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Eco-friendly fabrication of a cost-effective cellulose nanofiber-based aerogel for multifunctional applications in Cu(II) and organic pollutants removal

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摘要	Eco-friendly and cost-effective designs of adsorbents are highly desirable to realize highly efficient removal of heavy metals and organic pollutants from wastewater. Herein, the biomimetic co-deposition from polyphenol-substance tannic acid induced the grafting of renewable cardanol-derived siloxane on a cellulose nanofiber (CNF) framework to form an eco-friendly and low-cost microporous aerogel to capture Cu(II) and organic contamination. Owing to the three-dimensional cellulosic porous structure and easily accessible active sites, the as-prepared aerogel manifested a low density and favorable hydrophobicity, which were vital for highly efficient absorption toward Cu(II) and oil droplets. The saturated adsorption capacity of modified aerogels for Cu(II) was found to be 45.6 mg/L, which is higher than the majority of reported biobased adsorbents. Based on thermodynamic and kinetic studies, the Cu(II) adsorption closely approximated that of a spontaneous and endothermic chemisorption process. In addition, the modified aerogel effectively collected various oils and organic solvents from water, with maximum absorption capacities up to 108 g/g (chloroform); it also exhibited good stability in a Cu(II)/chloroform binary system. The multiple separation efficiency indicated that the obtained aerogel is very suitable for application in practical water purification. It is particularly important that the whole synthesis process of modified aerogels is green and economical without additional toxic agents; this allows them to significantly reduce secondary pollution to the environment after use, contamination emissions to the environment. These results demonstrated that the novel nanostructured composites with a naturally functional polymer layer have unexpected potential as an ideal candidate for practical water purification.
服务人员	尚玮姣
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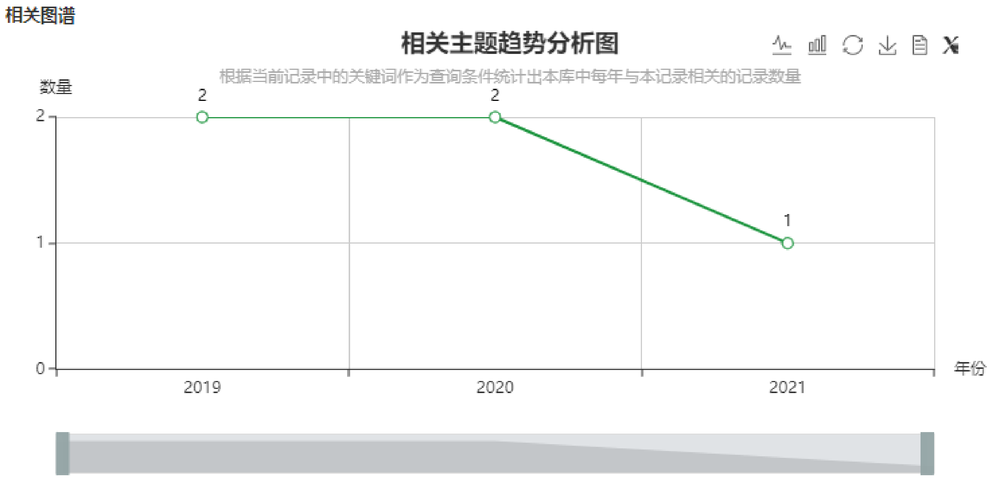

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