Rayleigh streaming phenomena at the physical origin of cellulose nanocrystals orientations during combined ultrasound and ultrafiltration processes.

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Supplementary data

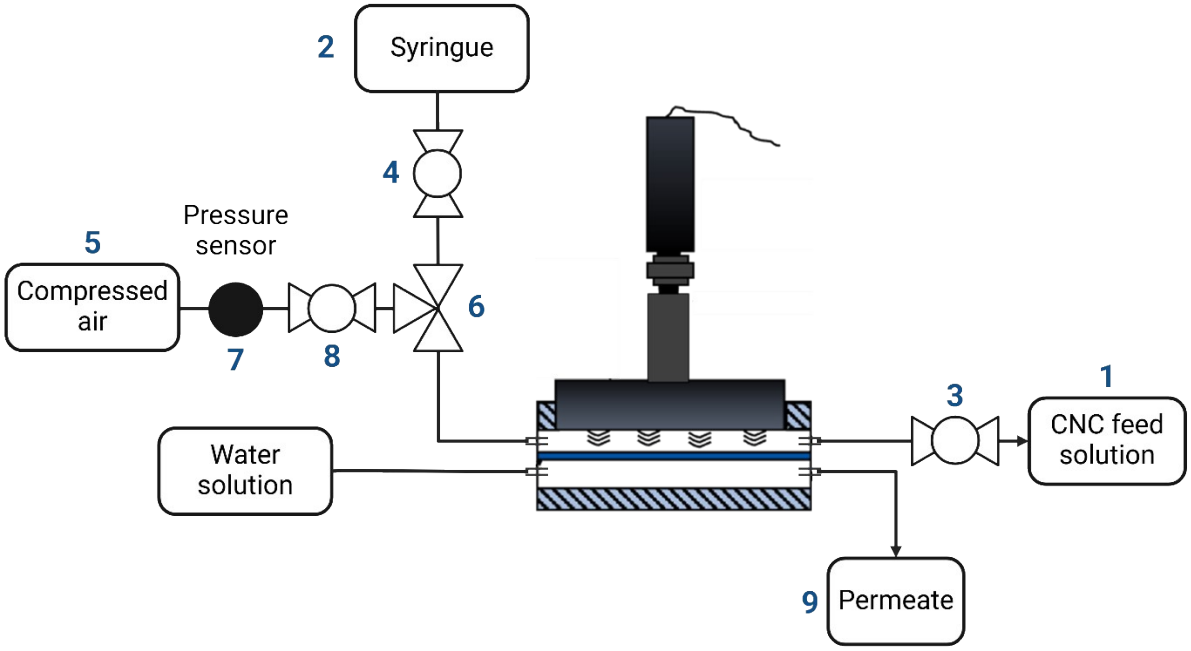

Figure S1. Schematic representation of the flow diagram of the FU-US system. (1) CNC feed solution, (2) syringe, (3) inlet valve, (4) outlet valve, (5) compressed air supply, (6) T-junction, (7) pressure sensor, (8) pressure vane and (9) small container for collecting the permeate.

