

Rheological and Printability Assessments on Biomaterial Inks of Nanocellulose/Photo-crosslinkable Biopolymer in Light-aided 3D Printing

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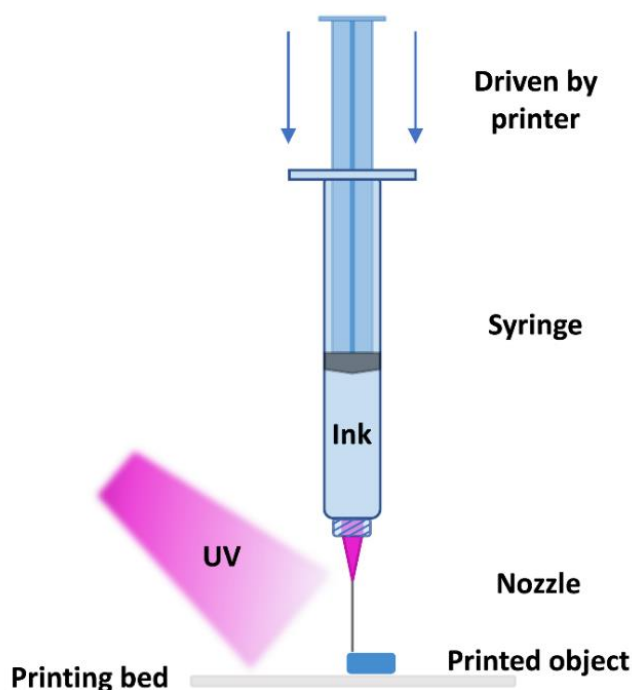


Figure S1. Schematic demonstration of 3D bioprinter and the hydrogel extrusion-based printing process. Photo-cross-linkable bioink was loaded into a syringe and extruded by the compress of the plunger, which is driven by the printer. During the extrusion, the syringe and nozzle were moving in x-y planed at a given path. The photo-crosslinkable bioink was further *in situ* crosslinked by UV after extrusion to strengthen the shape fidelity.

Table S1. Ink formulations in this work

Ink	GrowInk-N (wt%)	GrowInk-T (wt%)	GGMMA (wt%)	GelMA (wt%)	LAP (wt%)	Diluted with PBS/water
1/1.5/2% GrowInk-N-water	1/1.5/2	-	-	-	-	water
1/1.5/2% GrowInk-N-PBS	1/1.5/2	-	-	-	-	PBS
1/1.5/2% GrowInk-N+2% GGMMA-water	1/1.5/2	-	2	-	0.1	water
1/1.5/2% GrowInk-N+2% GGMMA-PBS	1/1.5/2	-	2	-	0.1	PBS
1/1.5/2% GrowInk-N+5% GelMA-water	1/1.5/2	-	-	5	0.1	water
1/1.5/2% GrowInk-N+5% GelMA-PBS	1/1.5/2	-	-	5	0.1	PBS
1/1.5% GrowInk-T-water	-	1/1.5	-	-	-	water
1/1.5% GrowInk-T-PBS	-	1/1.5	-	-	-	PBS
1/1.5% GrowInk-T+2% GGMMA-water	-	1/1.5	2	-	0.1	water
1/1.5% GrowInk-T+2% GGMMA-PBS	-	1/1.5	2	-	0.1	PBS
1/1.5% GrowInk-T+5% GelMA-water	-	1/1.5	-	5	0.1	water
1/1.5% GrowInk-T+5% GelMA-PBS	-	1/1.5	-	5	0.1	PBS

