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The combination and optimization study on RB29 dye removal from water by peroxy acid and single-wall carbon nanotubes

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ABSTRACT

The presence of synthetic dyes in aquatic environments poses potential health and ecological risks. Several techniques are available for dyes' removal. In this study the degradation of an anthraquinone dye, Reactive blue 29 (RB29), using an advanced oxidation process followed by single-wall carbon nanotubes (SWCNTs) was investigated. Advanced oxidation process was optimized over a period of 60 min by varying the ratio of acetic acid to hydrogen peroxide, the compounds which form peroxy acid. Reduction of 20.2–56.4% of RB29 was observed when the ratio of hydrogen peroxide/acetic acid/dye changed from 344/344/1 to 344/344/0.08 at different times (60, 120 and 180 min). Hydrogen peroxide served as controls in all advanced oxidation process and demonstrated minimal degradation over the time course study. The optimum ratio of acetic acid/hydrogen peroxide/dye was found to be 344/344/0.16 over 60 min. The resultant then introduced for further removal by SWCNTs as adsorbent. The adsorption of RB29 onto SWCNTs was also solely investigated. The Langmuir, Freundlich and BET isotherms were determined and the result revealed that the adsorption of RB29 onto SWCNTs well explained by BET model and changed to Freundlich isotherm when SWCNTs used after the application of peroxy acid. The maximum adsorption capacity of RB29 by SWCNTs also decreased from 496 mg/g to 472 mg/g when SWCNTs used solely and in sequence with peroxy acid, respectively. The removal of RB29 using an advanced oxidation process prior to the application of SWCNTs was also optimized over a period of 2 h. Color removal obtained over 2 h was 67.8–84.4% depending on the amount of SWCNTs used. Further studies are needed to identify the effects of peroxy acid degradation intermediates and to investigate their effects on SWCNTs.

Keywords: Reactive blue 29; Peroxy acid; Adsorption isotherm; Single-wall carbon; Optimization; Nanotubes

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