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Article

Wastewater Treatment of General Sherqat Hospital by Using Kaolin and Red Clay and Some Economical Plants

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Abstract: Currently, perinatal damage to the central nervous system of newborns occupies an important This study aimed to treat the wastewater of Sherqat Hospital in salahaldin city by using mud of (red clay and Kaoline) the experiments were conducted by using the Jar-Test as laboratory scale . Plants also had a role in reducing pollution indicators and heavy elements and the lettuce plant had a greater impact in reducing pollutants as a clear decrease in heavy elements, including cobalt, selenium and copper after treatment, as it amounted to 12 ,10 and 46.Many indicators were tested and it was noted that all of them changed at room temperature before and after the treatment through the use of the jar and mud device and it was noted that the red clay was more efficient in reducing the indicators BOD, COD, DO, PH, EC, T.D.S, T.S and they were respectively after the treatment 378,274,6.2,7.4,322,462,253,215,39,29, and 55 while they were very high in the wastewater outcame by the hospital and dumped into the Tigris River without any biological or abiotic treatment.

Keywords: : Kaolin, Red clay, alsherqat hospital, lettuce, and sugar cane

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1. Introduction

Numerous contaminants, including as those from medications, pharmaceuticals, lifestyle chemicals, radioactive species, and patient excreta, can be found in hospital wastewater [1]. Finding the right treatment plans for hospital waste streams is crucial to protecting both people and the environment [2]. Hospital wastewater can be treated using a variety of ways, including secondary treatment methods including rotating biological contactors, biofilter tanks, submerged biofilter tanks, and trickling filtered tanks [3]. Another technique that has been investigated on a trial size is thermal disinfection [4]. Safe management of hospital wastewater is crucial in light of the COVID-19 epidemic. A thorough analysis of the prevalence and techniques of SARS-CoV-2 disinfection in wastewater has been carried out [4]. Non-contact techniques like hydrogen peroxide vapor and UV irradiation, as well as preventive measures like the application of antimicrobial

surface coating, show promise in lowering the risk of disease transmission [5]. Chemical methods of disinfection, including chlorination, might cause products to further disinfect, making the treatment procedures more difficult [6].

Red mud, sometimes referred to as bauxite residue, is an industrial waste produced when bauxite is converted into alumina by the Bayer process [7]. Its red color is attributed to iron oxides, one of the several oxide compounds that make up its composition. The Bayer method produces more than 95% of the alumina produced worldwide; for every tonne of alumina produced, one to 1.5 tons of red mud are also created [8].

Red mud is a very alkaline solid waste that is released during the alumina production process 2. Due to its high alkalinity and volume of discharge, red mud is primarily held in dams, taking up a lot of area and posing a serious risk to the biological environment. 2. Red mud does, however, also include rare earth elements and important metals like titanium, aluminum, and iron. 3. In an effort to produce valuable ingredients for cement and concrete, efforts are being made to identify better ways to deal with it and store it safely, such as waste valorization [9].

Al2Si2O5(OH)4 1 is the chemical composition of the clay mineral kaolinite. It is a soft, earthy, typically white mineral that is created when aluminum silicate minerals like feldspar 1 weather chemically. Because of its wide range of qualities, including its chemical stability, non-toxicity, and white hue, kaolinite is utilized in many different industries. 10.

The Al-Sharqat neighborhood of the Salah ad Din Governorate in Iraq is home to Al-Sharqat General Hospital 123. It provides a range of procedures, including neck, parathyroid, and thyroid surgery; appendectomy, laparoscopic cholecystectomy; hernia repairs; abdominal surgeries (small bowel, colon, stomach); surgical oncology (cancer); liver, biliary tract, and pancreatic surgery [11]. Al-Sharqat General Hospital has 50 beds in total, according to its official website.The hospital has state-of-the-art medical facilities and equipment, such as a pharmacy, radiology department, and laboratory.

