SYNTHESIS AND CHARACTERIZATION OF NANO COMPOSITE ACTIVATED BENTONITE FOR DECONTAMINATING HEAVY METAL FORM WASTE WATER

Submitted By

Ramy Saleh Mostafa Elnagar

B.Sc. of Science (Chemistry), Faculty of Science, Ain Shams University, 2003

A Thesis Submitted in Partial Fulfillment
Of
The Requirement for the Master Degree
In
Environmental Sciences

Department of Environmental Basic Sciences
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APPROVAL SHEET

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ACKNOWLEDGEMENT

First and forever, thanks are due to Allah, the beneficent and merciful for giving me the capability and helping me to complete and finish this thesis and showing me the right path.

I am most indebted to my principal supervisor, Prof. Dr. / Mahmoud Ahmed Hewehy. I am grateful to him for his timely academic guidance and positive criticism which helped me improve my analytical, research, scientific-writing and presentation skills. I am also thankful to him for his painstaking effort in reviewing my thesis. The compilation of this thesis would have not been possible without his valuable suggestions and comments. I would like to thank you for your encouragement and inspiration throughout this project that helped me finish my study without any hurdles.

I owe a debt of gratitude to my supervisor Dr. / Sherif Faraj Mohamed, who always stood by when I needed him and for providing access to the laboratory for the use of instruments and devices.

My eternal gratitude goes to all my colleagues of Main Chemical Warfare Laboratories with whom I worked during my research study for their advice, moral support.

Finally, I would like to thank my wife, for her love, patience and understanding. Without whose support I would have struggled to find the inspiration and motivation needed to complete my research. I am also thankful to my mother, my sons, my brothers and all other family members for serving as a strong pillar of encouragement and support that they provided during my study.

ABSTRACT

Bentonite, extremely plentiful normal clay, has been considered as a potential absorbent for expelling contaminations from water and wastewater. Disregarding that, the viable use of bentonite for water treatment is restricted because of small surface area. Thus, the focus of this study was coordinated to the change of some physical and chemical properties of bentonite to increase its adsorption capacity.

The modification of raw bentonite was carried out by three chemical methods converted calcium bentonite to sodium bentonite then acid activation (AA) by sulfuric acid (3M) and finally combined activated bentonite to Fe_3O_4 nano composite was prepared by chemical co-precipitation method to increase surface area. The characterization of the modified bentonite clay was carried out by Braunneur – Emmet – Teller (BET) method for surface area, scanning electron microscopy (SEM) for morphological analysis of modified bentonite and Fourier transformation infrared (FTIR) spectroscopy for the determination of the effect of acid attack. The increase in surface area of the modified bentonite was 25.259 m^2/g, 31.86 m^2/g, 62.194 m^2/g and 107.998 m^2/g by Ca-bentonite, Na-bentonite, AA and nano composite bentonite, respectively. The microscopic images obtained through SEM showed that the structure of the modified clay has become more porous, offering additional adsorption sites enhancing the surface properties of bentonite.

The modified bentonite by sodium bentonite, AA and bentonite nano composite were examined for their performance as adsorbents for the heavy metals removal. The effect of key operational parameters, such as pH, contact time, the heavy metals concentration and adsorbent dosage was experimentally studied. The pH changes appeared to have significant impact. The best pH for adsorption arsenic, melobednium, selenium, chromium, antimony and barium were at

pH=6.

The heavy metals adsorption increased with an increase in modified bentonite dose, but optimum dose was at 0.5 g.

The heavy metals adsorption increased with an increase in contact time, but optimum time was at 15 min. The adsorption capability of bentonite increased with an increase in heavy metals concentration and decrease in removal efficiency.

The maximum removal of heavy metals was obtained by bentonite nano composite (98.4 %) for Cr, (98.8 %) for As , (91.3 %) for Se, (90.8 %) for Mo, (79.1 %) for Sb, (75.3 %) for Ba.

The results from this study suggest that a combination of acid activation and nano composite was an effective method to improve adsorption capacity of the bentonite. The bentonite modified by acid activation and nano composite provided the maximum surface area and adsorption capacity and was successfully employed for the removal of heavy metals from wastewater.

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