Synthesis of carbon dots from black sesame and their sensing applications

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Abstract: Carbon dots (CDs) are carbon nanoparticles which have unique properties including high photo stability and low toxicity. In this work, CDs were synthesized from black sesame via hydrothermal method at 200 °C for 4 h. CDs were characterized using UV-visible spectroscopy, fluorescence spectroscopy, Fourier-transform infrared spectroscopy, dynamic light scattering, transmission electron spectroscopy, and x-ray photoelectron spectroscopy. The results showed that the size of CDs was around 7.6 nm, and they exhibited blue color emission with a quantum yield of 2%. The obtained CDs were applied for metal ion detection (including Fe2+, Fe3+, Mg2+, Co2+, Ca2+, Ni2+, Cu2+, Zn2+, Cd2+, Sn2+, Pb2+, Na+ and K+, total 13). We were able to differentiate different types of metal ions using principal component analysis (PCA). A paper-based device was fabricated using Whatman filter paper to show the simplicity and practicality of our materials as sensors. Furthermore, they were used as a sensing layer for the detection of ammonia, trimethylamine, and ethylenediamine vapors using an electronic nose. This work thus demonstrated that carbon dots prepared from black sesame are intriguing sensing materials for various chemicals.

Keywords: Carbon dots; Black sesame; Hydrothermal method; Metal ion detection; Gas sensing