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**Title:** Reversible Photorheology in Solutions of Cetyltrimethylammonium Bromide, Salicylic Acid, and trans-2,4,4'-Trihydroxychalcone

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**Abstract:** We show photorheology in aqueous solutions of weakly entangled wormlike micelles prepared with cetyltrimethylammonium bromide (CTAB), salicylic acid (HSal), and dilute amounts of the photochromic multistate compound trans-2,4,4'-trihydroxychalcone (Ct). Different chemical species of Ct are associated with different colorations and propensities to reside within or outside CTAB micelles. A light-induced transfer between the intra- and intermicellar space is used to alter the mean length of wormlike micelles and hence the rheological properties of the fluid, studied in steady-state shear flow and in dynamic rheological measurements. Light-induced changes of fluid rheology are reversible by a the relaxation process. at relaxation rates which depend on pH and which are consistent with photochromic reversion rates measured by UV-vis absorption spectroscopy. Parameterizing viscoelastic rheological states by their effective relaxation time  $\tau(c)$  and corresponding response modulus  $G(c)$ , we find the light and dark states of the system to fall onto a characteristic state curve defined by comparable experiments conducted without photosensitive components. These reference experiments were prepared with the same concentration of CTAB, but different concentrations of HSal or sodium salicylate (NaSal), and tested at different temperatures.

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