Supporting Information

Utilizing the natural composition of brown seaweed for preparation of hybrid ink for 3D printing of hydrogels

Linn Berglund[*1], Jonathan Rakar[2], Johan PE Junker[2], Fredrik Forsberg[3], and Kristiina Oksman*[*1,4,5]*

[1] Division of Materials Science, Department of Engineering Sciences and Mathematics, Luleå University of Technology, SE-971 87 Luleå, Sweden,

[2] The Center for Disaster Medicine and Traumatology, and Experimental Plastic Surgery, Department of Biomedical and Clinical Sciences, Linköping University, SE-581 83 Linköping, Sweden

[3] Division of Fluid and Experimental Mechanics, Department of Engineering Sciences and Mathematics, Luleå University of Technology, SE-971 87 Luleå, Sweden

[4] Fibre and Particle Engineering, University of Oulu, FI-90014 Oulu, Finland

[5] Mechanical & Industrial Engineering (MIE), University of Toronto, M5S 3G8 Toronto, Canada

* Corresponding authors:

Linn Berglund (linn.berglund@ltu.se) and Kristiina Oksman (kristiina.oksman@ltu.se)

Table S1. Content for 100g of brown seaweed blades provided by the supplier The Northern Company.

Content	100g
Fat	<0.5g
Carbohydrate	5.9g
Fiber	6.4g
Protein	1.6g
Salt	1.8g
Potassium	0.78g
Calcium	0.19g
Magnesium	0.13g
Iodine	0.041g

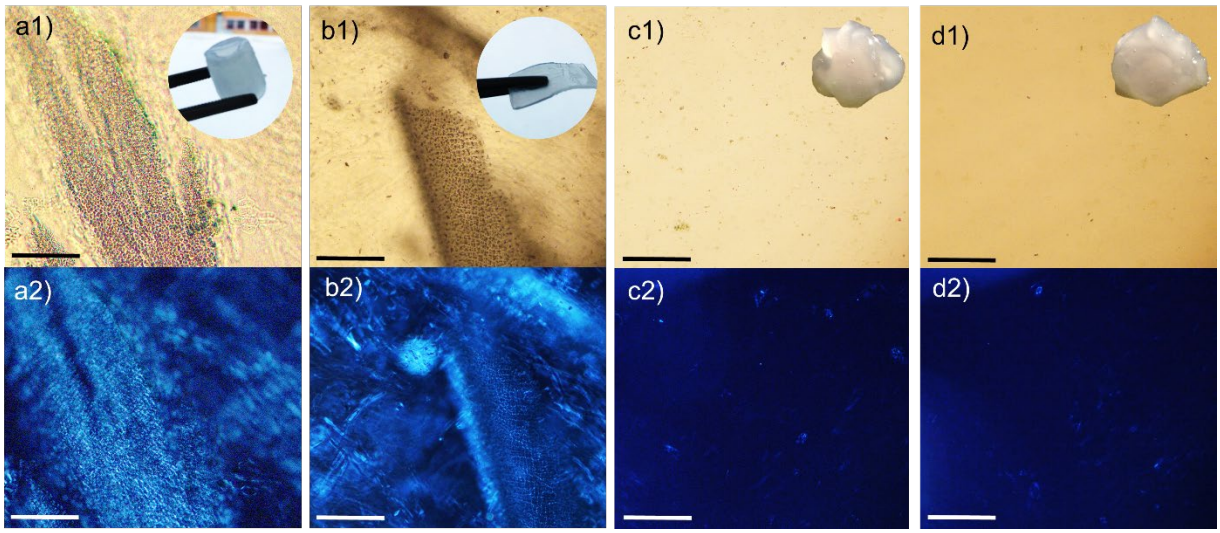

Figure S1. OM and POM of the stipe a1), a2), and blade b1), b2), respectively, and inset photograph after purification. OM and POM of the stipe c1), c2), and blade d1), d2), respectively and inset photograph of the gel, after the nanofibrillation. Scale bar: 200 µm.

