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Study of the Sorption of Cobalt(II) Ion on Magnetic Carbon Nanotubes by Atmospheric Pressure Plasma Jet

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1. Introduction

Water pollution problems over the world have stimulated the removal of heavy metal ions. Among all of the heavy metal ions, Co(II) can cause serious health troubles, such as low blood pressure, and bone defects. Thus, the removal of excess Co(II) ions from aqueous solution is of practical meaning for public's safety.

Carbon nanotubes (CNTs) have good chemical stability, relatively large specific area, porous and layered nanosized structures. And they have been proved to be good candidate as adsorbent.

The application of plasma technology for wastewater treatment has been growing into a simple, effective and environmental friendly technique. The plasma discharges produced in water forms the basis of an innovative advanced technology for water treatment because these discharges initiate potential chemical and physical processes useful for its application into various fields. Without complex vacuum devices, adsorption of Co(II) onto magnetic carbon nanotubes (Mag-CNTs) in aqueous soultion with atmospheric pressure non-thermal plasma has been investigated to understand the effect of plasma jet in the Co(II) adsorption process.

2. Experiment setup and conditions

The plasma conditions were: He plasma with frequency of 5 kHz, voltage of 10 kV and the flow rate of 500 sccm for 10 min. A schematic diagram of the compact experimental setup is shown in Fig. 1.

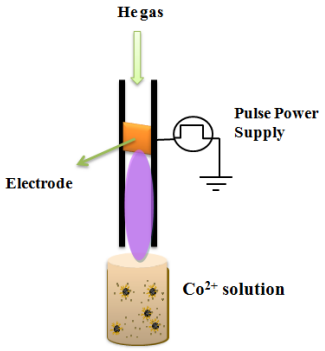

Fig. 1. The plasma jet system.

3. Experimental Results and Discussion

The SEM images of CNTs and Mag-CNTs are shown in Fig. 2. The surfaces of CNTs are smooth, while the Mag-CNTs composites depict the clusters of iron oxides coated on the surface. The SEM images show distinctly that some polymers are randomly decorated on the surface of CNTs, indicating that Mag-CNTs composites are synthesized successfully.

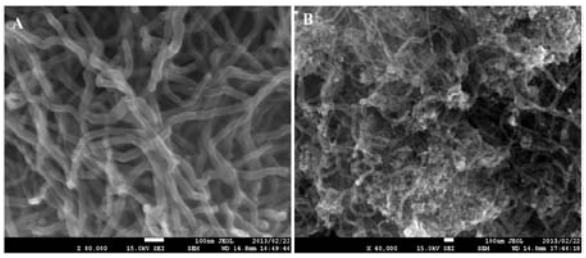

Fig. 2 SEM images of CNTs (A) and Mag-CNTs (B).