PÔSTER - RESUMO - SENSORES E BIOSSENSORES

CELLULOSE-DERIVED CARBON QUANTUM DOTS (CDS) FOR ENVIRONMENTAL CONTAMINANT DETECTION

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Water resources have been extensively impacted by contamination from diverse industries, releasing pollutants such as heavy metals and organic compounds. Many of these contaminants show high stability, difficulty in degrading naturally, bioaccumulation potential, and several effects on human health. The particular concern is related transition and heavy metals ions such as Pb(II), Fe(II) and Cu(II), since their toxicity is associated with acute neurotoxicity and damage to the cardiovascular and renal systems (Pb(II)), oxidative stress and disruption of biological redox balance (Fe(III)), and dose-dependent gastrointestinal and neurological disorders (Cu(II)) [1,2]. In this context, to develop of smart and non-toxic materials for the detection of these compounds is essential to guarantee the drinking water safety. Carbon quantum dots (CDs) have been cited as a promising biodegradable, non-toxic, and eco-friendly alternative obtained from renewable resources, showing intrinsic fluorescence properties suitable for sensing applications [1,3]. This study presents carbon quantum dots (CDs) synthesized from commercial cellulose to detect different heavy metals.

The CDs were synthesized via a hydrothermal method in a reactor (volume of 500 mL) containing 320 mg of cellulose powder at 200 °C for 4h. After cooling to room temperature, the product has brownish product was macerated in acetone for 30 minutes, followed by drying at 40 °C for 3h to ensure complete solvent evaporation. The CDs suspension was prepared by mixture of 0.01g of CDs in 20 mL of water (0.05% (w/w)) and sonicated for 30 minutes before analysis. Photoluminescence measurements were performed using a Fluorolog Horiba spectrofluorometer (model LPS 100) equipped with a Hamamatsu detector. The excitation and emission spectra were performed in the ranges of 300–400 nm and 400–550 nm, respectively. The CDs suspension exhibited a maximum excitation peak at 358 nm and an emission peak at 435 nm, which were fixed for Pb(II), Fe(III), and Cu(II) detection tests. The UV-Vis spectrum showed a maximum extinction peak at 279 nm. FTIR spectrum showed peaks characteristic bands at 3327 cm-1 for stretching vibration modes of –OH and 2905 cm-1 C–H bonds. The vibration mode of C=C at 1633 cm-1, and as well the bands at 1040 cm-1 the stretching vibrations of C–O bonds. For the metal ion detection, 3 mL of the CDs suspension was placed in quartz cuvette and then, was added 100 µL of each metal ion stock solution (0.001 mol/L), prepared from Pb(NO3)2, Fe(SO4)2 and Cu(SO4)2 precursor salts. The “turn-off” effect by the suppression of luminescence intensity was observed with the increasing heavy metal concentration. Therefore, this work provided the efficient detection of different heavy metal ions in water, becoming a biodegradable material through a facile and sustainable synthesis route, with potential applications in the detection of other heavy metals.

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Palavras-chave: carbon quantum dots (cds); heavy metals; turn-off effect; luminescence detection.