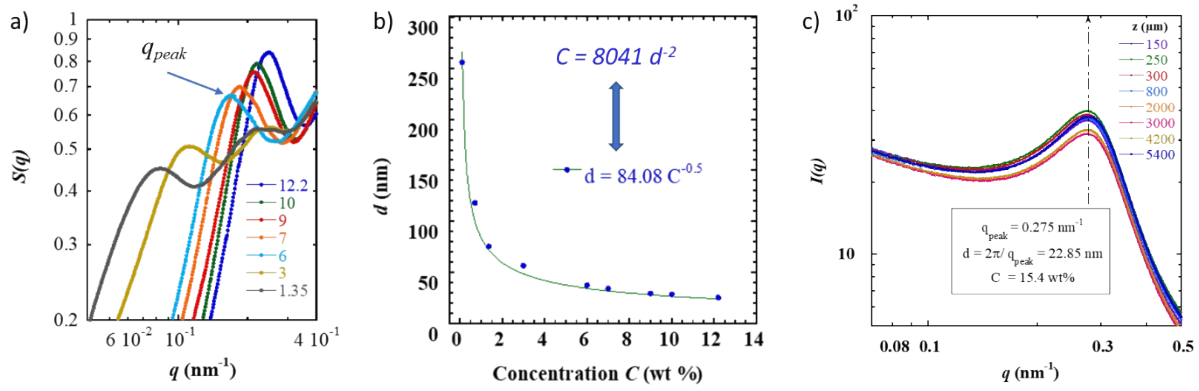

Figure S2. Determination of CNC concentration using SAXS. a) SAXS *S(q)* curves obtained for suspensions with known concentrations (1.35 wt % to 12.2 wt %), from which the q_{peak} values are measured. b) Relationship between the interparticle distance *d* (nm), calculating using $d = \frac{2\pi}{q_{peak}}$, and the CNC concentration (wt %). c) SAXS *I(q)* curves at different heights in the FU-US cell from the membrane surface to the vibrating blade after pressure release (t = 97 min, ΔP = 0 Pa and P_a = 6 W.cm^{-2}) showing that the q_{peak} position is not changing (same concentration inside the channel). The concentration at each height is calculated using the relationship determined in b) $C = 8041\, d^{-2}$.

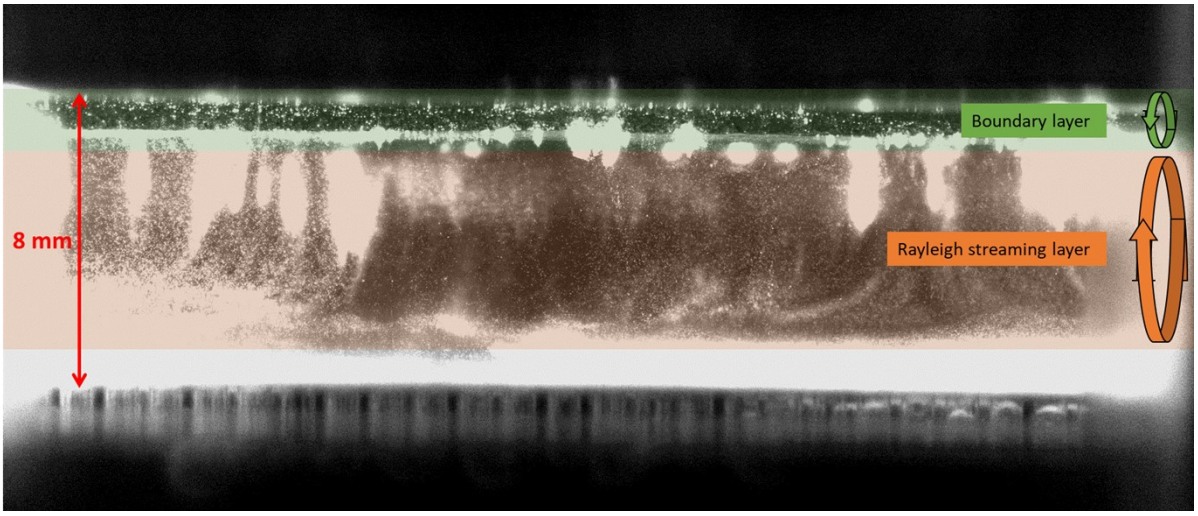

Figure S3. *In situ* micro-PIV image of the acoustic streaming phenomenon, obtained during Step 1 for t_{fl} = 88 min, ΔP = 1.2 x 10^5 Pa and P_a = 6 W.cm^{-2}. In green the boundary layer and in orange the Rayleigh streaming layer.

