Ain Shams University
Faculty of Science
Chemistry Department

Synthesis of Mg – Fe layered double hydroxides for the removal of various pollutants from wastewater

A Thesis

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By

Abdullah Ali Ahmed Brick

B.Sc. in applied Chemistry, Faculty of Science
Ain Shams University
2013

Under Supervision of

Dr. Ashraf Abdullaty Mohamed
Professor of analytical Chemistry, faculty of Science,
Ain Shams University

Dr. Mohamed Abd El-hay Ahmed
Assistant Professor of physical Chemistry, faculty of Science, Ain Shams University

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Approval Sheet

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This thesis for Master degree has been approved by:

Dr. Ashraf Abdullaty Mohamed
Professor of analytical Chemistry, faculty of Science, Ain Shams University

Dr. Mohamed Abd El-hay Ahmed
Assistant Professor of Physical Chemistry, Faculty of Science, Ain Shams University

Head of Chemistry Department
Prof. Dr. Ibrahim Hussainy Ali Badr

Ain Shams University
Faculty of Science
Chemistry Department

Student name : Abdullah Ali Ahmed Brick

Scientific degree: M.Sc.

Faculty name : Faculty of science – Ain shams university

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Abdullah Brick

Aim of work

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This current work aims to synthesis, characterization and application of an innovative, low cost, applicable layered double hydroxide and calcined layered double hydroxide nanoparticles as a sorbent for removal of indigo carmine dye (IC) and various pollutants from aqueous solution and waste water. The new nanoparticles were synthesized by sol-gel method using CTAB as structure and pore directing agent. XRD, FESEM, N_2-adsorption-desorption isotherm and HRTEM were used to investigate the physicochemical properties of the nanoparticles. The removal of indigo carmine dye was followed spectrophotometry by estimating the decrease in the color intensity.

Summary

Abstract

In this thesis, an innovative Layered double hydroxide (LDH) and calcined layered double hydroxide (C-LDH) nanoparticles are synthesized by the sol-gel method using CTAB as shape and pore directing agent for adsorption of indigo carmine dye (IC) from aqueous solution as an anionic dye in a batch system. The physicochemical features were monitored by X-ray diffraction (XRD), Fourier transformer infra-red (FTIR), N_2 adsorption-desorption isotherm, Field emission electron microscope (FESEM) and high resolution transmission electron microscope (HRTEM). Calcined and non-calcined LDHs were used as adsorbents to remove indigo carmine dye from an aqueous solution. Via follow up the reaction parameters including contact time, initial dye concentration, pH and temperature investigated. The adsorption kinetics were studied using classic equations of pseudo-first-order, second-order and intra-particle diffusion models. The dynamical data fits well with the pseudo-second order kinetic model. The positive value of the changes in enthalpy (ΔH°) and the negative value of Gibbs free energy (ΔG°), explored that the adsorption is endothermic and spontaneous at all the studied temperatures. The results indicated that LDH nanoparticles conserved a good activity even after five consecutive cycle of reuse. This demonstrates that LDH and C-LDH nanoparticles are considered as potential novel adsorbents for remediation of wastewater containing IC.

Key words: Nanoparticle, Layered Double Hydroxide, Indigo Carmen Dye, pollutants, Adsorption, Sol-Gel, mesoporous structure, Removal.

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