Supporting Information for:

Water-in-Water Emulsions Stabilized by Non-Amphiphilic Interactions: Polymer Dispersed Lyotropic Liquid Crystals

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4 pages

Structure of other water-soluble polymers tested for dispersing lyotropic liquid crystals.

Birefringence of liquid crystal droplets from dispersions of disodium cromoglycate in polyols.

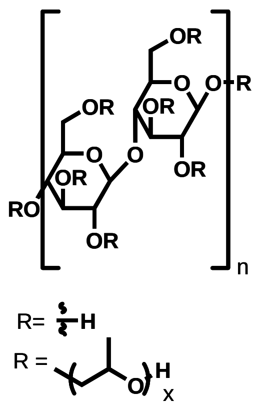
Birefringence of liquid crystal droplets from a dispersion of disodium cromoglycate in polyamide.

Determination of the droplet configuration of DSCG droplets having cross images in an aqueous solution of polyacrylamide.

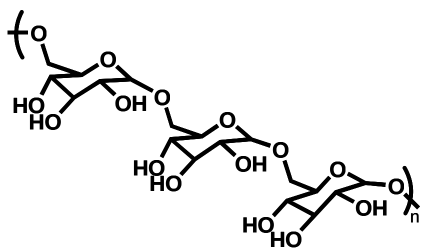
Structure of other polymers used in the experiment in addition to the polymers shown in the paper.

To verify our hypotheses that dispersions of liquid crystal (LC) in an aqueous solution of non-ionic polyols give rise to droplets with radial configuration, and that dispersions of liquid crystal (LC) in an aqueous solution of non-ionic polyamides give rise to droplets with bipolar configuration, we utilized other polymers which bear hydroxyl and amide groups. The structures of these polymers are shown in Scheme S1. The functional groups are attached as pendant groups in the polymer's backbones. For polyols, the polysaccharide pullulan, and hydroxypropylcellulose (HPC) were used to find out if the same droplet configuration (radial) can be generated as when poly(vinyl alcohol) were used. Likewise, a thermoresponsive polyamide, poly(N-isopropylacrylamide) (PNIPAAm) was used to test whether it can give rise to bipolar droplets like poly(acrylamide). Proving that these polymers give rise to the predicted droplets configuration would also confirm that the configuration and hence the stability of the droplets are governed by the strength of hydrogen bonding between the polymers' respective pendant functional groups and that of the DSCG molecule.

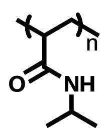
Scheme S1.



HPC



Pullulan



PNIPAAm

Birefringence of liquid crystal droplets from dispersions of disodium cromoglycate in polyols.

Figure S-1 shows the micrographs of DSCG droplets dispersed in polyols of Pullulan, and HPC. Results show that all of the three polyols give rise to LC droplets with radial configuration in water. This confirmed that in an aqueous environment, pendant hydroxyl groups in non-ionic polymers would facilitate the formation of radial LC droplets.