Asteraceae is an annual plant that is primarily grown for its leaves, however it is also occasionally grown for its stem and seeds1.Though the nutritional value varies based on the cultivar, it is often rich in vitamins K and A.While it can also be grilled, lettuce is most frequently used in salads, but it may also be found in soups, sandwiches, and wraps1.Asparagus lettuce, or celtuce, is one variety that is produced for its stems, which can be consumed raw or cooked.

The tall, perennial grass known as sugarcane is used to produce sugar 1.It is the largest crop in the world in terms of output volume, with 1.9 billion tons produced in 20201. It is farmed in tropical and subtropical locations.Brazil makes up 40% of the global total 1.Sucrose, which is abundant in sugarcane, builds up in the internodes of the stalk 1.In specialized mill facilities, sucrose is extracted from sugarcane and utilized as a raw material in the food industry, as well as consumed directly in confectionery, to sweeten drinks, as a preservative in jams and preserves, and as a decorative finish for cakes and pastries1.

The current research aims to compare the efficiency of some clays (kaolin and red clay) and their relationship to some plants (lettuce and sugar cane) as plant treatments that treat wastewater resulting from Al-Sharkat Hospital in Salah Al-Din Government and remove heavy metals such as cobalt and selenium..

2. Materials and Methods

2.1. Sample collection sites

2.1.1. Waste water from Alsherqat hospital. Samples were collected from alsherqat hospita near from the tigris outcome wastewater. The region is approximately 1.5 km from the Al-Sharkat Hospital.

2.1.2. Water samples were collected from the tigris River near the Al-Sharkat city. The station is approximately 1.9 km from the city center.

Figure 1. Station of collected wastewater from S

Figure 2. Wastewater from Al-Sharkat Hospital.

2.1. Experiment designed

The experiment was designed by taking lettuce and sugar cane plants as plant samples that were diagnosed and verified and then developed in glass containers to be ready to add wastewater resulting from Al-Sharkat Hospital containing heavy metals for the purpose of knowing the effect of plants in removing selenium and vanadium as heavy elements and comparing them with clays (kaolin and red clay) and knowing the efficiency of plants and muds in purifying sewage issued by Al-Sharkat Hospital.

Figure 3. Lettuce (*Lactuca sativa*)

Figure 4. Ssugar cane (*Saccharum officinarum*)

2.3. *Physical and chemical tests*

2.2.1. Physical and chemical characteristics

- Electrical conductivity: Use a multi parameter Lovibond model CON200 to measure the electrical conductivity of samples after calibrating the device and express the results in microcemines per centimeter.
- pH Degree: Use a pH meter type consort C350 after calibrating the device with pH solutions with pH 4, 7 and 9.
- Bio requirement for oxygen: I used the same method of measuring dissolved oxygen has been filled bottles size of 250 ml of the sample and then transferred to the laboratory and kept for five days in a water bath temperature of 25 ° C and expressed the results in milligrams per liter.
- Turbidity: The turbidity of water was measured by the Hannah LP2000 hardness measuring device, and the solutions are expressed in the total turbidity unit in a specific unit.
- Measurement of total dissolved substances: The dissolved substances were measured depending on the mentioned method by filtering 200 ml of the sample with Wattman

type filter paper and collecting the filtrate in a known weight and the filtrate was evaporated in an oven with a temperature of 105 ° C for 24 hours and then it was weighed.

- Determination of total solid suspended materials: The suspended solids were measured by filtration of ml of the sample on 0.45 μm filter paper known weight and then evaporation of the filtrate in an oven with a temperature of 103-105 °C for 24 hours and then it was weighed.

Statistical analysis was done using a computer through SPSS Special Program for statistical system (using ANOVA) test analysis of Variance, which is used to know the presence of significant differences or their absence in the studied variables (physical and chemical properties) according to the variables at the level of significance P≤0.05.

