"Mounting of coagulants on activated carbon for the removal of organic pollutants from water resources"

A Thesis Submitted for the Degree of Master of Science as a Partial Fulfillment for the Requirements of the Master of Science

Chemistry

(Analytical Chemistry)

By

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ABSTRACT

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Title of thesis: Mounting of coagulants on activated carbon for the removal of organic pollutants from water resources

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The aim of this work is to study the effect of using mounting of different coagulant on activated carbon in the removal of phenol from drinking water.

This has been carried out through coagulation, flocculation and sedimentation. The coagulation has been carried out using alum, ferrous sulphate, poly aluminium chlorides and poly aluminium sulphate mounted on activated carbon by different ratio for each coagulant individually. Effect of each mounted coagulant was studied in raw water injected by phenol on the pH, total dissolved solids, turbidity and phenol concentration. The optimum dose, concentration ratio and time of treatment were estimated for the whole study.

Keywords: mounting, activated carbon, alum, ferrous sulphate, poly aluminium chlorides, poly aluminium sulphate.

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APPROVAL SHEET

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This Thesis towards a Master Degree In Inorganic Chemistry

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List of abbreviation

No.	Abbreviations	Meaning
1	PAC	Poly Aluminum Chlorides
2	PAS	Poly Aluminum Sulphate
3	No.	Number
4	US	United state
5	WHO	World Health Organization
6	Alum	Aluminum Sulphate
7	PAHs	Poly Aromatic Hydrocarbons
8	MF	Million Feddans
9	BCM	Billion Cubic Meters
10	Yr.	Year
11	HAD	High Aswan Dam
12	MCLs	Maximum Contaminant levels
13	GAC	Granular Activated Carbon
14	SCADA	Supervisory Control and Data Acquisition
15	TOC	Total Organic Carbon
16	O&M	Operation and Maintenance
17	Mgd	Million Gallon per Day
18	Ft^2	Square feet
19	DAF	Dissolved Air Flotation
20	DBP	Disinfection Bi Products
21	DE	Diatomaceous Earth
22	DOC	Dissolved Organic Carbon
23	NOM	Natural Organic Matter
24	THMs	Tri Halo Methane
25	NTU	Nephelometric Turbidity Unit
26	N	Normal
27	rpm	Round per minute
28	ppm	Part per million
29	ms/cm	micro Siemen per centimeter
30	WTP	Water Treatment Plant
31	Alum/C	Alum mounted on activated carbon
32	Ferrous sulfate/C	Ferrous sulfate mounted on activated carbon
33	PAC/C	Polyaluminum chlorides mounted on activated carbon
34	PAS/C	Polyaluminum sulfate mounted on activated carbon
35	C.R.%	Concentration ratio

SUMMARY

1) Chapter (I)

Introduction about water as importance, uses, common pollutants and a back ground about phenol in drinking water and its impact and their ways of removal.

2) Chapter (II)

Literature survey has been presented on ways of treatment of drinking water and the removal ways of phenol with a high light in water resource and challenges in Egypt.

3) Chapter (III)

Includes the experimental part, materials, solutions, their preparation techniques, instruments, analysis used in this work, and the practical procedures that have been carried out in this study.

4) Chapter (IV)

Results and discussion:

The first part: includes calibration curve using standard phenol solution. colourimetric method was used.

The second part: Includes the practical results of each coagulant mounted on activated carbon by different concentration ratio and the optimum condition of each was:

1- For alum mounted on activated carbon :

The optimum dose was = 30 ppm

The optimum concentration ratio = 50%

The optimum time was = 20 minutes

The removal percent of phenol was = 85%

The removal percent of turbidity was = 71.5%

2- For ferrous sulphate mounted on activated carbon :

The optimum dose was = 60 ppm

The optimum concentration ratio = 30 %

The optimum time was = 30 minutes

The removal percent of phenol was = 92.49%

The removal percent of turbidity was = 40%

3- For PAC mounted on activated carbon :

The optimum dose was = 60 ppm

The optimum concentration ratio = 30%

The optimum time was = 30 minutes

The removal percent of phenol was = 93.1%

The removal percent of turbidity was = 54.8%

4- For PAS mounted on activated carbon :

The optimum dose was = 60 ppm

The optimum concentration ratio = 30%

The optimum time was = 30 minutes

The removal percent of phenol was = 90.1%

The removal percent of turbidity was = 74.5%

- No considerable improvement has been achieved in the removal of phenol after 30 minute of treatment, so it's recommended to work at 30 minutes only.
- No considerable change happen for the pH during the study, all result still in acceptable limit.
- The removal percent of phenol is decreased by increasing time of treatment above 40 minutes. This can be explained by release of phenol after adsorption.
- The removal percent of phenol is decreased above the concentration of 1 ppm of phenol. No noticed removal at concentration 4 and 5 ppm.

5) Chapter (V)

Includes the conclusion that has been extracted from this work.

This study reported better results with respect to:

- Coagulant mounted on carbon with dose of :
  - 30 ppm for alum
  - 60 ppm for ferrous sulphate
  - 60 ppm for PAC
  - 60 ppm for PAS

- Coagulant mounted on carbon by concentration ratio of :
  - 50% for alum
  - 30% for ferrous sulphate
  - 30% for PAC
  - 30% for PAS
- Treatment time, 30 minutes has been found to achieve the maximum phenol removal.
- Removal efficiency has been reached to 85% and 71.5% for phenol and turbidity, respectively, when alum mounted on activated carbon is used by dose of 30 ppm and concentration ratio of 50%. The removal efficiency has been gone higher up to 90.1% and 74.5% for phenol and turbidity, respectively, when PAS mounted

on activated carbon is used by dose of 60 ppm and concentration ratio of 30%. The removal efficiency of phenol has been gone higher up to 92.49 % when ferrous sulphate mounted on activated carbon is used by dose of 60 ppm and concentration ratio of 30%. Finally the removal efficiency of phenol has been gone higher up to 93.1 % when PAC mounted on activated carbon is used by dose of 60 ppm and concentration ratio of 30%.

- All the previous results have been achieved with initial concentration of phenol 1 ppm.

List of Tables