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Sewage Water Treatment of Chemistry Department in College of Science-Diyala University

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Abstract

The aim of presented study is to treatment of sewage water in chemistry department – college of science in Diyala University which is located in the north east of Baghdad City in Iraq using local Attapulgite clays before disposing them into the environment. This study includes the use of Attapulgite clays to decrease the proportions of heavy metals ions; (Cr, Co, Cd, Cu, Mn), and the proportions of Suspended Solids (SS) in sewage water. Besides recycling the sewage water after treatment and to minimize the environmental risks of this contaminated water and creating new industrial uses for Iraqi clays. To achieve this goal, experiments were conducted on sewage water to determine the lowest concentration and best time for processing to state the efficiency of clay in the sewage water treatment which consists of high contents of heavy metals and SS.

Laboratory tests proved the efficiency of local Attapulgite clays in treating sewage water from contaminants. Those clays were so affective in this treatment and in decreasing the concentration of heavy elements, under study, to less proportions from those existing before the treatment. It is noticed that the concentration of Chrome (Cr) decreased from 4 ppm before the treatment to 0.89 ppm after treatment. Besides, the decrease of the concentration of Cobalt (Co) from 8 ppm before the treatment to 0.32 ppm. While the concentration of Cadmium (Cd) decreased from 1.48ppm before treatment to 0.0025ppm. Copper (Cu) decreased from 7ppm before treatment to 0.25ppm. In addition, the concentration of Manganese (Mn) which decreased from 3ppm before treatment to 0.05 ppm after treatment.

The present experiments proved the efficiency of the local Attapulgite clays in sewage water treatment.

1 INTRODUCTION

Sewage water is a wastewater essentially consisting of wastes removed from domestic, industrial, commercial, and wholesome institutions, together with underground water, surface water, and rainwater as may be present. It is more than 99.9% pure water and is characterized by its volume or rates of flow, its physical condition, chemical constituents, and the bacteriological organisms that it contains [1].

Heavy metals are stable species that cannot be degraded or eliminated. Wastewater discharges to streams without treatment leads to rest and aggregation of heavy ions in soil, ground water, plants, and sediments [2]. The presence of various heavy metals in water can be the main reason of environmental problems as these ions contains toxic impacts upon both public health and environment [3].

Palygorskite or Attapulgite has their characteristic features that make them available for use for many years in different industrial applications. Attapulgite is used in oil industry such as oil well drilling muds, oil base and water base foundry sand binder, and adhesive viscosity control. Also used in pharmaceutical thickener and gelling agent, wax emulsion stabilizer, liquid suspension fertilizer, drying of oils, catalyst carrier, petroleum refining, desulfurization, and deodorizing… etc. [4]

There is confusion between attapulgite or palygorskite and montmorillonite because the chemical composition and some of its properties were similar enough to montmorillonite. The structure and shape of them were illustrated by electron microscopy in 1940.[2]

Attapulgite consists of twofold chain of silica tetrahedral run parallel to the fiber axis. They are connected by magnesium and aluminum in octahedral coordination to produce a streak similar in structure to the three-layer minerals. These three layers are connected at the corners by (Si – O– Si) bonds into a structure alike a checkerboard to go across with free channels of about 3.7A° by 6.0A° in cross-section running length of the needles. Channels of attapulgite can collapse when it is dehydrated, for the open-channel structure is stabilized by the water of composition which completes the edges of the octahedral streak. [5]

Diyala University lies to the northeast from Baghdad City in Iraq. The purpose of this study to treat the sewage water from heavy metals (Cr, Co, Cd, Cu, Mn) and recycle it after treatment by using locally attapulgite clays. In order to , decrease the environmental risks of polluted water and find industrial appliance of attapulgite clays .To achieve this, 70 experiments had done on sewage water to determine the efficiency of clays in the treatment of sewage water of station with high content of heavy metals and suspended solids(SS).

