July 16-21, 2017 at UC San Diego, CA, USA

Liquid Crystal Phase Behavior of Aqueous Mixtures of Sunset Yellow and a DNA Dodecamer

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Introduction: The organic molecule sunset yellow, a chromonic dye, and the self-complementary DNA dodecamer 5'-GCGCTTAAGCGC- 3', both self-assemble into rod-shaped aggregates of stacked molecules that further self-assemble into columnar liquid crystal phases in solution [1][2]. The sunset yellow molecules and the nano-DNA duplexes have similar structure, with hydrophobic cores and peripheral hydrophilic ions. Here we explore the molecular selection and partitioning of these two molecules into stacked aggregates. We report on mixtures of these two aggregates in miscible liquid crystal states and the eventual phase separation that occurs in the more concentrated columnar phases. Figure 1 shows this phase separated state and the remixing that occurs with elevated temperature. The structure and composition of the nematic, columnar, and separated columnar phases have been deduced from optical microscopy and x-ray scattering data. Studying this kind of molecular organization by chromonic molecular stacking will further the understanding of the role of self-assembly in prebiotic molecular selection and templating.

References:

[1] Nakata M et al. (2007) *Science* 318(5854):1276-1279. [2] Park HS et al. (2008) *Journal of Physical Chemistry B.* 112(51):16307-19.

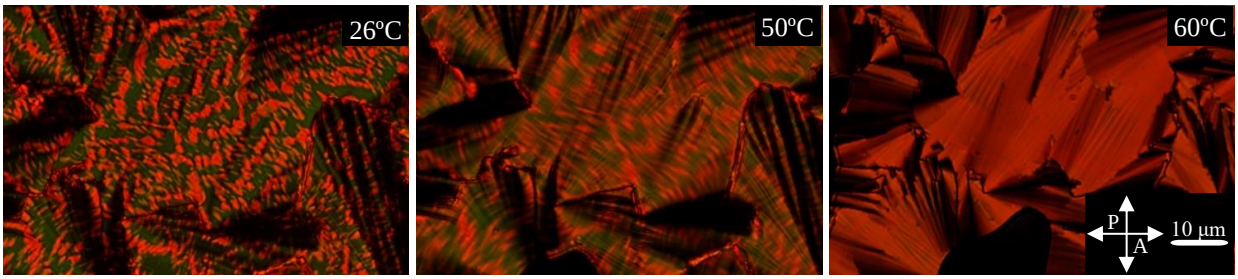

Figure 1 – Five micron thick sample of DNA and Sunset Yellow mixture viewed with polarized optical microscopy, showing phase separated columnar domains of sunset yellow-rich regions (red) and DNA-rich regions (green) at 26ºC and the remixing that occurs with elevated temperature.

Additional Information: This work was supported by NSF Biomolecular Materials Grants DMR-1207606 and DMR-1611272, and NSF MRSEC Grant DMR-1420736.