Electronic Supplementary Information (ESI)

Dynamics of flexible fibers and vesicles in Poiseuille flow at low Reynolds number

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DESCRIPTION OF THE MOVIES

The movies illustrate evolution of shapes of single vesicles and flexible fibers made of beads, entrained by the planar Poiseuille flow, for given values of the capillary number C_a, defined by Eqs. (7) and (29) as the ratio of the hydrodynamic force exerted by the Poiseuille flow on a flexible object to the bending force. Values of the capillary number $C_{a,s}$ related to the local shear, and distance y_0/R_0 of the flexible object center from the central plane of the flow are also indicated, with R_0 given by Eq. (5). For vesicles, the viscosity contrast $\lambda = 12$. The equilibrium shapes of vesicles and fibers are matched by choosing vesicle's reduced volume, defined by Eq. (6), as $\nu = 0.6$ for fibers made of $N = 5$ (movies S01-S08) and $\nu = 0.45$ for fibers made of $N = 10$ beads (movies S09-S12).

Movies S01-S08 illustrate the evolution shown in consecutive columns of Figure 7. Position and capillary numbers for a vesicle in column n and movie S0n is the same as for the flexible fiber in the next column, $(n + 1)$, and movie S0$(n + 1)$, and the time-dependent deformation of the corresponding shapes is similar. For large distances y_0, the dynamics is determined by the local shear flow, through the unique parameter $C_{a,s}$. This is not the case if y_0 becomes comparable with the length of flexible object.

Movie S01. Time-dependent deformation of a vesicle which migrates inward; C_a=0.15, y_0/R_0=9.3 and $C_{a,s}$=2.79.

Movie S02. Time-dependent deformation of a fiber which migrates inward; C_a=0.15, y_0/R_0=9.3 and $C_{a,s}$=2.79.

Movie S03. Time-dependent deformation of a vesicle which migrates outward; C_a=0.15, y_0/R_0=4.0 and $C_{a,s}$=1.20.

Movie S04. Time-dependent deformation of a fiber which migrates outward; C_a=0.15, y_0/R_0=4.0 and $C_{a,s}$=1.20.

Movie S05. Time-dependent deformation of a vesicle which migrates inward; C_a=0.01, y_0/R_0=139.5 and $C_{a,s}$=2.79.

Movie S06. Time-dependent deformation of a fiber which migrates inward; C_a=0.01, y_0/R_0=139.5 and $C_{a,s}$=2.79.

Movie S07. Time-dependent deformation of a vesicle which migrates outward; C_a=0.01, y_0/R_0=60.0 and $C_{a,s}$=1.20.

Movie S08. Time-dependent deformation of a fiber which migrates outward; C_a=0.01,

y_0/R_0=60.0 and $C_{a,s}$=1.20.

Movies S09-S10 and S11-12 correspond to the top-bottom panels of Figures 16 and 17, respectively. They illustrate the existence of two different modes of the dynamics: more flexible objects stay coiled, but more stiff ones straighten out along the flow while tumbling.

Movie S09. Shape evolution of a vesicle with $C_a = 0.07$ at $y_0/R_0 \approx 7.5$. The first mode, which is characterized by the succession of S-like shapes and shapes stretched along the flow.

Movie S10. Shape evolution of vesicles with $C_a = 0.07$ at $y_0/R_0 \approx 15$. The second mode, which is characterized by the vesicle being always coiled.

Movie S11. Shape evolution of flexible fibers with $A = 0.07$ at $y_0/R_0 \approx 6.22$. The first mode, which is characterized by the succession of S-like shapes and shapes straightened out along the flow.

Movie S12. Shape evolution of flexible fibers with $A = 0.07$ at $y_0/R_0 \approx 20.21$. The second mode, which is characterized by the fiber being always coiled.