2 MATERIALS AND METHODS

Attapulgite Clay

Attapulgite clay used in the present study was obtained from in the Iraq Geological Survey (GEOSURV) which can be found in Al- Najaf area SW of Baghdad City.It has been grounded to the size of (75μm) in the Iraq Geological Survey.

Mineralogical Analysis

The mineralogical analysis of clays has been done at the Iraq Geological Survey (GEOSURV) using XRD technique, Fig. 1 illustrate the result of mineralogical analysis.

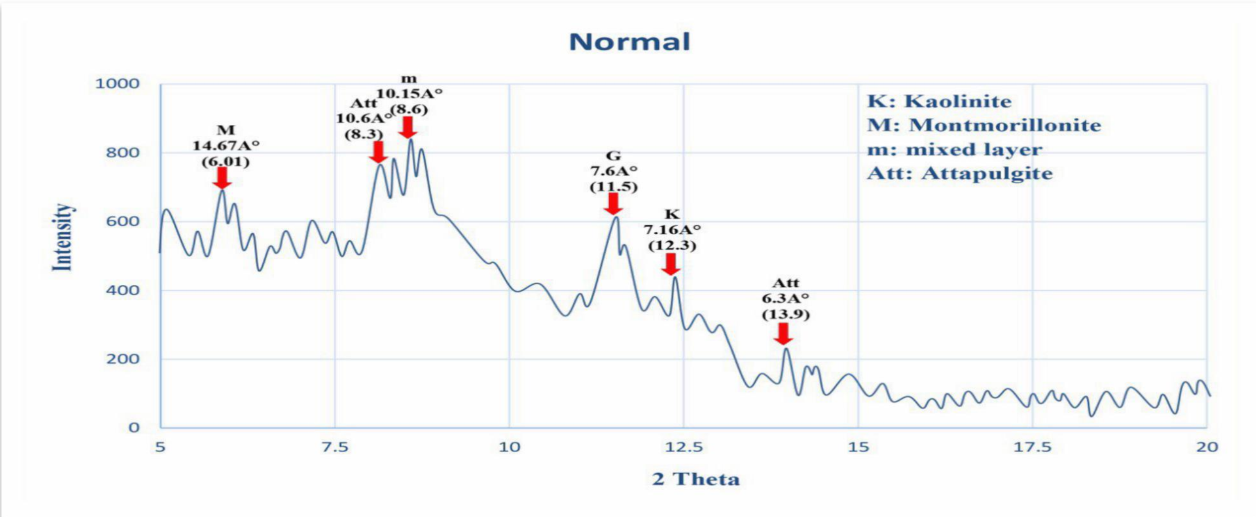


Figure (1): The mineral analysis of attapulgite clays

Chemical Composition

Chemical analysis to determine the chemical composition of Attapulgite clays was done using work procedures at the Iraq Geological Survey (GEOSURV) as show in Table 1.

Table (1): The chemical composition of attapulgite clays

The Chemical Composition of attapulgite clays	The Percentage of oxides (%)
SiO_2	41.54
Fe_2O_3	5.44
Al_2O_3	10.52
TiO_2	0.49
CaO	15.45
MgO	4.06
SO_3	0.17
Na_2O	0.93
K_2O	0.43
Cl	0.70
L.O.I	20.04
Total	99.77

3 HEAVY METALS ANALYSIS

The treated solutions were analyzed in the service laboratory at Baghdad University-Science College-Chemistry Dept. using Atomic Absorption Spectrophotometer (AAS) technique, to determine the concentrations of (Cr, Co, Cd, Cu and Mn) in sewage water before and after treatment with attapulgite clays. the concentrations of heavy metals ions in sewage water was appointed by (AAS) before the treatment process. The concentrations of heavy metals before and after treatment are shown in Table 4.

