Liquid Crystal-based Sensor for Detecting Copper Ions in One Step by Using Imidazole-based Molecular Probes

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In this study, a liquid crystal (LC)-based sensor for detecting copper ions was developed. This sensor applies an LC/aqueous interface where an imidazole-based molecule, i.e., 2-(4'-pentyl-[1,1'-biphenyl]-4-yl)-4,5-dihydro-1H-imidazole (5CB-imid) is doped in LCs as the probe. When positively charged copper ions were presented in the aqueous phase to chelate with the imidazole moiety of the probe, the interfacial potential was enhanced to induce the homeotropic orientation of LC, resulting a bright-to-dark transition of LC images as the optical signal of the sensor. The lowest detectable concentration of this sensor towards copper ions is 5 μM, and it does not response to other divalent metal ions. In addition, we demonstrated that this sensor can effectively detect copper ions in the wastewater collected from electroplating plants. In this system, 5CB-imid acts not only as the probe for chelating with copper ions, but also as the alignment molecules to induce the transition of LC signals. Therefore, the entire sensing process can be accomplished by adding sample solutions to the LC-based sensing platform in one step. This works provides a simple design strategy for the LC-based sensors for fast-screening and on-site applications.

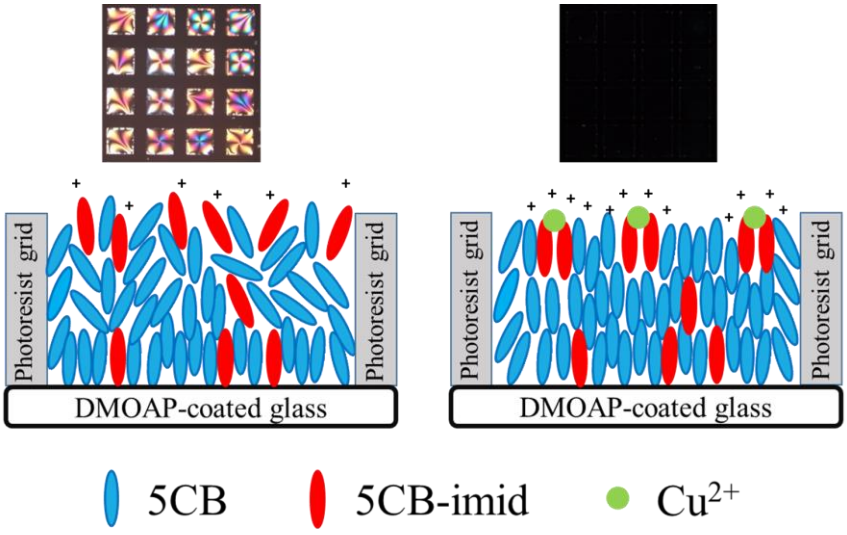

Figure 1. The detection mechanism of copper ion detection.

References

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