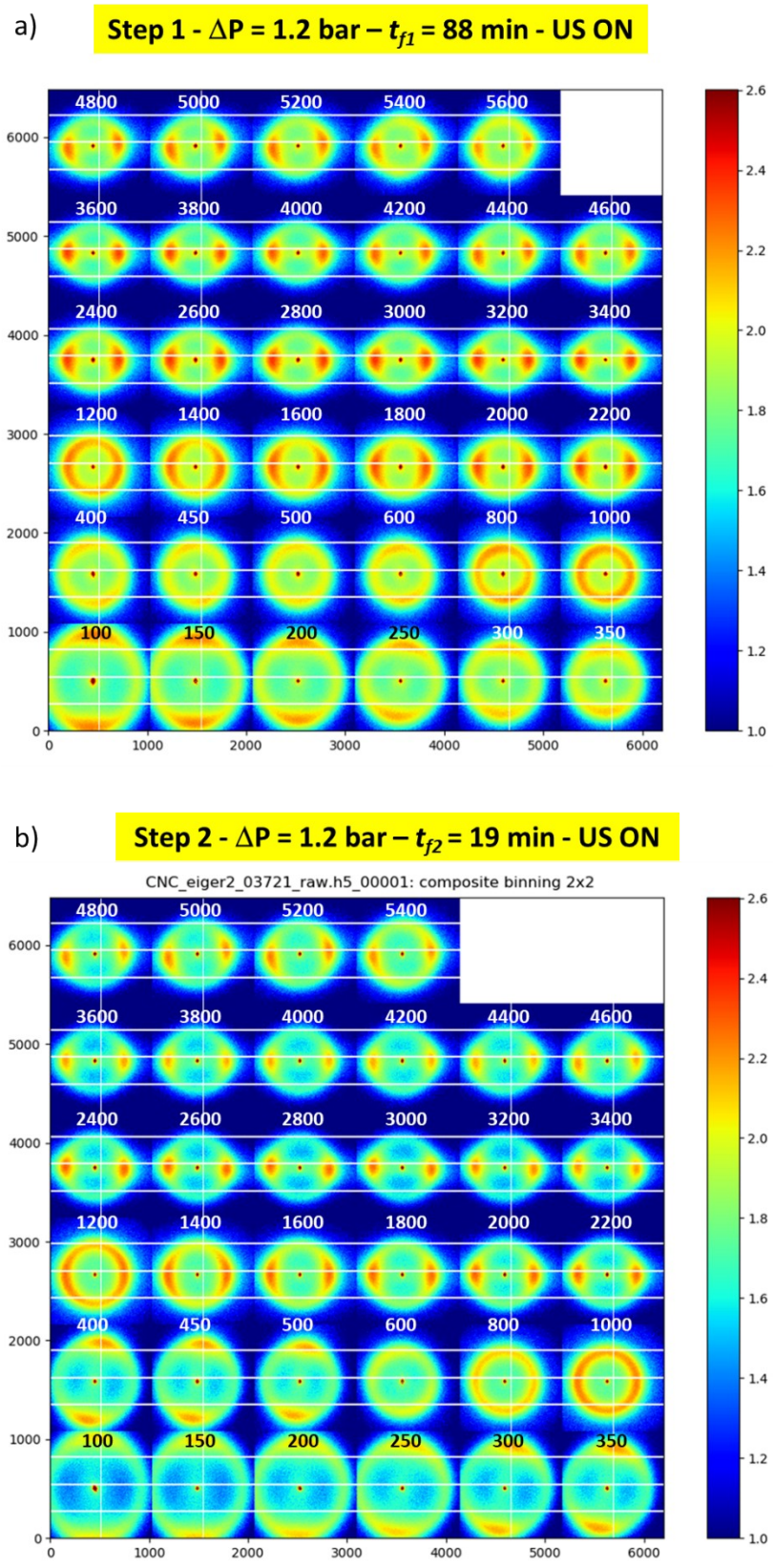

Figure S4. 2D-SAXS patterns for different z distance from the membrane surface for two conditions : a) t_{f1} = 88 min ΔP = 1.2 x 10^5 Pa and b) t_{f2} = 19 min and ΔP = 1.2 x 10^5 Pa.

