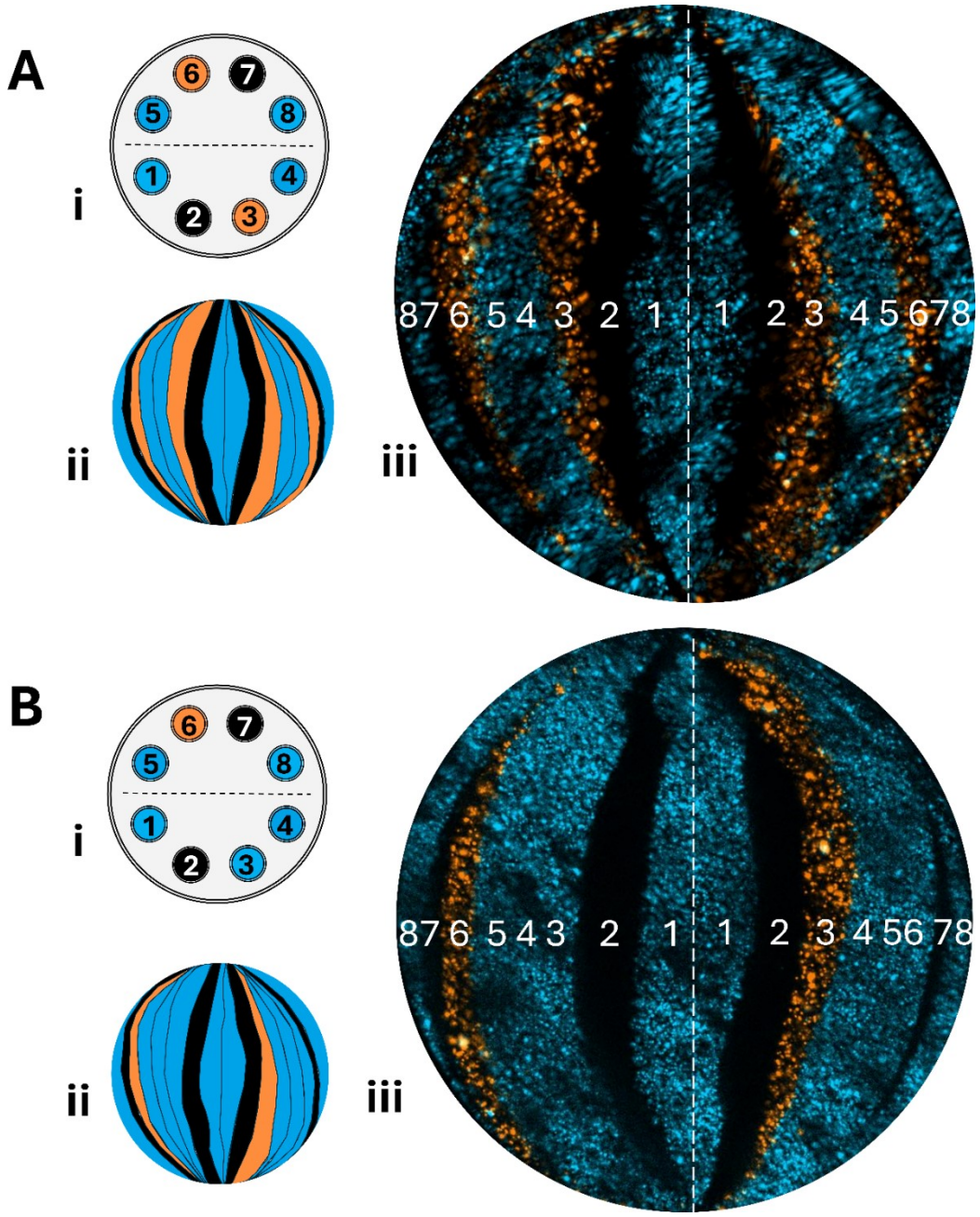

Figure S1. Validation of compartmentalization and ink positioning in printed hydrogel fibers. (A) and (B) illustrate two different 8-inlet printing configurations with distinct ink assignments. (i) Schematics of the inlet arrangements showing the distribution of sacrificial (black), structural (blue), and cell laden (orange) inks. (ii) Schematic cross-sections displaying the expected layered pattern after chaotic mixing through two KSM elements. (iii) Experimental cross-sections of printed fibers visualized via fluorescence microscopy, confirming the predicted compartmental distribution. The numbering of compartments (1–8) corresponds to inlet assignments and demonstrates the successive order at which layers of different materials should appear within the printed hydrogel filament according to the position at which each material is fed. Note also the reproducibility of the layered architecture across mirrored halves of the fiber.

