

## **SUPPLEMENTARY MATERIAL:**

### **TUNABLE FILTER FOR HIGH MOLECULAR WEIGHT DNA**

### **SELECTION AND LINKED-READ SEQUENCING**

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## Determination of the flow velocity and flow rate in the multicapillary device:

Given that we deal with slow flow velocities in narrow capillaries, the Reynolds number is small and creeping flow equations can be used. The flow rate  $Q$  in the multicapillary device is proportional to the hydrostatic pressure in the system  $\Delta P$  and the hydraulic resistance  $R_h$  of the multicapillary system:

$$Q = \frac{\Delta P}{R_h} \quad (S1)$$

Knowing the hydraulic resistance  $R_{eq}$  of one capillary:

$$R_{eq} = \frac{8\mu L_f}{\pi R^4} \quad (S2)$$

with  $\mu$  the dynamic viscosity of the fluid,  $L_f$  the length of the fiber and  $R$  the radius of one channel of the fiber, we can express  $R_h$  for the 61 parallel channels by:

$$\frac{1}{R_h} = \frac{61}{R_{eq}} \quad (S3)$$

The hydrostatic pressure drop is defined by:

$$\Delta P = \rho g L_T - \frac{2\sigma}{R_v} \quad (S4)$$

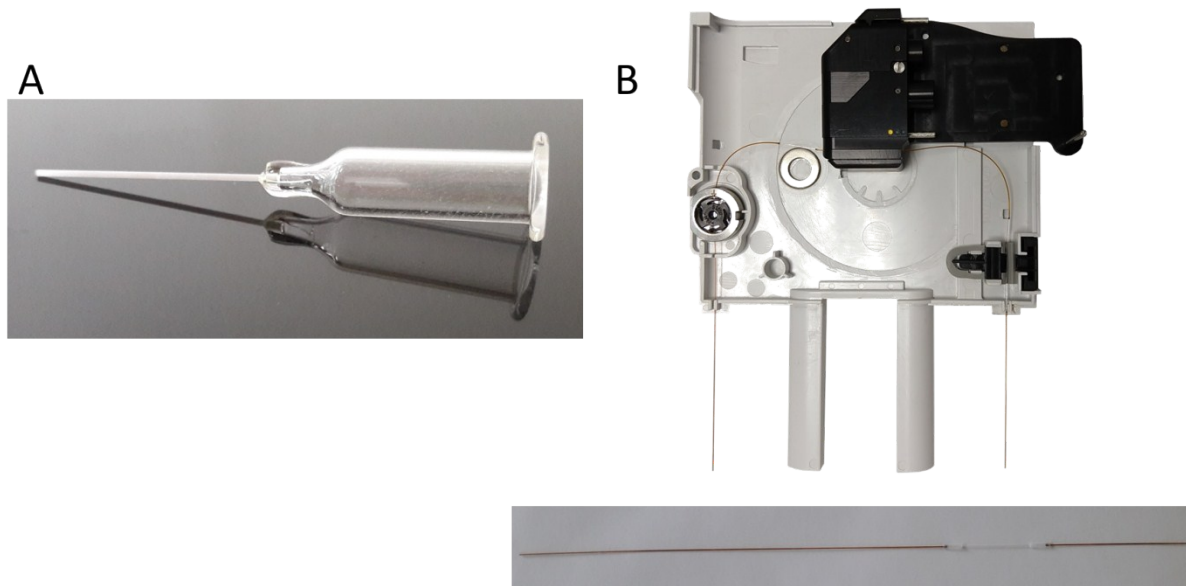
with  $\rho$  the volumic mass of the fluid,  $g$  the gravity, and  $L_T$  the total height of the multicapillary system, as defined by the sum of the capillary length  $L_f$  and the vial height  $L_v$ . The second term corresponds to the correction of the Laplace tension in the vial with  $\sigma$  the surface tension and  $R_v$  the radius of the vial. Thus, we deduce:

$$Q = \frac{\rho g 61 \pi R^4}{8\mu L_f} \left( L_T - \frac{2\sigma}{\rho g R_v} \right) \quad (S5)$$

