WASTEWATER TREATMENT USING MODIFIED NATRUAL POLYMER

By

MagedAhmed Shaker Hassen
B.Sc. Faculty of Sci. (Chemistry),
Helwan University, 2008

A Thesis Submitted in partial fulfillment
Of
The Requirement for the Master Degree
In
Environmental Science

Department of Environmental Basic Science
Institute of Environmental Studies & Research
Ain Shams University

2016

APPROVAL SHEET

WASTEWATER TREATMENT USING MODIFIED NATRUAL POLYMER

By

Maged Ahmed Shaker Hassen

B.Sc. Faculty of Sci. (Chemistry), Helwan University, 2008

This Thesis towards Master Degree in Environmental Science

Has Been Approved by:

Name ***Signature***

2016

WASTEWATER TREATMENT USING MODIFIED NATRUAL POLYMER

By

Maged Ahmed Shaker Hassen

B.Sc. Faculty of Science, Chemistry department,
Helwan University, 2008

A Thesis Submitted in partial fulfillment of the
Requirement for the Master Degree
In Environmental Science
Department of Environmental Basic Science
Institute of Environmental Studies & Research
Ain shams university

Under the Supervision of:

Prof. Dr / Mostafa M. H. Khalil

Prof. of Inorganic and Analytical Chemistry,
Faculty of Science,
Ain- Shams University

Dr/ Gamal Abdel Aziz Meligi

Associate prof of Organic Chemistry,
Faculty of Science,
Ain- Shams University

Prof. Dr / Amr El-Hag Ali

Professor of Radiation Chemistry,
National Center for Radiation
Research & Technology,
Atomic Energy Authority

2016

Acknowledgement

Praise to Allah, the most gracious and the merciful who guides us to the right way. First of all I would like to thank Allah who helped me during my work and only by his will, this work was accomplished.

I would like to express my deep gratitude to my master thesis supervisor ***Prof. Dr.*** **Mostafa M. H. Khali,** *Prof. of Inorganic and Analytical Chemistry, Faculty of Science, Ain- Shams University. I have learned many things since I became Dr.* ***Mostafa's*** *student. He spends very much time instructing me how to search literature, how to choose the point for research, how to collect data, how to carry out practical work, how to write a paper and how to overcome problems originated during the work. He gave help and support throughout all steps of this master thesis from choosing the research point to writing and revision of this thesis.*

I am also grateful to ***Prof. Dr.*** **Gamal Abdel Aziz Meligi,** *Associate prof of Organic Chemistry, Faculty of Science, Ain Shams University for his help and support throughout all the research steps. he supervised me in the practical work and writing the master thesis .he spent a lot of Time reading and revising this thesis.*

Deepest gratitude is owed to ***Prof. Dr.*** **Amr.El-Hag Ali** *Professor of Radiation Chemistry National Center for Radiation Research and Technology Atomic Energy Authority for his sincere guidance, capable supervision, assistance and valuable discussion throughout this work*

I thank my lab mates and all my coworkers for their help and good cooperation with me. Finally, I would like to thank all the members of my family; especially the spirit of my parents.

Maged Ahmed Shaker

Abstract

Polysaccharides are ideal ecofriendly materials. They surround us in every conceivable form. They are the most important constituents of food, clothing, structural materials and are also of special usage as adhesive, matrix for controlled drug release, flocculant, adsorbents, etc.

Chemical modifications of polysaccharide result in fine tuning of its properties which opens up the possibility of diverse applications. One of the most effective methods of chemical modification is grafting with synthetic polymeric materials. The resulting hybrid material can have tailor-made properties optimized towards any particular application.

High energy radiation initiated method (gamma rays or electron beam) is a more convenient method for graft copolymer synthesis. In many cases of synthesis, it is the only method fit as a candidate for commercial production. However, the high energy radiations make no distinction between the bonds to be broken and the bonds essential for structural integrity of the preformed/backbone polymer.

The monomers, acrylamide and acrylic acid, was graft copolymerized onto Carboxymethyl cellulose (CMC) using gamma rays as initiator.

