Title:	Liquid Crystal based Detection of Pb(II) Ions Using Spinach RNA as Recognition Probe
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Abstract:	We report a new method for label-free, sensitive, and facile detection of lead(II) ions (Pb2+) based on an aptamer–target binding event, which is recognized by orientations of liquid crystals (LCs) at aqueous interfaces. The LC film suspended in the aqueous phase demonstrated a homeotropic orientation in contact with a cationic surfactant cetyltrimethylammonium bromide (CTAB) due to self-assembly of CTAB molecules at the aqueous–LC interface. The ordering of LC subsequently changed to planar in the presence of the spinach RNA aptamer (SRNA) due to interactions between CTAB and SRNA. In the presence of the Pb2+ ion, the ordering of LC changed to homeotropic caused by reorganization of CTAB at the LC–aqueous interface. This is due to formation of more stable quadruplex structures of SRNA with Pb2+ ions in comparison to the CTAB-SRNA complex. The sensor exhibited a detection limit of 3 nM, which is well below the permissible limit of Pb2+ in drinking water. Our experiments establish that addition of Pb2+ leads to (i) the formation of Pb2+-SRNA complexes and (ii) a decrease in density of SRNA on the LC interface, but additional studies are required to determine which of these processes underlie the response of the LCs to the Pb2+. We have also demonstrated the potential application of the LC sensor for detection of Pb2+ in tap water. Unlike current laboratory-based heavy-metal-ion assays, this method is comparatively simple in terms of instrumentation, operation, and optical readout.
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