2.4. Used kaolin and red clay in treatment :

The method of examining the jar was followed according to what was mentioned in 1 as a method of coagulation, as clays (kaolin and red clay) were used as coagulants in the treatment process for the water issued by Al-Sharqat General Hospital, as the waste water was placed in the jar examination device and the mixing process was carried out at a speed of 200 cycles per minute and for a period of 8 minutes with the addition of one of the clays and re-mixing again, but at a speed of less 70 cycles per minute and for 20 minutes. Then stop mixing and let the solution leak for 20 minutes, then take the clear solution and study it to find out the best removal and the best optimal efficiency , That is, knowing the optimal dose in obtaining the best efficiency for the removal of heavy metals and pollutants, and these indicators are COD, BOD, DO, T.D.S, T.S.S, PH, EC, T.

3. Result and Discussion

Through the current research, a clear variation was observed in the values of the physical and chemical indicators between the wastewater issued by Al-Sharqat General Hospital using many parameters for water treatment, as two types of clay (kaolin and red clay) were used as non-vital treatments and plants as bio treatments (lettuce and sugar cane).

Many indicators were tested and it was noted that all of them changed at room temperature before and after the treatment through the use of the jar and mud device and it was noted that the red clay was more efficient in reducing the indicators BOD, COD, DO, PH, EC, T.D.S, T.S and they were respectively after the treatment 378,274,6.2,7.4,322,462,253,215,39,29, and 55 while they were very high in the wastewater outcome by the hospital and dumped into the Tigris River without any biological or abiotic treatment and as proven in Table 1 And shapes from 1-10

Plants also had a role in reducing pollution indicators and heavy elements and the lettuce plant had a greater impact in reducing pollutants as a clear decrease in heavy elements, including cobalt, selenium and copper after treatment, as it amounted to 12.10 and 46.plants work to reduce pollution because of their high ability to absorb heavy elements and deposit them in the roots and chelate, and through the current research it was found that the lettuce plant was highly efficient and exceeded even the use of clay, which indicates its high ability to reserve elements Plants also had a role in reducing pollution indicators and heavy elements and the lettuce plant had a greater impact in reducing pollutants as a clear decrease in heavy elements, including cobalt, selenium and copper after treatment, as it amounted to 12 , 10 and 46 plants work to reduce pollution because of their high ability to absorb heavy elements and deposit them in the roots and chelate, and

through the current research it was found that the lettuce plant was highly efficient and exceeded even the use of clay, which indicates its high ability to reserve elements Contaminated from Al-Sharqat Hospital .

The current study also showed that the clays significantly outperformed the plants in their ability to treat contaminated water by reducing the polluting indicators of water, while the plants had a high ability to reduce heavy metals such as cobalt, selenium and copper to acceptable limits as in Table 1 and Figures 1-10

Plants work to reduce heavy metals from contaminated water resulting from the hospital due to the ability of lettuce and sugar cane plants to trap pollutants in the trunk , Plants work to reduce heavy metals from contaminated water resulting from the hospital due to the ability of lettuce and sugar cane plants to trap pollutants in the roots, stems and leaves and proved through the current research the efficiency of the lettuce plant and its moral superiority over the sugar cane plant and reduce all physical and chemical indicators and pathogens such as bacteria and fungi. Contaminants by efficient transport and storage in cells.

Table 1. showed the heterogeneity of wastewater before and after treatment and the heterogeneity is clear in all biological and abiotic indicators and contaminants of heavy metals and muds excelled in all indicators except for heavy elements that plants had a major role in reducing and reducing pollution with heavy metals.