4 RESULTS AND DISCUSSION

The results showed high concentration of heavy metals ions in the sewage water before treatment. The results illustrated that the concentration of Chrome, Cobalt, Cadmium, Copper, and Manganese were found in sewage water with (4, 8, 1.48, 7, 3) ppm respectively. The efficiency of attapulgite clays increase in precipitation and purification of sewage water with increasing the amount of clays used in treatment process. In addition, time required to precipitate suspended solids (SS) decrease with increasing the amount of clays as shown in Figure 2.

By mixing the attapulgite clays with sewage water, they stuck with impurities and precipitated them in the bottom of beaker due to the gravity. The behavior of (SS) in sewage water where these (SS) remain stuck in the water and didn't precipitate for (72h) without using attapulgite clays. In contrast, samples of sewage water that treated with attapulgite clays need less time around (24h) to precipitate (SS) to the bottom of the beaker. Also, the rate of precipitation depends on the size of particles of the raw materials used in the treatment whenever, the smaller size of clay decreases the rate of precipitation .As shown in Table (2) weight of (ss) in treated and untreated sewage was (0.72gm) at time (zero) and the weight of them became (0.16gm) in water treated with attapulgite clays after (6h) when its weight was (0.19gm) in untreated sewage. The decline continued slowly in weight of (ss) from (0.17gm) in sewage to (0.15gm) in treated water when they left in contact with clays for (24h).

Figure. (2): Decline in time required for settlement process

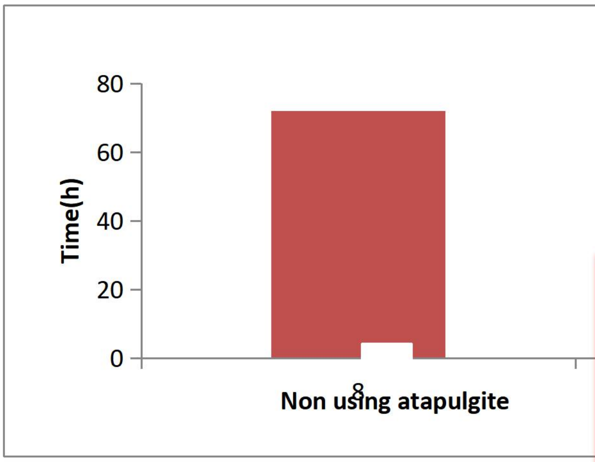


Table (2): (SS) in untreated and treated wastewater in different times

Time(h)	SS in wastewater untreated with attapulgite clays(gm)	SS in wastewater treated with attapulgite clays(gm)
Zero	**0.72**	0.72
6	**0.19**	0.16
24	**0.17**	0.15
48	**0.12**	0.11
72	**0.11**	0.04

5 EFFECT OF MIXING TIME ON TREATMENT OF SEWAGE WATER USING ATTAPULGITE CLAYS

Mixing time of treatment of sewage water using attapulgite clays has been studied to determine the optimal time that required for the best treatment as shown in Table 3.A steady concentration 5gm/L of attapulgite clays mixed with sewage water for different time (1,3,6,9,12 and 15) hours in order to increase the contact time between sewage water and attapulgite clays.The results of mixing time were oscillated have not shown gradual decline for the concentration of heavy metals with increasing in mixing time compared with the increasing in the concentration of attapulgite clays.

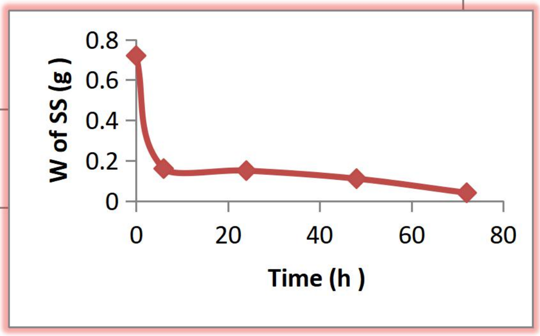


Figure (3): Decreasing weight of (SS) with increasing time

Table 3: concentration of heavy metals in sewage water treated with attapulgite at different time