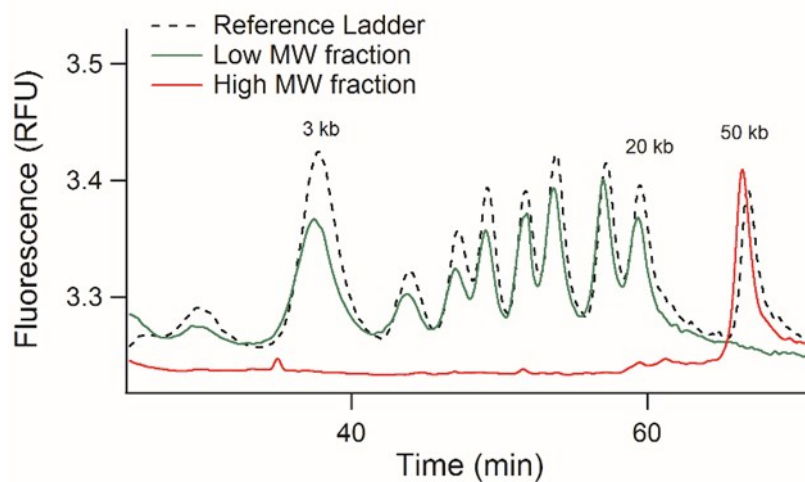
The mean flow velocity in each channel of the fiber is then:

$$V_0 = \frac{\rho g R^2}{8\mu} \left( 1 + \frac{L_v}{L_f} - \frac{2\sigma}{R_v L_f \rho g} \right) \quad (S6)$$

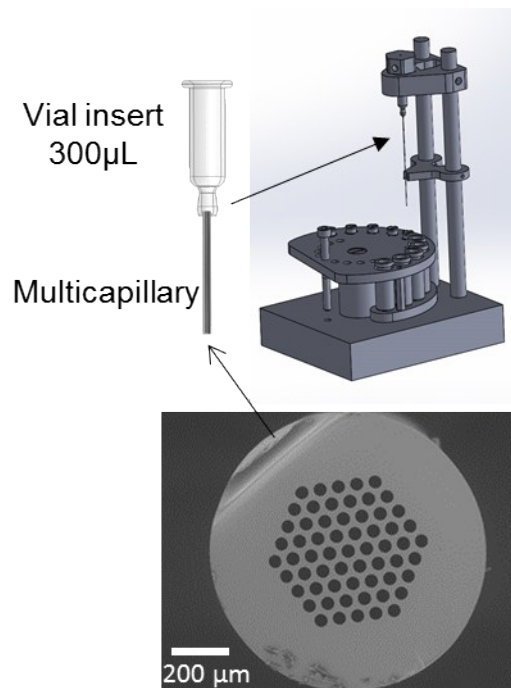
The numerical values for the mean flow velocity and flow rate are  $V_0 = 1.1 \text{ mm/s}$  and  $Q = 6.1 \text{ }\mu\text{L/min}$ . In real applications, we measured a comparable value of the flow rate of  $5.5 \text{ }\mu\text{L/min}$ .



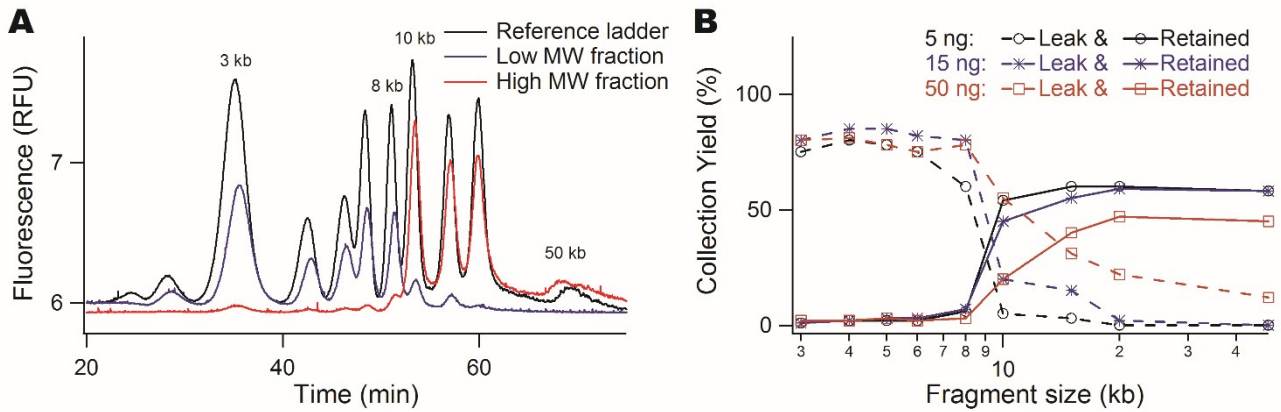
**Supplementary Figure S1:** Panel A is a micrograph of the multicapillary system integrated with a vial of  $300 \text{ }\mu\text{L}$ . (B) The two pictures represent the single capillary system (lower panel) with a large capillary (transparent section) connected to two smaller capillaries. This monicapillary system is integrated in a cassette shown in the upper panel for fluid handling in a capillary electrophoresis.