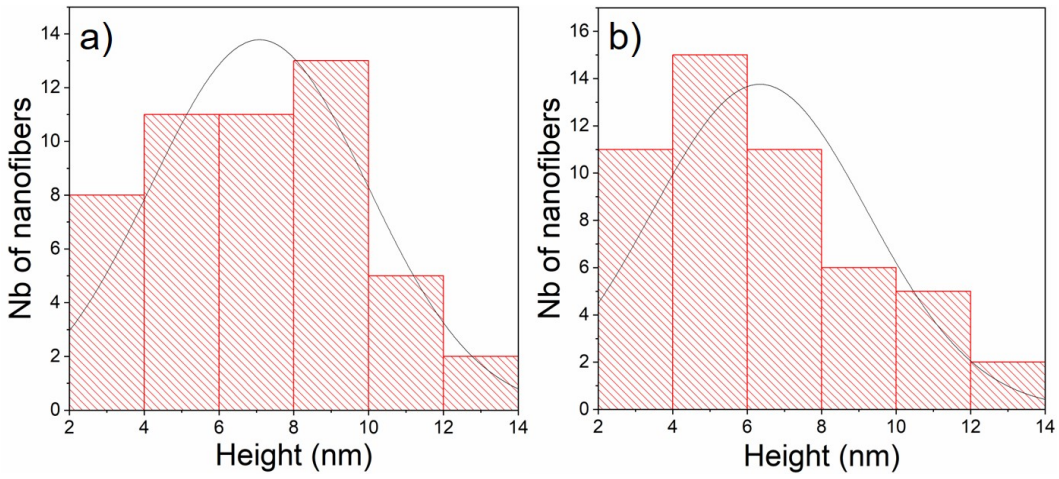

Figure S2. Nanofiber size distribution measured from AFM height images from a) S-A-CNF, and b) B-A-CNF.

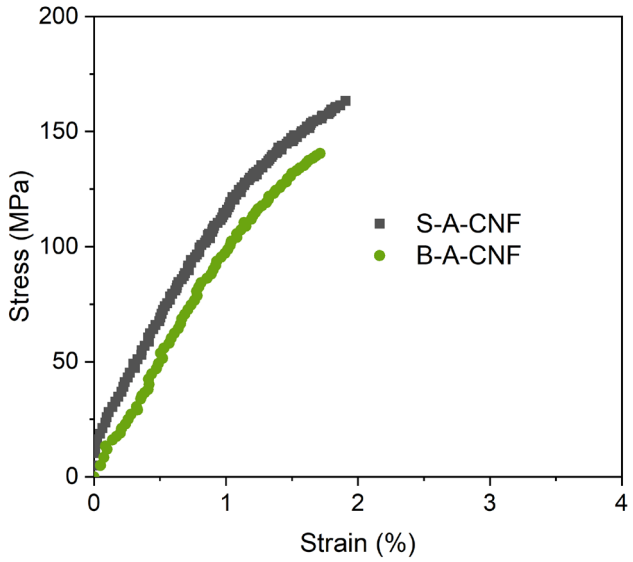

Figure S3. Stress and strain curves from tensile testing of the nanofilms prepared from the stipe-alginate-cellulose nanofiber (S-A-CNF), and blade-alginate-cellulose nanofiber (B-A-CNF) samples after purification and nanofibrillation.

