Chemical Engineering Journal 210 (2012) 475–481

Contents lists available at SciVerse ScienceDirect

Chemical Engineering Journal

journal homepage: www.elsevier.com/locate/cej

Poly(acrylic acid) grafted multiwall carbon nanotubes by plasma techniques for Co(II) removal from aqueous solution

He Chen, Jiaxing Li *, Dadong Shao, Xuemei Ren, Xiangke Wang

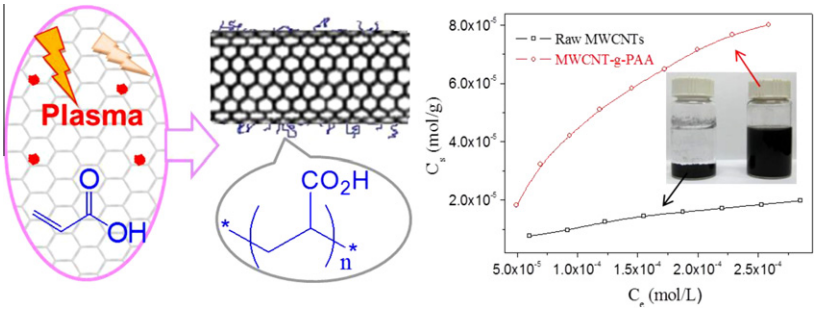
Key Laboratory of Novel Thin Film Solar Cells, Institute of Plasma Physics, Chinese Academy of Sciences, P.O. Box 1126, 230031 Hefei, PR China

HIGHLIGHTS

- MWCNT-*g*-PAA was synthesized by using plasma techniques.
- The sorption capacity of MWCNT-*g*-PAA for Co(II) was higher than that of raw MWCNTs.
- The sorption of Co(II) was highly dependent on the pH value.
- The sorption of Co(II) was endothermic and spontaneous.

GRAPHICAL ABSTRACT

MWCNT-*g*-PAA was synthesized by using plasma technique; compared with the raw MWCNTs, the sorption capacity of MWCNT-*g*-PAA for Co(II) was greatly enhanced.



ARTICLE INFO

Article history:
Received 9 July 2012
Received in revised form 23 August 2012
Accepted 23 August 2012
Available online 7 September 2012

Keywords:
MWCNTs
Co(II)
Poly(acrylic acid)
Sorption
Plasma technique

ABSTRACT

Poly(acrylic acid) grafted multiwall carbon nanotubes (MWCNT-*g*-PAA) was synthesized by using plasma techniques, and was applied as a adsorbent to remove Co(II) from aqueous solution. Fourier transferred infrared spectroscopy (FT-IR) and thermo gravimetric analysis (TGA) demonstrate that poly(acrylic acid) was successfully grafted on the surface of MWCNTs. Scanning electron microscopy (SEM) and transmission electron microscopy (TEM) show that the bulk properties of MWCNTs were not changed after plasma treatment. The sorption capacity of Co(II) is improved conspicuously after plasma treatment due to the oxygen-containing functional groups. The removal of Co(II) by MWCNT-*g*-PAA occurs rather quickly, which can be well described by the pseudo-second-order model. The sorption of Co(II) is strongly dependent upon the pH values. The sorption isotherms fit the Langmuir sorption model well. The thermodynamic data (ΔH^0, ΔS^0 and ΔG^0) are calculated from the temperature-dependent sorption isotherms, and the results suggest that the sorption process of Co(II) on MWCNT-*g*-PAA is spontaneous and endothermic.

Crown Copyright © 2012 Published by Elsevier B.V. All rights reserved.

1. Introduction

As an indispensable element for human's body, Cobalt (Co) played a vital role in immune system [1], however, excessive intake could cause serious health problems. Polycythemia, diarrhea, nasopharyngitis and gastrointestinal disorders have been proved to have a close relationship with inappropriate Co(II) assimilation. Thus, the removal of Co(II) from aqueous solution is significant for public's safety. Various methods, including precipitation, coprecipitation, oxidation, ion-exchange, reverse osmosis, membrane electrolysis, and sorption have been employed during the past decade to remove Co(II) from large volume of aqueous solution [2,3]. However, various demerits have been found among the methods tried before in the trail application. As far as we know, sorption is one of the most efficient methods. Proper adsorbent is supposed to

* Corresponding author. Tel.: +86 551 559 3308; fax: +86 551 559 1310.
E-mail address: lijx@ipp.ac.cn (J. Li).

1385-8947/$ - see front matter Crown Copyright © 2012 Published by Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.cej.2012.08.082