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Abstract

Carbon Dots as a Fluorescence pH Nanosensor by Application of an Active Surface Preservation Strategy †

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Abstract: In the environmental, industrial, and biomedical fields, pH monitorization is of the upmost importance. However, the most used type of pH sensors, glass pH-electrodes, still present limitations in their application in low volume samples and in cellular pH sensing, due to their size and invasive nature. Fluorescence-based sensors present a solution to such issues, providing a non-invasive solution to pH sensing. Herein, we report the rational development of carbon dots (CDs) as a pH nanosensor via an active surface preservation (ASP) method. Carbon dots (CDs) are carbon-based fluorescent nanoparticles with valuable properties such as high aqueous solubility, low cost and good biocompatibility, with remarkable fluorescence performance, been increasingly used as fluorescent nanosensors. Namely, these nanomaterials present advantages over molecular probes in terms of (photo)stability and water solubility, among others. By employing ASP strategies, the CDs will be prepared by using precursors with known active functional features. The ASP method allows the nanoparticles to retain the structural features of precursors, thus retaining their properties, without the need for costly and time-consuming post-synthesis functionalization procedures. In this work, we intend to provide a proof-of-concept of this type of strategy by utilizing the known pH-sensitivity of fluorescein to provide a pH-based response to CDs. The resulting CDs presented reversible response by fluorescence enhancement in the range of pH from 4 to 12. The nanoparticles exhibited excellent photostability, in different pH solutions. The studied CDs were also unaffected by, either variation of ionic strength or the presence of interferent species, while being compatible with human cancer cells. Finally, CDs were able to determine the pH of real samples. Thus, a selective pH fluorescent CDs-based nanosensor was developed.

Keywords: carbon dots; pH sensing; active surface preservation; nanosensor; fluorescence; biocompatibility

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