Faculty of science
Chemistry Department

"Removal of organic pollutants from water using advanced oxidation process"

A Thesis

"Submitted for the degree of Master of Science as a Partial fulfillment for requirements of the master of Science"

Prepared by

Hossam Abd El-Ghany Abd El- Twab Salem Ghaly

(B.Sc., Chemistry-Physics, Cairo University, 2005)

To

Chemistry Department

Faculty of Science

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Under Supervision of

Prof. Dr. Eglal Myriam Raymond Souaya

Professor of Inorganic Chemistry,

Faculty of Science, Ain Shams University

Dr. Nour El-Din Ahmed Abd El-Sattar

Lecturer Professor of Organic Chemistry,

Faculty of Science, Ain Shams University

Dr. Amer Samy Mohamed El-Kalliny

Doctor of Water Chemistry, Water Pollution Research

Department, National Research Centre

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Thesis Supervisors	Signature
Prof. Eglal Myriam Raymond Souaya Professor of Inorganic Chemistry Faculty of Science, Ain Shams University	…….
Dr. Nour El-Din Ahmed Abd El-Sattar Lecturer Professor of organic Chemistry Faculty of Science, Ain Shams University	…….
Dr. Amer Samy Mohamed El-Kalliny Doctor of Water Chemistry, Water Pollution Research Department, National Research Centre	…….

Prof. Dr. Ibrahim .H.A. Badr

Head of Chemistry Department

Faculty of Science, Ain Shams University

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This thesis for master degree in inorganic chemistry has been approved by:

Name	Signature
Prof. Dr. Eglal Myriam Raymond Souaya Professor of Inorganic Chemistry Faculty of Science, Ain Shams University	**…….**
Prof. Dr. Kamal Aziz Barsoum Professor of Inorganic Chemistry Faculty of Science, Cairo University	**…….**
Prof. Dr. Shawky Zaki Sabae National institute for Oceanography and Fisheries	**…….**

Prof. Dr. Ibrahim .H.A. Badr

Head of Chemistry Department

Faculty of Science, Ain Shams University

Supervisor Certification

I certify that this thesis was prepared under my supervision at the Department of Chemistry, Faculty of Science, Ain-Shams University as a partial requirement for the degree of Master of Science in Chemistry.

Prof. Dr. Eglal Myriam Raymond Souaya

In view of the available recommendations I forward this thesis for debate by the Examining Committee.

Prof. Dr. Ibrahim .H.A. Badr

Head of Chemistry Department

Faculty of Science Ain Shams University

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CONTENT

AIM OF THE THESIS

The main aim of the thesis is to prepare and to characterize a novel heterogeneous photocatalyst to be used efficiently in the removal of organic water pollutants under solar light. This photocatalyst should possess good stability for recycle process. For that purpose, the following steps were fulfilled:

1) A series of Ag/AgCl-polyaniline composites were prepared with various amounts of PANI by deposition-precipitation reaction followed by photo-reduction method.

2) The prepared materials were characterized by X-ray diffraction (XRD), field emission scanning electron microscope (FE-SEM), energy dispersive X-ray spectroscopy (EDS), ultraviolet-visible diffuse reflection spectroscopy (DRS), photoluminescence emission spectroscopy (PL), thermo gravimetric analysis (TGA), and the specific surface area which calculated from the N_2 adsorption/desorption isotherm using the Brunauer–Emmett–Teller (BET) equation.

3) The photocatalytic activity of the photocatalyst was evaluated toward the photo-degradation of Methylene Blue (MB) as pollutant model under solar light.

4) The effect of different parameters such as polyaniline (PANI) content, initial pH of the matrix, catalyst dosage, and MB concentration on the photo-degradation process were studied.

5) The mechanism of the photocatalytic process was investigated based on the trapping experiments.

6) The stability of the prepared photocatalyst was tested through recycle experiments.

ABSTRACT

ABSTRACT

A series of novel plasmonic photocatalysts of Ag/AgCl-polyaniline (Ag/AgCl-PANI) were successfully synthesized by deposition–precipitation reaction followed by a photo-reduction method. The prepared materials were characterized by X-ray diffraction, field emission scanning electron microscopy with energy dispersive X-ray spectroscopy, ultraviolet-visible diffuse reflectance spectroscopy, the specific surface areas measure using BET equation, photoluminescence emission spectroscopy, and thermogravimetric analysis.

Ag/AgCl-PANI was used to degrade methylene blue (MB) under simulated solar light. The effects of different parameters such as PANI content, initial pH and concentration of the MB solution, and catalyst dosage on the photo-degradation efficiency were assessed.

The photocatalytic activity and stability of Ag/AgCl is improved after introducing PANI into the prepared photocatalyst. PANI improves the surface area and increases the visible-light absorption ability of the prepared photocatalysts. Furthermore, the enhanced photocatalytic activity and stability of the photocatalysts can be attributed to the presence of synergistic effect of hetero-junction structure formed in the interface between Ag/AgCl and PANI which is effective in separation of photoexcited electron–hole pairs.

Ag/AgCl-PANI(5%) showed the highest photocatalytic performance with a rate constant ~ 4 times higher than that of the pure Ag/AgCl. However, increasing the percentage of PANI to more than 5% led to a reduction in