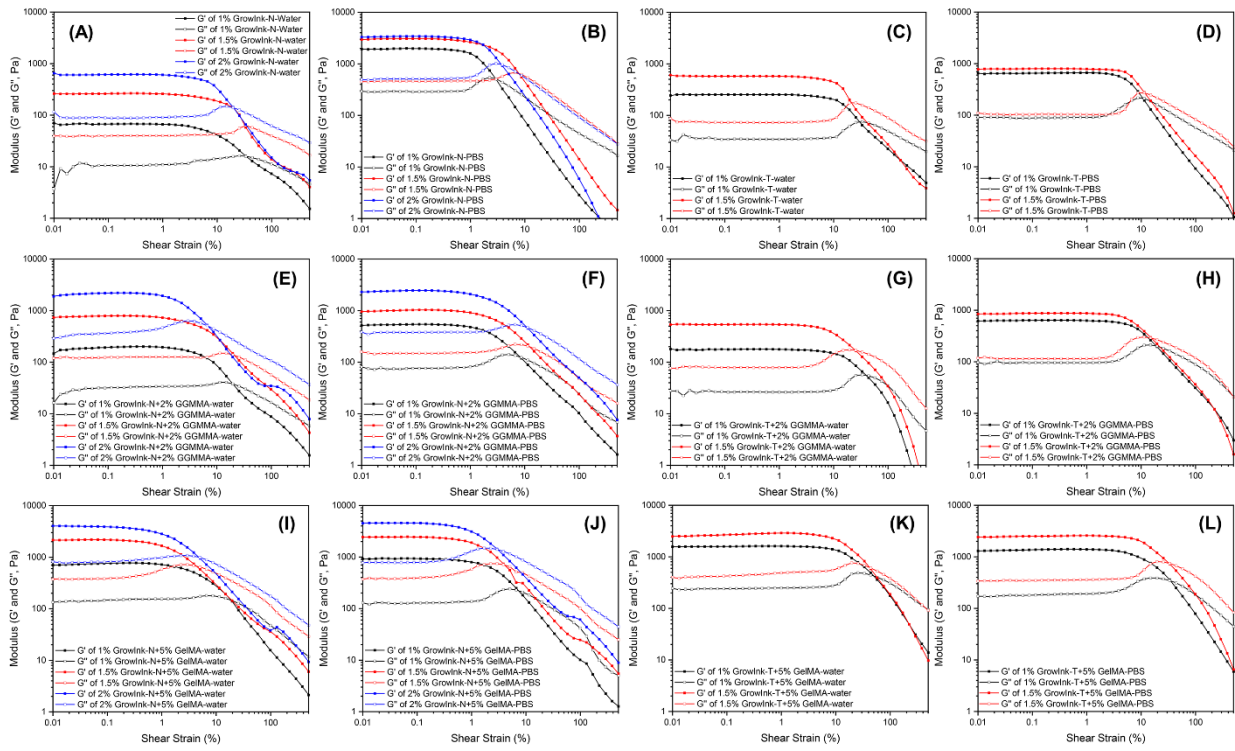


Figure S2. Amplitude sweep of the formulated inks plotted against the shear strain. (A-D: GrowInk-N and GrowInk-T, E-H: GGMA incorporated GrowInk-N and GrowInk-T-based inks, and I-L: GelMA incorporated GrowInk-N and GrowInk-T-based inks diluted with PBS buffer and water, respectively. Closed symbol: G' , open symbol: G'')

Table S2. Time required for G' of the inks to exceed 2.15 kPa after UV irradiation.

Ink	Time (s)	G' (kPa)
1% GrowInk-N+2% GGMMA-PBS	1.5	2.10
1.5% GrowInk-N+2% GGMMA-PBS	1.5	2.60
2% GrowInk-N+2% GGMMA-PBS	0	-
1% GrowInk-N+2% GGMMA-water	7	2.29
1.5% GrowInk-N+2% GGMMA-water	2	2.65
2% GrowInk-N+2% GGMMA-water	1	2.21
1% GrowInk-N+5% GelMA-PBS	2	2.31
1.5% GrowInk-N+5% GelMA-PBS	1.5	2.62
2% GrowInk-N+5% GelMA-PBS	0	-
1% GrowInk-N+5% GelMA-water	8	2.19
1.5% GrowInk-N+5% GelMA-water	1.5	2.54
2% GrowInk-N+5% GelMA-water	0	-
1% GrowInk-T+2% GGMMA-PBS	3	2.50
1.5% GrowInk-T+2% GGMMA-PBS	2	2.93
1% GrowInk-T+2% GGMMA-water	4.5	3.46
1.5% GrowInk-T+2% GGMMA-water	3	3.29
1% GrowInk-T+5% GelMA-PBS	15	2.16
1.5% GrowInk-T+5% GelMA-PBS	1.5	2.47
1% GrowInk-T+5% GelMA-water	2	2.88
1.5% GrowInk-T+5% GelMA-water	1	2.42

