

CHAPTER I

INTRODUCTION

1.1 Introduction

Synthetic dyestuffs are widely used in various fields, such as textiles, leather, paper, plastic, before being discharged into various water sink, leading to a serious environmental problem. The treatment of dye-contaminated wastewater is a concerned issue in many countries. Dye pollutant is a cause of not only mental aesthetic problem but also reducing light photosynthesis which could affect ecological balance. Most of the used-synthetic dyes are stable to photo degradation, bio-degradation and oxidizing agents. Furthermore, it is difficult to remove such dyes using chemical coagulation due to their stability in water.

Therefore, some adsorption processes using carbon materials as adsorbent have been attractive due to various advantages, such as efficiency, effectiveness and simple facility. However, the separation inconvenience is also the main drawback of such process. Magnetic separation is anticipated a good separation system in adsorption process.

Synthesizing carbon nanoparticles (CNPs), particularly carbon nanotubes (CNTs) have attracted a lot of researchers attentions due to their unique structure, chemical and electrical properties as long as they were officially reported by Iijima in 1991 [1]. CNTs can be classified into single-walled carbon nanotubes (SWCNTs) and multi-walled carbon nanotubes (MWCNTs) from the graphene layer. The properties of CNTs can be influenced by surface modification with selected organic, inorganic and biological species. Because of their relatively large specific surface area, small size and excellent in structure, CNTs are recognized as a new promising type of solid-phase adsorbents. However, there are very limited reports on the dye adsorption of CNTs with magnetic property.

There are many methods which have been applied for CNP synthesis, such as laser ablation, arc discharge [2], chemical vapor deposition and pyrolysis [3-8]. Among those methodologies, pyrolysis is recognized as an efficient mean for large-scaled production with low operating costs and possible usage of cheap carbon source, such as anthracene [3], acetylene [4-6], naphthalene [7] or benzene [8] to decrease the amount of expensive ferrocene consumed in the synthesis.

In this work, a simple and efficient method for synthesizing CNPs which including multi-walled carbon nanotubes (MWCNTs) and multi-shell carbon nanocapsules (CNCs) with magnetic characteristics by co-pyrolysis of ferrocene and glycerol will be conducted and then the adsorption of some typical dyes onto the synthesized will thoroughly be investigated. In addition, the regeneration of used MWCNTs which will be separated by magnetic system will also be investigated.

1.2 Objectives

1. To synthesize MWCNTs with a magnetic property by co-pyrolysis of ferrocene and glycerol, and the adsorption of some typical dyes onto the synthesized MWCNTs will be investigated.
2. The regeneration of used MWCNTs which will be separated by magnetic system will also be investigated.

1.3 Scope of research works

The scope of this research is limited in laboratory scale as follows:

1. Preparation of MWCNTs by co-pyrolysis of glycerol and ferrocene with molar ratio of 5:1.
2. Characterization of MWCNT morphology and properties.
3. Dispersion of three typical dyes (Methylene Blue, Reactive Red 31 and Reactive Black 5) in distilled water.

4. Investigation of the dye adsorption performance of the synthesized CNPs.
5. Study the effect of initial concentration of dye solutions in the range of 10-100 mg/L
6. Study the amount of MWCNTs loading in the range of 0.3-0.9 g/L
7. Study the effect of initial pH value of dye solutions in the range of 3-11
8. Investigation of the magnetic separation and the recovery efficiency in water with various pH values.

1.4 Procedures of the research

1. Survey and review related literatures.
2. Prepare chemicals and equipments to be used in this research.
3. Carry out synthesis and characterization of MWCNTs.
4. Carry out experiments under various conditions of adsorption and recovery.
5. Determine suitable condition of dye adsorption.
6. Analyze and conclude the experimental results.
7. Summarize all experimental works and prepare thesis.