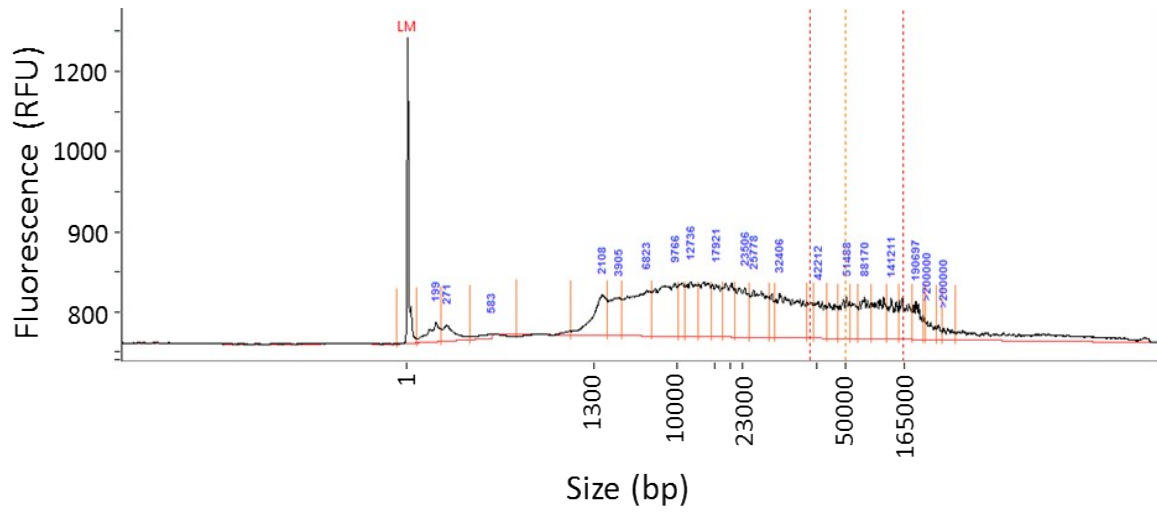
**Supplementary Figure S2:** The plot presents chromatograms with the reference ladder with bands of 3 to 50 kbp (dashed black curve), and the leak and retained fractions in green and red, respectively. The electric field was set to 4 kV/m during the selection phase. The red and green curves have been multiplied by the dilution factors 11.5 and 30, respectively.



*Supplementary Figure S3: The sketch presents the prototype to perform size selection with the multicapillary system. The prototype comprises a carousel for the collection of the different fractions.*



**Supplementary Figure S4: Size selection with the multicapillary system. (A)** The chromatogram shows the ladder spanning 3 to 50 kbp (black solid line) with the leak and retained fractions collected with the multicapillary system using an electric field set to 4 kV/m. Size selection is carried out with 15 ng of ladder injected in the system. The selection phase took place during 40 minutes and the electric field was then turned off to collect the high MW material for 10 minutes. The injected volume of DNA was 1  $\mu$ L, and the leak and retained fractions contained 260 and 60  $\mu$ L, respectively. The red and blue curves have thus been multiplied by the dilution factors 60 and 260. **(B)** The graph shows the purification yield as a function of DNA MW, as obtained with the multicapillary system for an electric field set to 4 kV/m (as in panel (A)). The yield is computed by determining the amount of each band in the chromatograms of the leak and purified fractions.



**Supplementary Figure S5:** FEMTO *Pulse*® analysis of the melon genomic DNA sample.