**Supporting information**

**Colorimetric detection of anionic surfactant using polydiacetylene/zinc (II)/zinc oxide nanocomposites with unique yellow-to-red color transition**

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| **Table S1.** Colorimetric sensors of anionic surfactants developed by using different types of materials | **Limit of detection** | 1 ppm | N/A | 10⁻⁶ M | N/A | 10⁻⁶ M | 10⁻⁶ M | 0.03 - 0.10 mg/L | 10⁻⁷ M (28.7 ppb) | 71.5 - 120 nM |
| **Working pH range** | N/A | 7.4 | 5.8 | 5.0 | N/A | N/A | 7.5 | N/A | 2-13 |
| **Matrix** | Aqueous solutions | Aqueous solutions and HEPES buffer | Aqueous solutions | Aqueous solutions and filter papers | Aqueous solutions | Aqueous solutions | Aqueous solutions | Aqueous solutions | Aqueous solutions |
| **Analytes** | Lauryl sulfate (LS), Tetradecyl sulfate, Alkylbenzene sulfonate (LAS), and Dodecyl phosphate | Sodium dodecyl sulfate (SDS), Sodium dodecylbenzenesulfonic acid (SDBS), Sodium dodecyl carboxylate (SDC), and Sodium dodecyl phosphate (SDP) | Sodium dodecylbenzenesulfonate (SDBS), Sodium dodecyl sulfate (SDS), Sodium lauryl sulfate (SLS), and Sodium dodecyl carboxylate (SDC) | Sodium dodecanoate (SDC), Sodium dodecyl sulfate (SDS), and Sodium dodecylbenzenesulfonate (SDBS) | Sodium dodecylbenzenesulfonate (SDBS), Sodium dodecyl sulfate (SDS), Sodium lauryl sulfate (SLS), and Sodium dodecyl carboxylate (SDC) | Sodium dodecyl sulfate (SDS), Sodium dodecyl benzenesulfonate (SDBS), and Sodium lauryl sulfate (SLS) | Sodium dodecylbenzene sulfonate (LAS) | Sodium dodecyl sulfate (SDS), Sodium dodecylbenzenesulfonate (SDBS), Sodium dodecylsulfonate (SDSO), and Sodium dodecanoate (SD) | Sodium dodecyl sulfate (SDS) |
| **Maretials** | Imidazolium-containing ionic liquids on a solid support | Imidazolium-functionalized polydiacetylene | A forming complex between poly(3-(4-methyl-3′-thienyloxy)propyltrimethylammonium) (PMTPA) and 8-hydroxy-1,3,6-pyrenetrisulfonic acid trisodium salt (HPTS) or PMTPA/HPTS complex disassembles | Polydiacetylene carrying amino groups, such as primary amine, secondary amine, and ammonium head group | Poly[N,N,N-trimethyl-4-(thiophen-3-ylmethylene)-cyclohexanaminium chloride] (PTCA-Cl) | Poly[3-(1,1′-dimethyl-4-piperidinemethylene)thiophene-2,5-diyl chloride] (PDPMT-Cl) | Poly(acrylic acid)-coated magnetite nanoparticles (PAA@Fe₃O₄) | Naphthalimide-based cationic dyes | TPE-Br (4,4′,4′′,4′′′-(ethene-1,1,2,2-tetrayltetrakis(benzene-4,1-diyl))tetrakis(1-(4-bromobenzyl)pyridin-1-ium) bromide) and TPE-I (4,4′,4′′,4′′′-(ethene-1,1,2,2-tetrayltetrakis(benzene-4,1-diyl))tetrakis(1-methylpyridin-1-ium) iodide) |
| **Author, Year** | Coll et al., 2007 | Chen et al., 2010 | An et al., 2011 | Thongmalai et al., 2011 | Wang et al., 2012 | Li et al., 2012 | Wei and Mo, 2014 | Zhao and Li, 2015 | Feng et al., 2020 |

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**Table S2.**Hydrodynamic radii (*Rh*) values of PDA(8,12)/Zn2+/ZnO nanocomposites from 3D-DLS measurements at 25 oC (298 K).

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| --- |
| PDA(8,12)/Zn2+/ZnO nanocomposites |
| CTAB conc. (mM) | **Hydrodynamic radii, *Rh* (nm)** |
| 00.10.30.51 | 165 ± 2 |
| 192 ± 9 |
| 279 ± 0 |
| 333 ± 4 |
| 454 ± 7 |
| PDA(8,12)/Zn2+/ZnO nanocomposites with 1 mM CTAB |
| SDS conc. (mM) | **Hydrodynamic radii, *Rh* (nm)** |
| 0.30.513 | 239 ± 3 |
| 205 ± 9 |
| 200 ± 1 |
| 196 ± 2 |

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**Fig. S1.** Absorption spectra of PDA(8,12)/Zn2+/ZnO nanocomposites with (a) 0, (b) 0.1, (c) 0.5, (d) 3, (e) 5, (f) 7, and (g) 10 mM CTAB measured upon the addition of SDS.

**Fig. S2.** FT-IR spectra of (blue phase) PDA(8,12)/Zn2+/ZnO nanocomposites, (yellow phase) PDA(8,12)/Zn2+/ZnO nanocomposites with 1 mM CTAB, and (top) pure CTAB molecules.

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**Fig. S3.** Expanded 2300-1300 cm-1 region of Raman spectra. Lorentz deconvolution function bands of the Raman spectra of PDA(8,12)/Zn2+/ZnO nanocomposites upon the addition of 0, 0.1, 0.3, 0.5, 3, and 7 mM CTAB. Raman spectrum of CTAB is included for comparison. A broad peak is attributed to the scattering of water molecules.



**Fig. S4.** Expanded 2300-1300 cm-1 region of Raman spectra. Lorentz deconvolution function bands of the Raman spectra of (blue phase) pristine PDA(8,12)/Zn2+/ZnO nanocomposites and PDA(8,12)/Zn2+/ZnO nanocomposites with 1 mM CTAB upon the addition of 0.9 mM SDS. Raman spectrum of SDS is included for comparison. A broad peak is attributed to the scattering of water molecules.