Detection of Nitroaromatic Pollutant Using Nanoparticle Sensor

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The detection of nitroaromatic compounds is extremely vital in many areas including military and civilian safety, chemical industry and environmental monitoring. 4-Nitrophenol (4-NP) is one kind of nitroaromatic pollutant, which is listed as a priority pollutant by US Environmental Protection Agency (EPA) due to its toxicity and environmental persistence. 4-NP is being used in dyes, polyurethane foams, herbicides, insecticides, and explosives, etc. Such sources contaminate water with 4-NP and make it harmful for aquatic life and humans' use. Currently, around 2 million people die each year due to toxic pollutants present in drinking water. Thus, it is necessary to develop inexpensive and prompt sensor for the detection of 4-NP pollutants to investigate the toxicity of water. Herein, a new, reliable, inexpensive and portable nanoparticle sensor for the detection of 4-NP is presented. Nanoparticles of NaFl are prepared in acetonitrile (MeCN) by reprecipitation method. Photodynamics of the nanomaterials are studied in the presence of different concentrations of nitroaromatics using UV-visible absorption spectrophotometry and fluorescence spectrometry. Drastic changes in the intensity of absorption as well as emission spectra are observed in the presence of low concentrations of 4-NP in liquid and solid phases. Examination of results reveals that NaFl nanoparticles are extremely selective towards 4-NP among other tested nitroaromatics in the study. High sensitivity of sensor towards 4-NP in comparison to 3-NP is attributed to the presence of strong acidic hydrogen donor group in 4-NP. Thus, NaFl nanoparticles have been demonstrated as an economical, sensitive and robust optical nanoparticle sensor for 4-NP.

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