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Editorial

Colorimetric and Fluorescent Sensors: Current Status and Future Development

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Chemosensors for diverse analytes have become a significant research topic experiencing innovative real-time development [1,2]. In this context, the development of colorimetric and fluorometric probes for screening of diverse analytes has become attractive for their real-time applications [3,4]. In fact, colorimetric and fluorometric responses for analytes can be achieved using probes constructed from small molecules, metal–organic frameworks (MOFs), chemodosimeters, nanomaterials, hybrid structures, etc. [5–8]. This thematic Special Issue covers recent advances in sensing enabled by organic, inorganic, and hybrid nanostructures for the recognition of distinct ions and species, with a detailed real-time demonstration. As displayed in the List of Contributions, this Special Issue comprises two review papers and seven research articles, which present a range of sensing performance data for distinct materials with defined applications.

Articles published in this Special Issue are briefly summarized as follows. Gowda et al. synthesized a Schiff base PMPD via one-pot condensation of 1-pyrene carboxaldehyde and 3-amino-1H-pyrazole-5(4H)-one and employed it in the fluorescent detection of Cu^{2+} and Fe^{2+} with estimated detection limits (LODs) of 0.42 μM and 0.51 μM, respectively. The sensory applications were demonstrated through real water, logic gates, smartphone-driven RGB analysis, and bioimaging studies. This is an impressive and unique study, with amendments for future applications. In addition to this work, multiple analyte-sensing and theranostic applications of pyrene-based Schiff bases have been demonstrated previously [9–11]. Silva et al. described the use of Ruthenium(II) and Rhenium(I) complexes $Ru(bpz)(\mathbf{btip})_2]^{2+}$ and $[Re(CO)_3(H_2O)(\mathbf{btip})]^+$ for "Turn-On" luminescent sensing of Antimony(III). In which, based on ultraviolet/photoluminescent (UV/PL) and time-resolved spectroscopic interrogations, the mechanistic aspect was clearly revealed. This work demonstrates evidence for an organometallic compound-based sensor [12].

Next, Á. Fernández-Merino and co-workers developed red-emissive carbon dots (CDs) and illustrated their PL quenching selectivity to Fe(III) ions. This work demonstrated the solvothermal synthesis of CDs from O-Phenylenediamine and Toluene, as well as the sensing mechanism of Fe(III). This is a unique research study in addition to carbon dot-based sensors [13]. Ochoa et al. proposed the use of thiosemicarbazone- and thiourea-functionalized calix [4]arenes receptors for the recognition of ions, including Co^{2+}, Cu^{2+}, and Ni^{2+}, which displayed high selectivity to Co^{2+} with a LOD of 2.94 μg/L. This study is remarkable for its exceptional calixarene structural features [14]. Using in situ and colorimetric analyses, Li and co-workers studied pigment ageing and its environmental effects on Tibetan Buddhist murals. This study presented colorimetric analyses and a replicable model for mural investigations in a complex environment [15]. Kadam et al. developed a benzo[d]thiazole-based Schiff base derivative FBTS for selective PL "Turn-On" sensing

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of Al(III) ions. This is a distinct study with detailed sensory investigations, including interference studies, DFT optimization, real water analysis, cellular imaging, fish tissue imaging, and smartphone-based fluorescence analysis [16]. Alansari et al. synthesized highly luminescent CDs with a quantum yield (QY) of 47.12% for the selective quantification of Fe(III) and Hg(II) ions. The effectiveness of this work was demonstrated in its real sample applications [17].

Apart from the aforementioned articles, Jagannathan and co-workers described the colorimetric sensing of metal ions using newly constructed electrospun nanostructured materials in a recent review [18]. This article provided details on the development of electrospun nanostructures and their selectivity for metal ions (including Cu, Fe, Hg, Cr, Pb, Ag, and Cs) and non-metal ions. Shellaiah et al. presented a comprehensive review of pyrene-based materials used for detecting Hg(II) ions and nitroaromatics [19]. This review not only detailed the mechanisms underlying sensing and the selectivity of the aggregation-induced emission (AIE) state of the pyrene derivative towards nitroaromatics, but also illustrated the complex facilitation of excimer formation and assembly-driven nitroaromatic detection [20–23].

Finally, we want to thank all the authors who contributed to this Special Issue with their exceptional research, which has enriched this research field. We also acknowledge the reviewers for their timely review reports, which improved the quality of the published manuscripts. We also thank the Editors for their diligent efforts during the peer review process, who have supported the Special Issue throughout.

Conflicts of Interest: The authors declare no conflicts of interest.

List of Contributions

1. Jagannathan, M.; Yohan, R.K.; Cho, S. Recent Development of Electrospun Nanostructured Fibers as Colorimetric Probes for Metal Ion Sensing: A Review. *Chemosensors* **2024**, *12*, 129. https://doi.org/10.3390/chemosensors12070129
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