Versatile hydrogen-bonded organic framework (HOF) platform for simultaneous detection and efficient removal of heavy metal ions

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The ever-deteriorating water pollution problem caused by heavy metal ions has spurred the development of new materials for efficient detection and removal of heavy metal ions. In this work, a porous hydrogen-bonded organic framework (HOF) PFC-1 was found to be excellent sensors for Pb^{2+} and Cu^{2+} via fluorescent quenching effect, with good selectivity and low limit of detection (LOD) values. Surprisingly, PFC-1 also exhibited superior removal abilities towards Pb^{2+} and Cu^{2+}, with maximum adsorption capacities of 384.6 and 214.1 mg/g at 298.15K, respectively, which are comparable with the performance of some MOFs and COFs adsorbents. Langmuir isotherm model and pseudo-second-order kinetic model could well illustrate the adsorption processes towards these two heavy metals. PXRD, FTIR, XPS and DFT modelling were employed together to investigate the mechanism of fluorescent quenching and adsorption for Pb^{2+} and Cu^{2+}. The results indicated that electrostatic interactions and host-guest interactions afforded PFC-1 excellent detection and removal performance for Pb^{2+} and Cu^{2+}. Results presented in this work provided new inspirations for broader applications of HOFs materials in the area of environmental remediation.