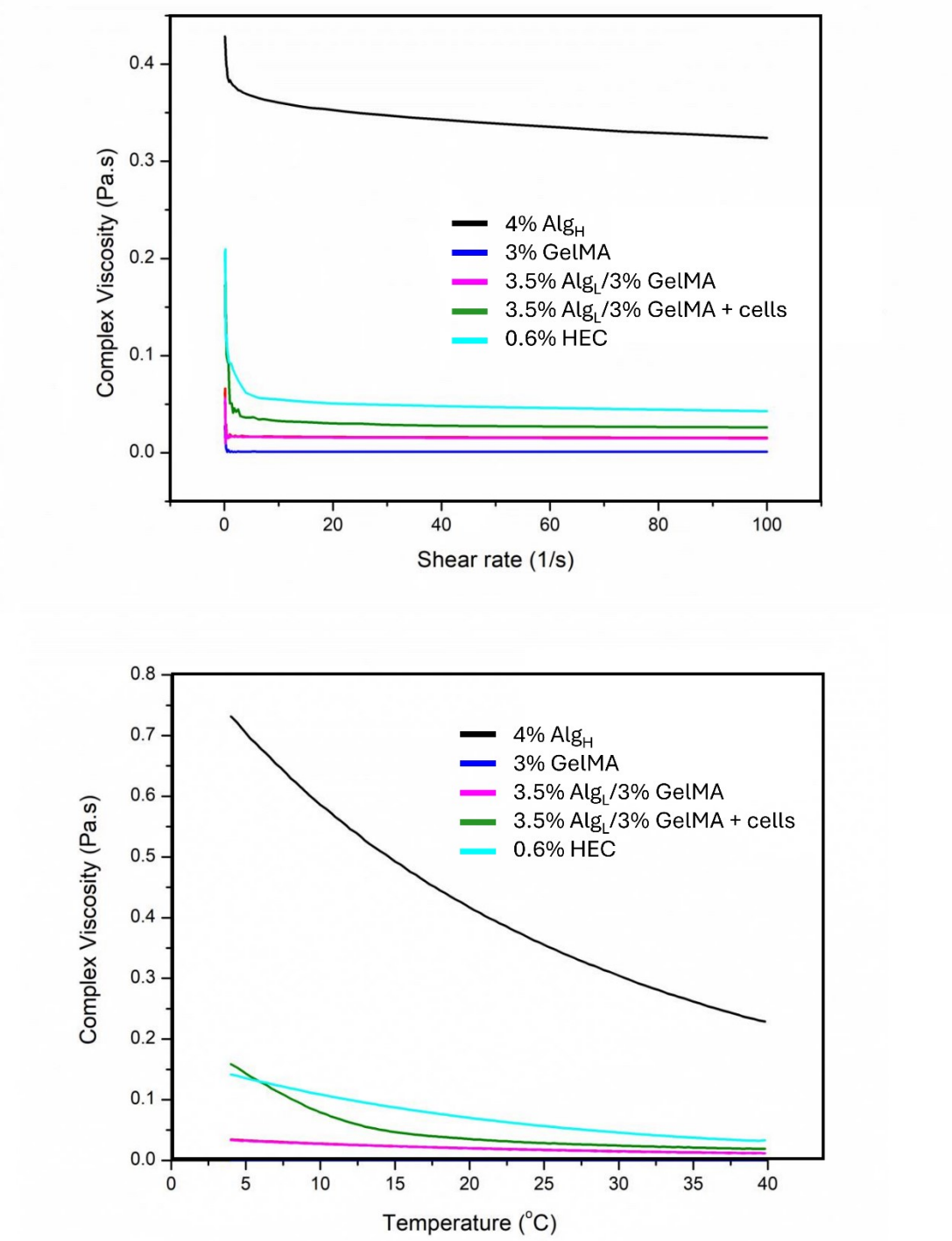

Figure S2. Rheological characterization of inks used for chaotic printing. (A) Complex viscosity as a function of shear rate and (B) temperature for the materials employed in this study. All formulations exhibited shear-thinning behavior and Newtonian-like flow profiles under printing conditions. The temperature-dependent analysis shows stable rheological behavior in the working range (10–37 °C), supporting the suitability of these inks for extrusion-based chaotic bioprinting.