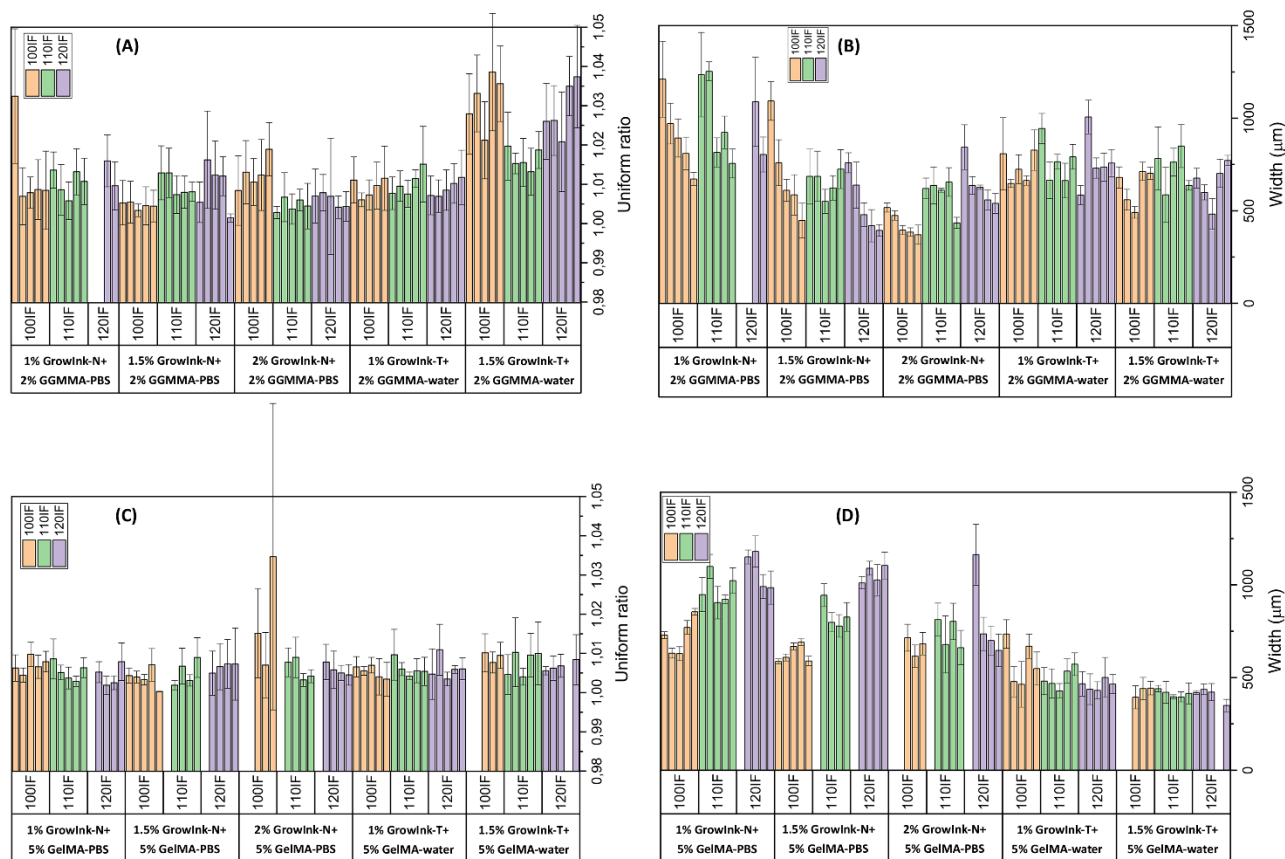


Figure S3. Uniformity ratio and width of (A and B) GrowInk-GGMMA and (C and D) GrowInk-GelMA-based inks. (5 columns under the same input flow rate and from left to right corresponding to the printing speed of 4, 8, 12, 16, and 20 mm/s. The non-extrudable filaments were not listed in the figure)