Heavy metals	concentration of heavy metals after treatment with attapulgite in different time(ppm)					
	1h	**3h**	**6h**	**9h**	**12h**	15h
Cr	**0.89**	**0.91**	**0.88**	**0.89**	**0.75**	0.73
Co	**0.32**	**0.42**	**0.33**	**0.35**	**0.3**	0.29
Cd	**0.0025**	**0.0027**	**0.0024**	**0.0025**	**0.0022**	0.0017
Cu	**0.27**	**0.25**	**0.22**	**0.225**	**0.21**	0.18
Mn	**0.05**	**0.052**	**0.05**	**0.046**	**0.039**	0.037

6 THE EFFICIENCY OF ATTAPULGITE CLAYS IN THE TREATMENT OF SEWAGE WATE

The use of attapulgite clays in this research reduces the concentration of heavy metals ions existing in sewage compared with their concentration in sewage treated with clays. We can show in Table 4. that the concentration of Chrome and Cobalt decreased from 4 and 8 ppm respectively after their concentrations were 0.89 and 0.32ppm. In addition, the significant decline in the concentration of Cadmium, Copper, and Manganese from 1.48, 7, and 3 ppm to 0.0025, 0.25, and 0.05 ppm respectively after being treated with clays. The ability of attapulgite clays to adsorb and reduce the concentration of heavy metals ions from treated sewage water due to the crystal replacements in the eightfold layer as well as, the channels in this ore could be an effective absorption sites [2].

Table 4: Concentration of heavy metals in sewage water before and after treatment with Attapulgite clays

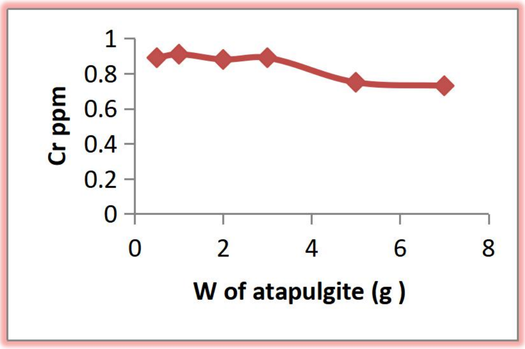
The heavy metal	The concentration of heavy metals before treatment with clays (ppm)	The Concentration of heavy metals after treatment with clays (ppm)
Cr	**4**	**0.89**
Co	**8**	**0.32**
Cd	**1.48**	**0.0025**
Cu	**7**	**0.25**
Mn	**3**	**0.05**

From the results mentioned, the attapulgite clays have high efficiency on scavenge the heavy metals ions (Cr, Co, Cd, Cu and Mn) from wastewater and reduce their concentration to less than environmental allowed concentration. Also, from the results can notice follows:

a- Decreased the concentration of heavy metals under study whe low concentration of clays (5gm/L) is used because tl adsorption capability of clays increased with decreasing tl concentration of sorbent due to the abundance of presence tl effective sites of absorption [6].

b- These results were achieved when using 5gm/L of clays mixe with wastewater and stirred for 3h.

c- The figures from 3-7 illustrate the effect of attapulgite clays c heavy metals under study.



