Photo-controllable rotational motion of cholesteric liquid crystalline droplets in a dispersion system

Yota Sakai[1], Woon Yong Sohn [1] and Kenji Katayama [1,2,*]

1 Department of Applied Chemistry, Chuo University, Tokyo 112-8551, Japan;

2 PRESTO, Japan Science and Technology Agency (JST), Saitama 332-0012, Japan

*Corresponding authors:

K. Katayama, Phone: +81-3-3817-1913, E-mail: kkata@kc.chuo-u.ac.jp

Video information

Movie S1(a) A movie of the rotational motion of the S811-doped MBBA droplet in a PVA solution during the on-off irradiation of a UV light. The diameter of the droplet was 100 μm. The file name is S1a_S811_doped _MBBA.wmv. (b) A movie of the rotational motion of the R811-doped MBBA droplet in a PVA solution during the on-off irradiation of a UV light. The diameter of the droplet was 120 μm. The file name is S1b_R811_doped _MBBA.wmv. In both cases, the UV light was irradiated from the top side with an intensity of 25 mW/cm^2, and the concentration of PVA was 1 wt%.

Movie S2 A movie of rotational motion of the S811-doped MBBA droplet including a micron-sized polystyrene particle (D=1 μm) in a PVA solution during the on-off irradiation of a UV light. The UV light was irradiated from the top side with an intensity of 25 mW/cm^2. The concentration of PVA was 1 wt%. The diameter of the droplet was 80 μm. The movie is played at 16 times faster speed than the original. The file name is S2_polystyrene_particle_inside.wmv.

Movie S3 A movie of rotational motion of the R811-doped MBBA droplet in a PVA solution including a micron-sized polystyrene particle (D=1 μm) during the on-off irradiation of a UV light. (During the observation, the particles constantly showed spontaneous random motion due to the Brownian motion.) The UV light was irradiated from the top side with an intensity of 25 mW/cm^2. The concentration of PVA was 1 wt%. The movie is played at 8 times faster speed than the original. The file name is S3_polystyrene_particle_outside.wmv.

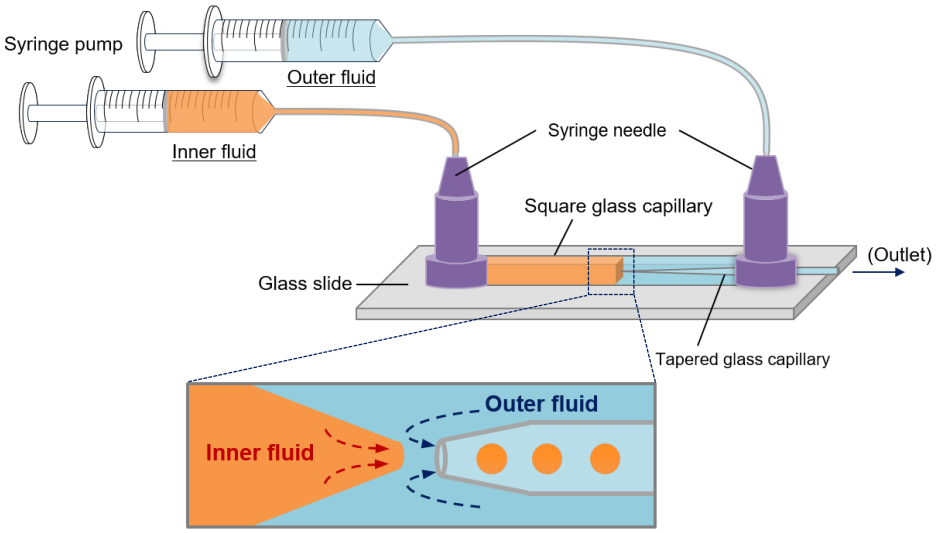

Fig.S1. The schematic of the microfluidic device consisted of a glass capillary, and the geometry of micro-capillaries and the formation mechanism of a single emulsion is shown. A square glass capillary (inner diameter: 0.90×0.90 mm^2) was attached on a glass slide, and a tapered cylindrical capillary was inserted into it. The tapered capillary was prepared by tapering a tip of cylindrical glass capillary (inner diameter: 0.70 × 0.70 mm^2, outer diameter: 0.87 × 0.87 mm^2) using a micropipette puller (P-1000, Sutter Instrument, Novato, CA, USA). The tip diameter was 50 μm. Syringe needles were connected to the syringe pump via a micro-tube, and the two types of liquids (inner fluid and outer fluid) were introduced. The inner fluid was sheared by the outer fluid in the inlet of the tapered cylindrical capillary, and droplets were formed. The droplets were collected from the tapered capillary on the right side. The hydrophilic treatment was applied for the tapered capillary by plasma cleaner (PDC-32G, Harrick Plasma, Ithaca, NY, USA). The microfluidic device was operated at room temperature (25 ˚C).

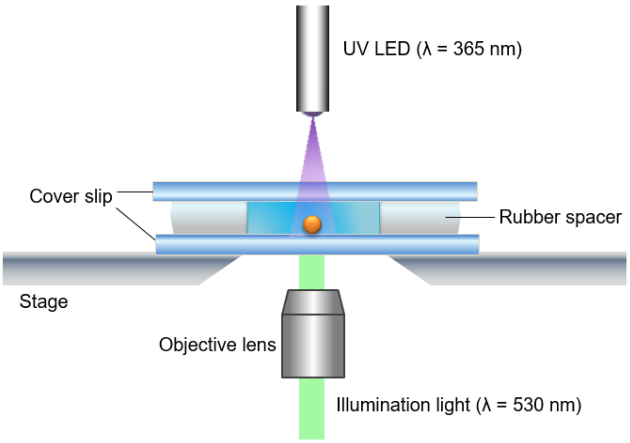

Fig.S2. A schematic drawing of the observation setup is shown. A rubber spacer (thickness: 0.2 mm) with an open space was sandwiched with two coverslips (thickness: 0.12~0.17 mm), and a PVA solution including CLC droplets was pipetted into the open space. The cell was placed on an inverted optical microscope (IX71, OLYMPUS), and the behavior of the LC droplets under light illumination (Execure LH-1V, HOYA, Center wavelength: 360 nm) was observed. The illumination light was a LED (DC2100, Thorlabs, wavelength: 530 nm).

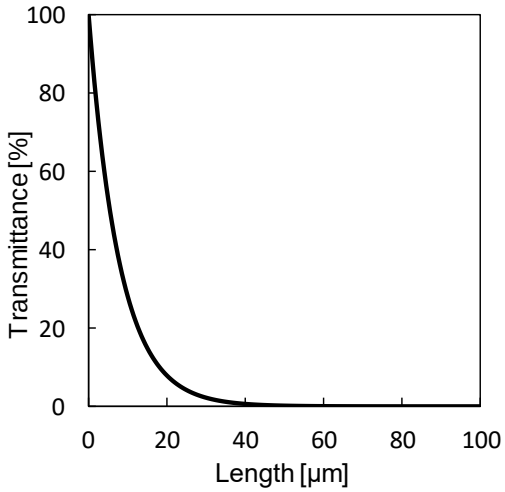

Fig.S3. The dependence of transmittance on the optical penetration depth for MBBA is shown. The absorption coefficient obtained from the absorbance at 365 nm was 1.27×10^4 cm^{-1}, and the optical penetration depth was 40 μm.