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Full Paper

4-Aminosalicylic Acid Functionalized Multiwalled Carbon Nanotubes for Rapid Removal of Crystal Violet Dye from Wastewater Using Minicolumn

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Graphical Abstract

In this paper, 4-aminosalicylic acid functionalized Multiwalled carbon nanotubes (CNT-ASA) were applied for fast adsorption-desorption of Crystal violet dye using minicolumn attached to a flow-injection system and UV-Visible spectrophotometer for determination of dye concentration. The nanoadsorbent showed high dye removal efficiency of ~99 % and adsorption capacity of 440 mg g^{-1}. The nanoadsorbent also showed high reusability and hence has great potential to remove dyes and other toxic pollutants from wastewater.

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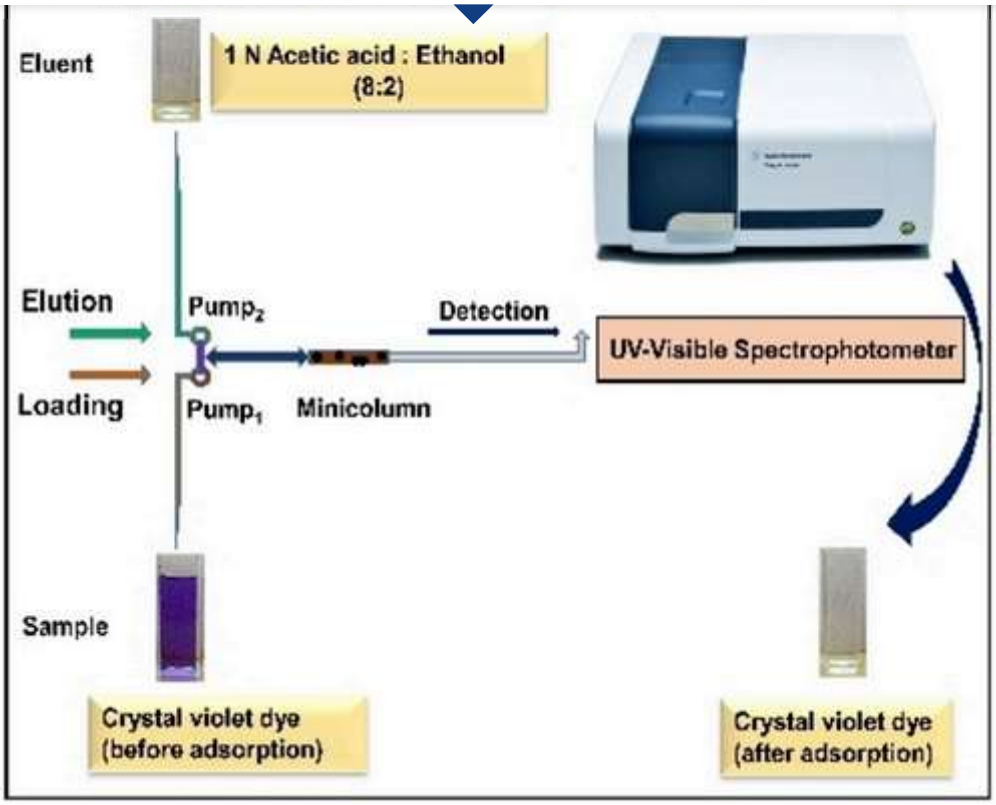

Abstract

In this paper, 4-aminosalicylic acid functionalized multiwalled carbon nanotubes (CNT-ASA) filled in a mini-column and attached to a Flow-injection system for the adsorptive removal of Crystal violet (CV) dye was employed. The remaining CV concentration was detected by a UV-Visible Spectrophotometric method, which is proposed in this paper. The factors influencing the adsorption and desorption of CV, such as pH, eluent, sample and eluent flow rates were optimized. The optimum pH was 5.5, the eluent selected for desorption was 1 N acetic acid: ethanol (8 : 2), and the sample and eluent flow rate were both 5 mL min^{-1}. Under the optimum conditions, the results obtained showed that CNT-ASA possessed excellent dye removal efficiency of ~99 % and adsorption capacity of 440 mg g^{-1} for CV. The advantage of using the flow-injection system is the faster adsorption process (in just 1 minute), less amount and high reuse of the nano-adsorbent, which is better in comparison to the traditional column method. The proposed method was applied on industrial and river water samples and good recovery (99–105 %) was obtained. Hence, it can be concluded that the proposed method is fast, effective, and can be applied on large-scale wastewater treatment.

Conflict of interest