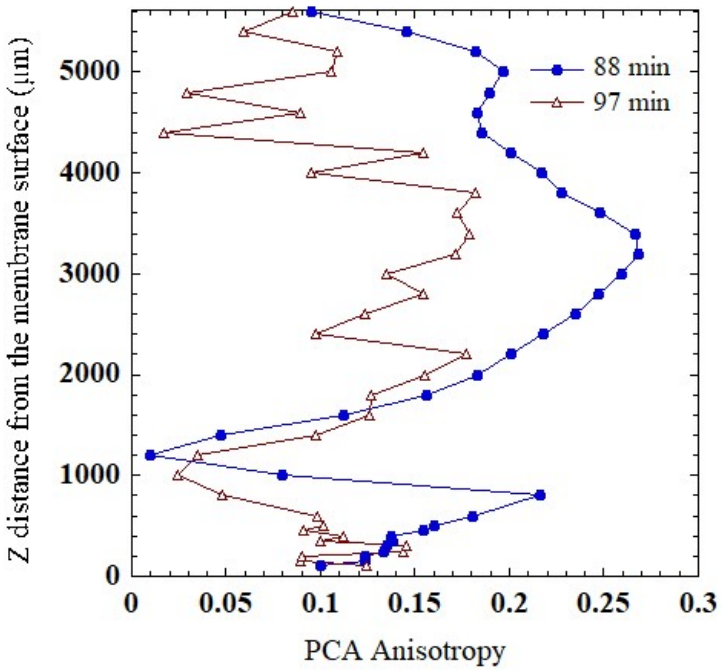

Figure S5. Comparison of *PCA Anisotropy* for two conditions : a) t_{fl} = 88 min ΔP = 1.2 x 10^5 Pa and b) t_{fl} = 97 min and ΔP = 0 Pa.

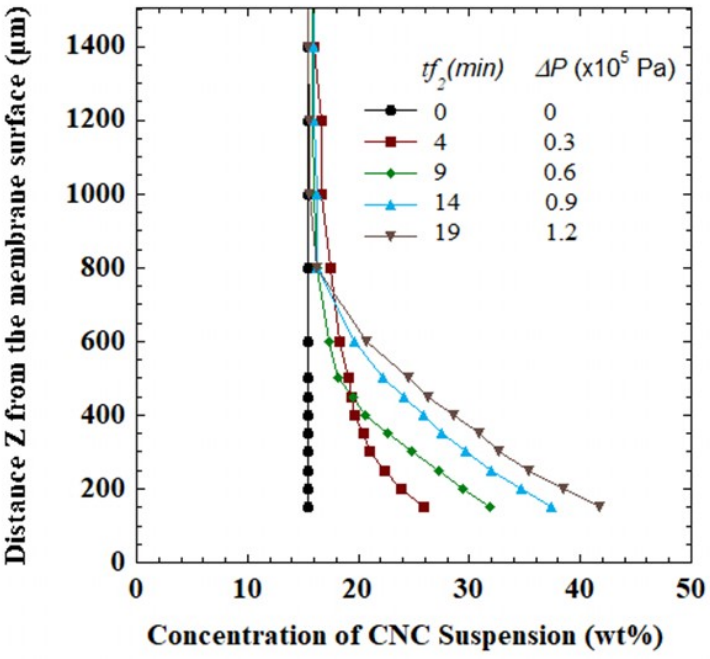

Figure S6: Concentration profile $C(z,t)$ as a function of the distance z from the membrane surface and for various transmembrane pressures ΔP applied during FU-US processing of a CNC suspension with initial concentration from beginning of Step 2 of about C = 15 wt %.