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RESEARCH ARTICLE

A preliminary investigation on the effect of ingredient flow speed in extrusion-based printing through experimental and theoretical approaches

Supplementary File

Table S1. Average time taken at different dot volumes extruded

Parameters	Measured values			
Dot volume (V_{dot}/mL)	1	2.5	5	7.5
Average time taken (t/s)	1.148 ± 0.0109	3.166 ± 0.0152	7.066 ± 0.0134	10.22 ± 0.0200

Note: All values are expressed as mean ± standard deviation.

Table S2. Time taken for each dot volume extrusion

Ingredient flow speed	Dot volume (V_{dot}/mL)	Dot volume extrusion time (s)
1.65	1	1.148 ± 0.0109
	2.5	3.166 ± 0.0151
	5	7.066 ± 0.0134
	7.5	10.220 ± 0.0200
	10	14.106 ± 0.0250
	20	28.250 ± 0.0070
	50	71.366 ± 0.370
6.6	1	1.166 ± 0.0057
	2.5	3.220 ± 0.0200
	5	7.083 ± 0.0321
	7.5	10.240 ± 0.0208
	10	14.110 ± 0.0378
	20	28.240 ± 0.0264
	50	71.280 ± 0.0152

Note: All values are expressed as mean ± standard deviation.

Table S3. Filament width at different ingredient flow and Foodini printing speeds for a 4.0-mm nozzle diameter

Foodini printing speed (mm/min)	Ingredient flow speed	Filament width (mm)
3500	1.65	4.43 ± 0.08
	3.3	6.57 ± 0.12
	5.0	8.60 ± 0.48
14,000	1.65	4.23 ±0.15
	3.3	6.53 ± 0.19
	5.0	8.76 ± 0.38
25,000	1.65	4.60 ± 0.07
	3.3	6.02 ± 0.19
	5.0	8.61 ± 0.16

Note: All values are expressed as mean ± standard deviation.

Table S4. Filament width at an ingredient flow speed of 1.65 and different set printing speeds for different nozzle diameters

Foodini printing speed (mm/min)	Nozzle diameter (mm)	Filament width (mm)
3500	0.8	4.49 ± 0.27
	1.5	4.48 ± 0.07
	4.0	4.43 ± 0.08
14,000	0.8	3.60 ± 0.19
	1.5	5.12 ± 0.40
	4.0	4.23 ± 0.15
25,000	0.8	3.10 ± 0.39
	1.5	3.87 ± 0.19
	4.0	4.60 ± 0.07

Note: All values are expressed as mean ± standard deviation.

Table S5. Arbitrary scale M relating volumetric flow rate to ingredient flow speed for a 4.0 mm nozzle diameter

Printing speed (mm/min)	Ingredient flow speed	*M*
3500	1.65	15.7
14,000	1.65	62.0
25,000	1.65	93.0
3500	3.3	3.0
14,000	3.3	15.0
25,000	3.3	29.0
3500	5.0	1.69
14,000	5.0	6.86
25,000	5.0	12

Note: M is calculated from $M = \frac{\text{volume}}{\text{ingredient flow speed} \times \text{printing time}}$; volumetric flow rate = *M* x ingredient flow speed.