Parameter	**Waste water**	**After used calys**		**Plant1 (lettuce)** *Lactuca sativa*	**Plant 2 (sugar cane)** ***Saccharum officinarum***
	Before	**Kaolin**	**Red clay**	**After**	**After**
	Treatment			**Treatment**	**Treatment**
BOD	625 mg/l	579c	378a	530c	487b
COD	820mg/l	623d	274a	587c	503b
DO	7.3mg/l	7.0b	6.2a	7.2d	7.1c
PH	8.1	7.8b	7.4a	8.0d	7.9c
EC	762 ms	476b	322a	586c	573c
T.D.S	857mg/l	657b	462a	643b	699b
T.S.	805mg/l	401c	253a	376b	492c
T	401mg/l	332b	215a	364b	367b
CO	52mg/l	47d	39c	12a	17b
Se	38mg/l	25c	29d	10a	20b
Cu	124mg/l	98d	55c	46a	49b

Figures 5-15 showed variations in the biological requirement for oxygen, dissolved solids, electrical conductivity, pH, turbidity, contaminated solubles and heavy elements such as cobalt, selenium and copper.

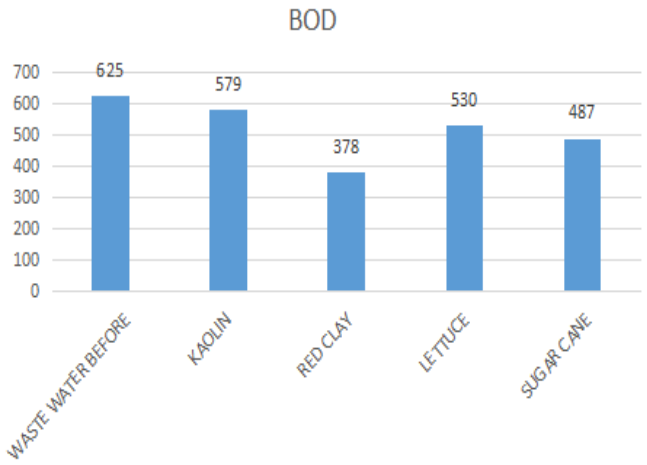