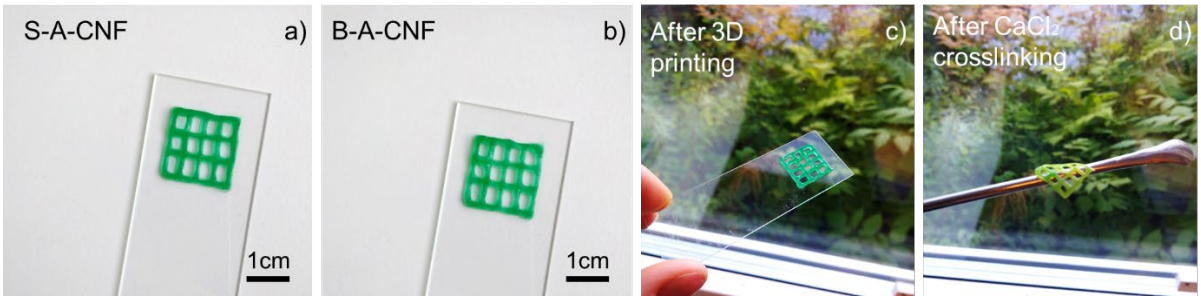

Figure S4. Photographs of the printing resolution for a) S-A-CNF and b) B-A-CNF inks (colored green) after 3D printing. c) 3D printed grid structure before crosslinking and d) after $CaCl_2$ crosslinking.

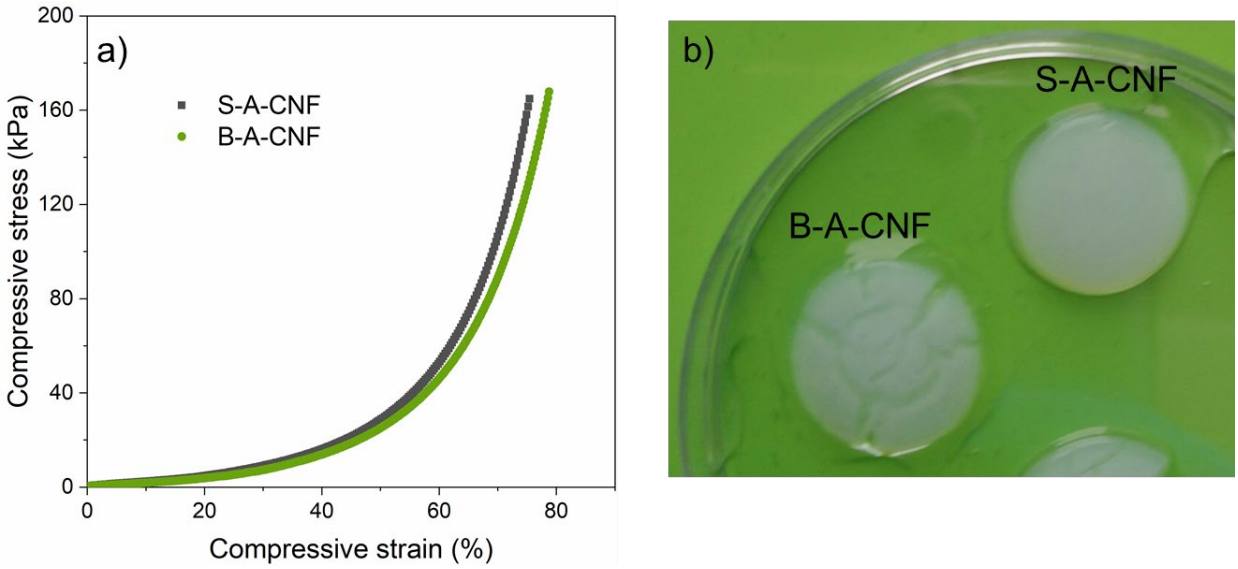

Figure S5. a) Compressive stress and strain curves from testing of the 3D printed and $CaCl_2$ crosslinked hydrogels, from the stipe-alginate-cellulose nanofiber (S-A-CNF), and blade-alginate-cellulose nanofiber (B-A-CNF) hybrid-inks, b) photographs of the hydrogels samples after compression test.

Table S2. Swelling ratio of the crosslinked hydrogels at equilibrium swelling and after 1 week of immersion in PBS solution at 37 °C.

Hydrogel	Swelling ratio (g/g)	Swelling ratio after 1 week (g/g)
S-A-CNF	11.5 ± 0.8	11.1 ± 0.6
B-A-CNF	12.1 ± 0.7	11.9 ± 0.9