The structure of pure CMC and grafted with monomers was characterized by FTIR spectra, SEM and DSC analysis, The effect of various factors affecting grafting, such as concentration of the monomer and dose of gamma rays were studied to achieve the optimum grafting parameters.

Adsorption processes do not add undesirable by-products and have been found to be superior to other techniques for wastewater treatment in terms of simplicity of design and operation, and insensitivity of toxic substances.

The results obtained show that the prepared substrates can be used in the wastewater treatment.

The grafted Carboxymethyl cellulose (CMC) was examined and optimized for its dosage level (100mg/L), optimum pH level (pH 7), contact time (90 minutes) and applied against wastewater samples, removal efficiencies for total suspended solids, chemical oxygen demand, biochemical oxygen demand, total nitrogen, ammonia, phosphate, oil& grease and sulphide found to be: 80, 70, 55.8, 48.3, 36.8, 60, 43.4 and 41.6%, respectively.

CONTENTS

Chapter 4

Results and Discussion

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVATIONS

AAc	Acrylic acid
AAm	Acrylamide
APHA	American Public Health Association
As	Arsenic
BOD	Biochemical Oxygen Demand
BPC	bamboo pulp cellulose
$CaCO_3$	Calcium carbonate
CAN	ceric ammonium nitrate
Cd	Cadmium
CFP	Cities Feeding People
CMC	Carboxymethyl cellulose
COD	Chemical Oxygen Demand
CR	Congo red
CS	Chitosan
DB	Disperse Blue
DMAEMA	2-(dimethylamino) ethyl methacrylate
DSC	differential scanning calorimetry
EDS	Energy dispersive spectrometer
EV	Electron volt
FESEM	field emission scanning electro micrsocopic
FTIR	Fourier transform infrared
G%	graft yield
GE%	graft efficiency
H_2S	Hdrogen Sulphide
Hg	Mercury
IR	Infra red Spectroscopic analysis.
kGy	Kilo gray
LDPE	low-density polyethylene
MeV	Million electron volt
MG	malachite green chloride
Mg/l	Milligram /liter
MO	methyl Orange
MP	methylene blue
MS	medical stone
MV	Methyl Violet
MWCNT	multiwalled carbon nanotubes
NaA	partially neutralized acrylic acid

NH_3-N	Ammonia
nm	Nonometetr
OMMT	organic montmorillonite
PAM	polyacrylamide
PAN	poly acrylonitrile
Pb	Lead
Se	Selenium
SEM	Scanning electron microscopy
TDS	Total Dissolved Solids
Tg	Glass transition temperature
TGA	Thermogravimetry analysis
Tm	Temperature of the crystalline melting
TN	Total nitrogen
TP	Total Phosphorous
TSS	Total suspended solids
VAc	vinyl acetate
XRD	X-ray diffraction

CHAPTER 1

INTRODUCTION

1.1. Problem Statement

One of the most challenges facing Egypt nowadays is Water resources shortage and environmental degradation. Untreated Wastewater is one of the biggest sources of pollution and had a negative effect on major public health in many developing countries. Urgent techniques for wastewater treatment are needed as soon as possible with low cost due to limited financial resources available. About two-thirds of the population in developing countries has no sanitation service and suitable sanitation for disposing excreta **(Rose, 1999)**.

The greatest challenge facing most of the countries next two decades in water and sanitation sector is searching for economical wastewater treatment technique, that may help in reuse of treated effluents for agricultural and industrial purposes **(Maria and Mayrina, 2011)**.

1.2. Existing Situation in Egypt

Quick population rise, fast urbanization, unequal distribution of residents, government strategy to reclaim new land, water consumption because of supplying drinking water to villages and water unsustainable were the majors environmental challenges facing our society **(Abdel Wahaab and Omar, 2012)**.

Serious water pollution problems and negative impacts on health were caused by development of water supply networks in towns, villages and cities without the parallel construction of new sewage system.

In Egypt, wastewater treatment in small communities and /or rural areas lags far behind potable water supply. Only small part rural areas about 5%