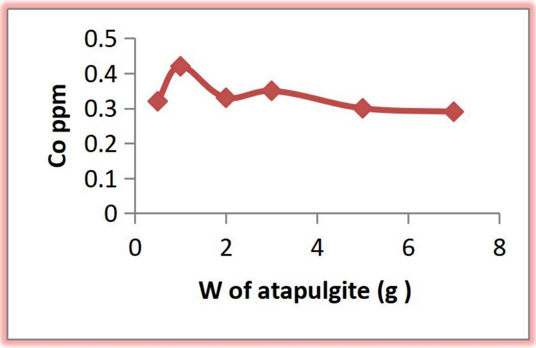
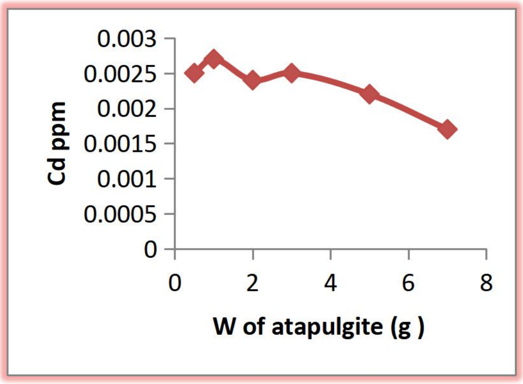


Figure 3: Concentration of Cr in sewage water after treatment
Figure 4: Concentration of Co in sewage water after treatment
Figure5: Concentration of Cd in sewage water after treatment
Figure 6: Concentration of Cu in sewage water after treatment
Figure 7. Concentration of Mn in sewage water after treatment

7 THE CONCLUSIONS

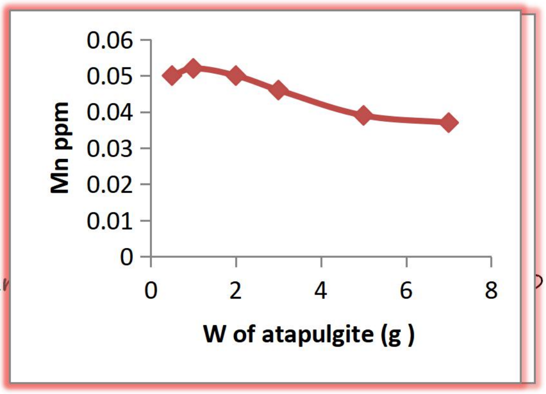
Heavy metal ions in wastewater come from human wastewater, industrial wastes, and water used in laundry. Locally attapulgite clays accelerate the settlement and the precipitation of solid planktons with the used clays, the reduction of the concentration of heavy metal ions in the sewage by using attapulgite clays. The concentration of heavy metals ions (Cr, Co,Cd , Cu, Mn) in wastewater decreased from (4, 8, 1.48, 7, 3)ppm respectively to (0.89, 0.32, 0.0025, 0.25, 0.05)ppm respectively after treatment, The optimum conditions for treatment of wastewater as follow:



1. The particle size of clays 75µm.
2. The concentration of clays 5gm/L at 3h of mixing time.

REFERENCES

1. S.T. Sanamdikar and K. R. Harne, " Advanced Method for Sewage Water Treatment " Journal of Advanced Technology in Civil Engineering, ISSN: 2231–5721, Volume-1, Issue-2, 2012
2. Ahmed N. Abd, Kareem K.and Faihaa F. Hadi,” Sewage Water Treatment of Al- Warqaa station in Baqubah City, Iraq using local Attapulgite Clays”. Journal of Applied Sciences Research, Vol.13, No.2, pp:10-19, 2017.
3. S.M. Shartooh, M.N.A. Al-Azzawi and S.A.K. Al-Hiyaly, “Pomegranate Peels as Biosorbent Material to Remove Heavy Metal Ions from Industerial Wastewater”, Iraqi Journal of Science, Vol. 54, No.4, pp:823-831, 2013.
4. Faihaa F. Hadi, Ahmed N. Abd and Mohaned A. Rashed,” Sewage Water Treatment of Burgha’a Puncture in Baqubah City, Iraq using Attapulgite Clays”, Journal of Critical Reviews, Vol.7, pp.508-513, 2020.
5. Barter, R. M. and Mackenzie, N.,” Sorption by attapulgite Part I. Availability of intracrystalline channels”, The Journal of Physical Chemistry, Vol. 58, pp. 560-568, 1954.



BIOGRAPHIES

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