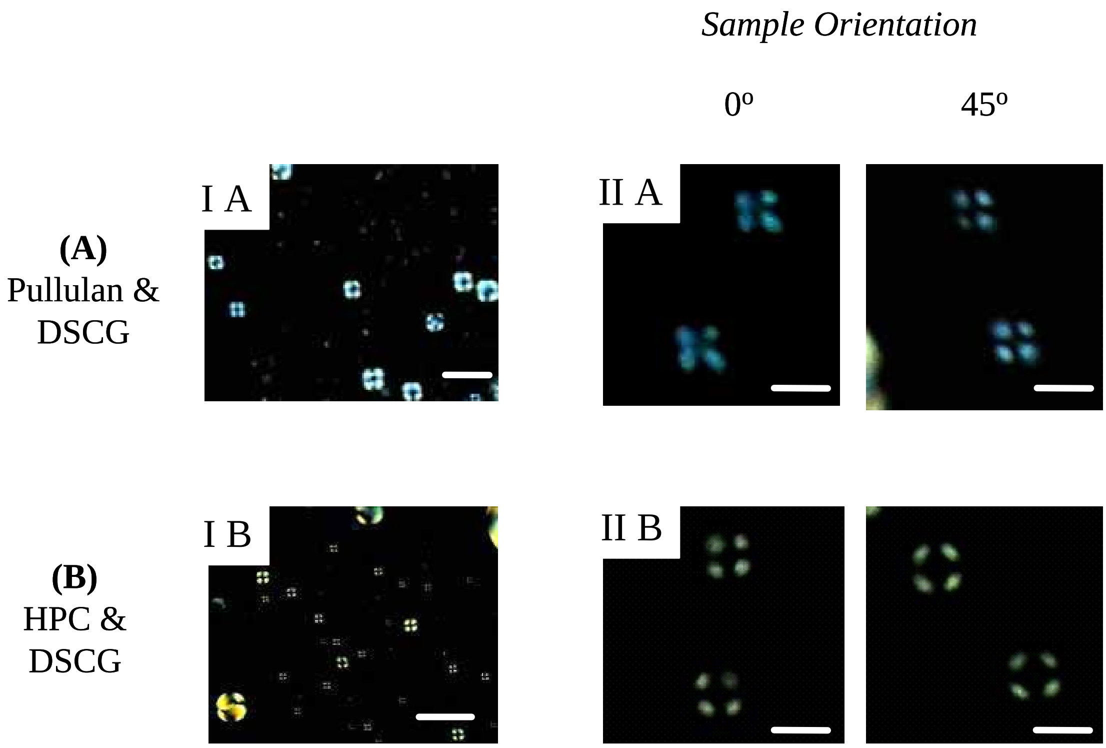


Figure S-1. (I) Micrograph images of 8 wt% DSCG in different aqueous solutions of polyols (IA) 10.9wt % Pullulan and (IB) 7.9wt% HPC in water between crossed polarizers. Scale bar = 136µm. (II) Enlarged images of birefringent droplets of (IIA) Pullulan and (IIB) HPC. Scale bar = 34 µm. Spacer thickness~ 42µm

Birefringence of liquid crystal droplets from a dispersion of disodium cromoglycate in polyamide.

Figure S-2 shows the micrographs of DSCG droplets dispersed in another polyamide, PNIPAAm. Results show that PNIPAAm gives rise to LC droplets with bipolar configuration in water. This confirmed that in an aqueous environment, pendant amide groups in non-ionic polymers would facilitate the formation of bipolar LC droplets.

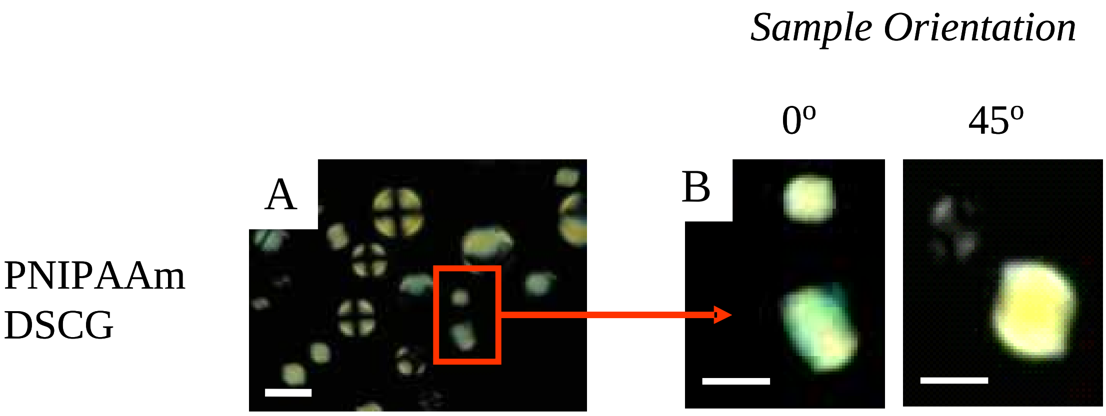


Figure S-2. (A) Micrograph image of DSCG in an aqueous solution of polayamide, PNIPAAm. Scale bar = 38 µm (B) Enlarged images of the birefrngent droplets of PNIPAAm. Scale bar = 15 µm. Spacer thickness ~42 µm

Determination of the droplet configuration of DSCG droplets having cross images in an aqueous solution of polyacrylamide.

In the dispersion of DSCG in polyamides, some droplets have a cross image in their birefringence, which can be caused by either a radial configuration or a bipolar configuration, of which the long axes of the droplets orients parallel to the path of the white light passing through the crossed polarizers. In order to determine the configurations of these droplets, we assembled a liquid crystal cell having a space sufficient enough to allow the LC emulsion sample to flow, and thus the LC droplet was able to move and tumble around. Video clips were taken to record the change of the birefringence as the LC sample flows. We observe that the radial-looking droplets “transform” to bipolar configuration as they tumble in the polyamide medium. This result suggests that these droplets which initially appeared to be radial are, in fact, bipolar droplets. Please see attached video Droplet_Confirm.avi