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ADSORPTION OF METHYLENE ORANGE ON EMBEDDING CARBON NANOTUBES SODIUM ALGINATE /CHITOSAN GEL BEADS

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Abstract

This study focused on the carboxylation method on multi-walled carbon nanotube (MWCNT) structure and property. The applicability of a new adsorbent, SA, CTS and MWCNT and the SA/MWCNT-CTS composite, for the sorption of MO dyes from an aqueous solution were investigated. The decolorization of MO showed that the stability and reusability of SA/MWCNT-CTS could prove potentially advantageous in wastewater treatment.

Introduction

Dyes from the pollutants released along with industrial effluents are easily detected because of their inherently high visibility, meaning that concentrations as low as 0.005 mg/L can easily be detected and capture the attention of the public and the authorities [1]. Since carbon nanotube was first discovered by S. Ijima in 1991, it has lightweight, high strength, high toughness, flexibility, high surface area, high thermal conductivity, and good electric conductivity and is chemically stable [2]. Sodium alginate (SA) and chitosan (CTS) are used in many types of wastewater treatment, enzyme immobilization and drug-delivery systems. This study focused on the carboxylation method on multi-walled carbon nanotube (MWCNT) structure and property. Furthermore, the applicability of a new adsorbent, SA, CTS and MWCNT and the SA/MWCNT-CTS composite, for the sorption of MO dyes from an aqueous solution were investigated.

Materials and methods

The MWCNTs was treated with a mixture of sulfuric and nitric acid under ultrasonic vibration. The compositions and schematic evolution of the SA, MWCNT, CTS and SA/MWCNT-CTS series specimens prepared in this study are summarized in Table 1 and Figure 1.

Table 1 The composites of SA/MWCNT-CTS series samples.

Sample		SA (%, w/v)	MWCNT (%, w/v)	$CaCl_2$ (%, w/w)	CTS (%, w/w)
1#	SA_2MWCNT_0	2	0	10	0
2#	SA_2MWCNT_0	2	0	10	0.5
3#	$SA_2MWCNT_{0.06}$	2	0.06	10	0.5
4#	$SA_2MWCNT_{0.12}$	2	0.12	10	0.5
5#	$SA_2MWCNT_{0.18}$	2	0.18	10	0.5
6#	$SA_2MWCNT_{0.24}$	2	0.24	10	0.5

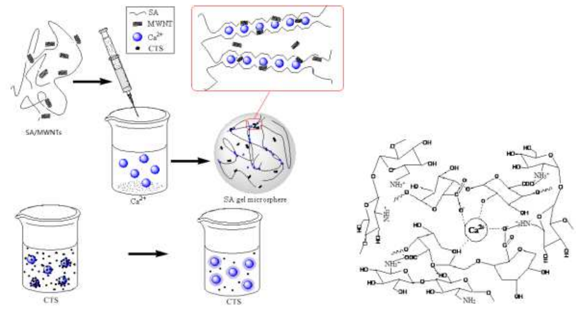

Figure 1 The preparation process of the SA/MWCNT-CTS composite gel beads.

Results

As shown in Figure 2, the absorption of MO increased with time. The decolorization of sample #1 reached 11.8% after 120 h, meaning that SA itself has the ability to absorb MO. Compared with sample #1, the decolorizations of 6# ordered by increasing content of MWCNT, was 98.9%, when tested under the same conditions. Another reason for this decolorization may be due to the large specific surface area of MWCNT that greatly affects adsorption ability. Voids present in the MWCNT may also favor of the adsorption of MB.

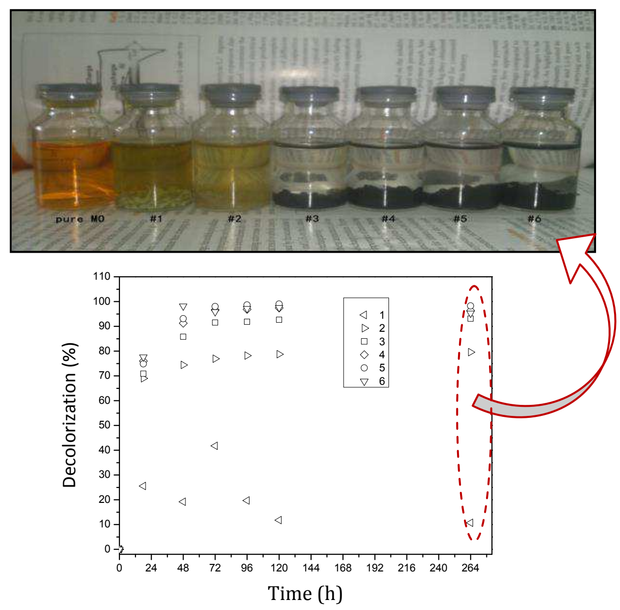

Figure 2 Decolorization of MB by SA/MWCNT-CTS microsphere determined at 25 °C.

Conclusions

This study effectively analyzed the adsorption of MB using gel beads prepared by sol–gel with SA and MWCNT-CTS. The formation conditions and mechanism of adsorption of the gel beads were also discussed. The decolorization of MB showed that the stability and reusability of SA/MWCNT-CTS could prove potentially advantageous in wastewater treatment.

References

1. Ray S, Okamoto M. Polymer/layered silicate nanocomposites: A review from preparation to processing. Prog Polym Sci 2003;28:1539–641.

2. Olson TM. Oxidation kinetics of natural organic matter by sonolysis and ozone. Water Research 1994;6:1383–91.