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Certificate of Attendance

This is to certify that Mr/Mrs **A. Ahmadpour** *participated in the 2nd International Congress on Nanoscience and Nanotechnology (ICNN2008), held by University of Tabriz in co-operation with the Iranian Nano Society (INS), on 28-30 October 2008, by presenting a paper entitled:*

Investigating The Chromium Ion Removal By Nano-structured Adsorbents

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Investigating The Chromium Ion Removal By Nano-structured Adsorbents

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Introduction

Chromium is one of the extremely toxic heavy metals found in various waters. Several processes such as chemical precipitation, membrane filtration, ion exchange and adsorption, have been reported to remove Cr(VI) ion from aqueous solutions. The latter is a more useful method for metal removal than other processes [1]. The absorbents commonly recommended for Cr removal are alumina, silica and activated carbon. Many reports have appeared on the development of low-cost activated carbon adsorption from cheaper and readily available materials for the removal of heavy metals from waters. Walnut shells are an agricultural waste product which is mainly used as fuel [2]. Carbon nanotubes (CNTs), on the other hand, are increasingly attracting interest since their discovery in 1990. Their small sizes, large surface areas, high mechanical strengths and remarkable electrical conductivities indicate their tremendous potential for future engineering applications [3]. In this study, the adsorption of Cr(VI) ions from aqueous solutions is investigated under different conditions using two different nano-structured adsorbents namely CNTs and low cost activated carbons.

Experimental

Activated carbons (ACs) were prepared by physical and chemical activations according to the procedure explained elsewhere [4, 5]. The multi-wall CNTs with diameter of 5-30 nm, length of about 0.5-2 mm, and purity of higher than 95%, were supplied by Iran research institute of petroleum industry. Synthetic solutions of Chromium were prepared from potassium dichromate stock solution. In batch studies, the predetermined doses of adsorbent were mixed with 50 ml of 100ppm Cr(VI) solution in 250 ml conical flasks and kept for predetermined time intervals on a mechanical shaker on 30°C. The pH was adjusted using sulfuric acid. The solutions were then filtered using filter papers [6]. The filtrate was analyzed for residual Cr ion using an atomic adsorption spectrophotometer (Varian, spectra-110-220/880). The uptake of the metal ion in solution was calculated by the difference in their initial and final concentrations. Effect of various pH, adsorbent dose, contact time, temperature and initial concentration were then studied.

Results and Discussion

The results obtained from different experiments were analyzed to determine the adsorption capacity and kinetics of the adsorbents prepared in different conditions. In the activated carbon series, the best results are obtained for a physically AC prepared from walnut shell. Therefore, from now on the experimental results of this carbon will be compared to those of CNTs.

A plot of concentration vs adsorption time is shown in Figure 1 for the two adsorbents. The equilibrium time in AC is seen to be much shorter than CNTs and also the adsorption capacity increased in longer contact time for both adsorbents.

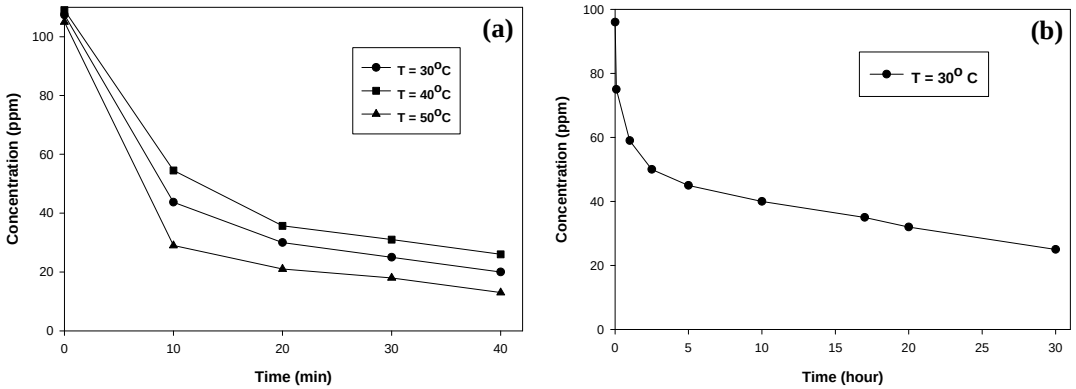

Fig. 1. Effect of contact time in Cr(VI) removal using (a) AC and (b) MWNT adsorbents.

The pH is one of the most important parameters controlling the metal ion sorption process. The experimental data indicates that AC is more active in lower pH range (2-3), while CNTs has better performance in the normal pH (5-6). Figure 2 shows that the percentage of Cr removal decreases with increasing adsorbate concentration. In lower concentration, the adsorbate could occupy the active sites on the carbon surface sufficiently.

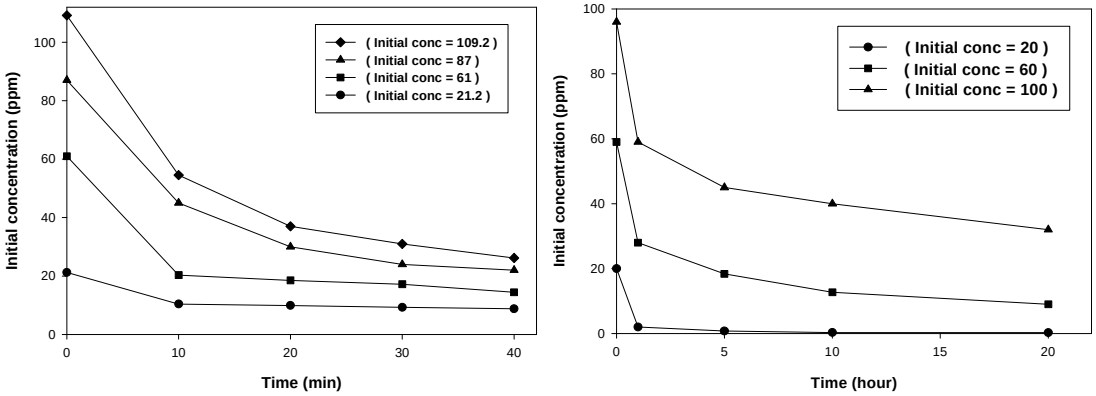

Fig. 3. Effect of Cr(VI) initial concentration in its removal using (a) AC and (b) MWNT.

Conclusions

Based on the present investigation, it can be concluded that the adsorption capacity of low-cost adsorbent (AC) from an agriculture based material is comparable with that of CNTs for chromium ion removal. The experimental results revealed optimum operating conditions. Chromium removal was pH dependent and the efficiency was observed to be fairly high at pH 2-3 for AC, whereas it was experienced at pH 5-6 for CNTs. Adsorption was increased with increasing the adsorbent dose and time at initial stages and then it became somewhat constant due to the attainment of equilibrium. Also, the percentage of Cr removal was decreased with increasing the adsorbate concentration.

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