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N-doped carbon nanospheres as selective fluorescent probes for mercury detection in contaminated aqueous media: chemistry, fluorescence probing, cell line patterning, and liver tissue interaction

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A precise nano-scale biosensor was developed here to detect Hg^{2+} in aqueous media. Nitrogen-doped carbon nanospheres (NCS) created from the ultrasonic spray pyrolysis of melamine–formaldehyde resin were characterized by FESEM, XRD, Raman spectra, EDS, PL, UV–vis spectra, and N_2 adsorption–desorption, and were used as a highly selective and sensitive probe for detecting Hg^{2+} in aqueous media. The sensitivity of NCS to Hg^{2+} was evaluated by photoluminescence intensity fluctuations under fluorescence emission in the vicinity of 390 nm with a λexc of 350 nm. The fluorescence intensity of the NCS probe weakened in the presence of Hg^{2+} owing to the effective fluorescence quenching by that, which is not corresponding to the special covalent liking between the ligand and the metal. The effects of the fluorescence nanoprobe concentration, pH, and sensing time were monitored to acquire the best conditions for determining Hg^{2+} ([1]). Surprisingly, NCS revealed excellent selectivity and sensitivity towards Hg^{2+} in the samples containing Co^{2+}, Na^{+}, K^{+}, Fe^{2+}, Mn^{2+}, Al^{3+}, Pb^{2+}, Ni^{2+}, Ca^{2+}, Cu^{2+}, Mg^{2+}, Cd^{2+}, Cr^{3+}, Li^{+}, Cs^{+}, and Ba^{2+}. The fluorescence response was linearly proportional to Hg^{2+} concentration in 0.013–0.046 μM with a limit of detection of 9.58 nM. The in vitro and in vivo toxicological analyses confirmed the completely safe and biocompatible features of NCS, which provides promise for use for water, fruit, vegetable, and/or other forms of natural-connected materials exposed to Hg^{2+}, with no significant toxicity noticed toward different cells/organs/tissues ([2]).

Keywords: Nitrogen-doped carbon spheres, Melamine formaldehyde resin, Ultrasonic spray pyrolysis, Fluorescence probe, Hg^{2+}

References

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