Figure 1. Showed BOD in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

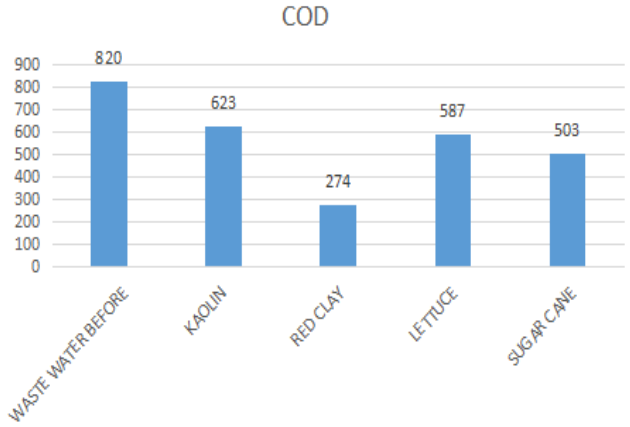

Figure 2. Showed COD in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

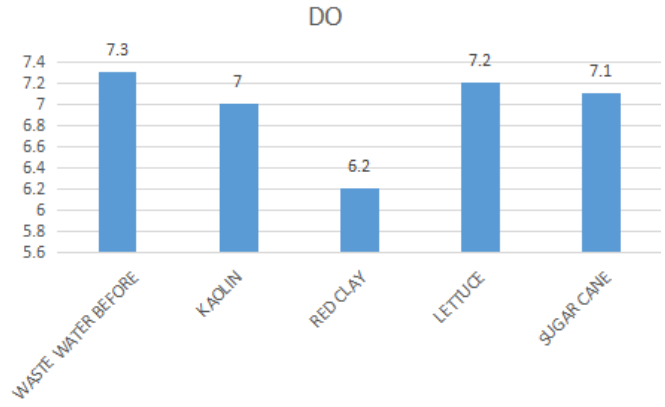

Figure 3. Showed DO in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

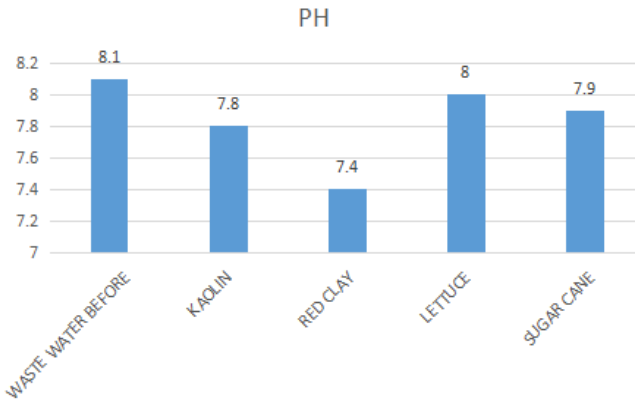

Figure 4. Showed PH in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant .

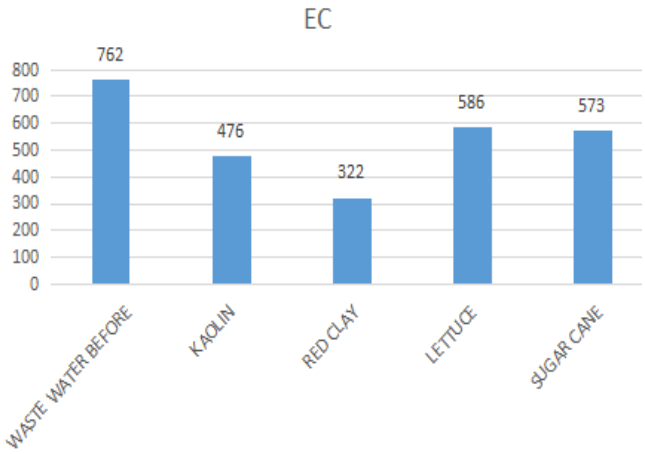

Figure 5. Showed EC in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (MC).

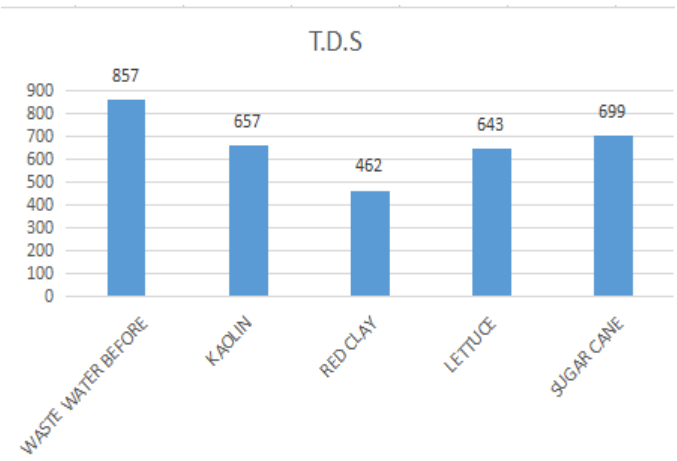

Figure 6. Showed T.D.S in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

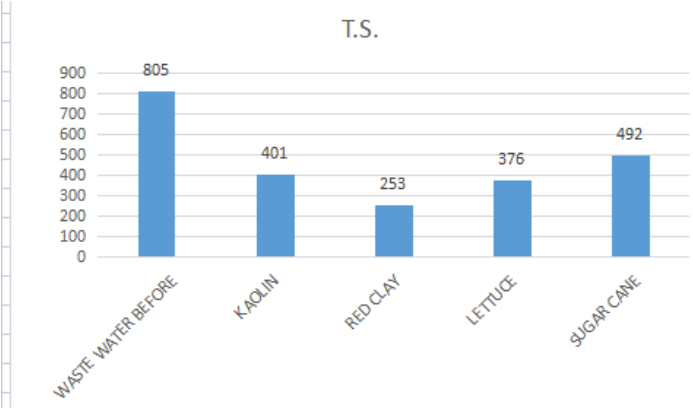

Figure 7. Showed T.S. in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

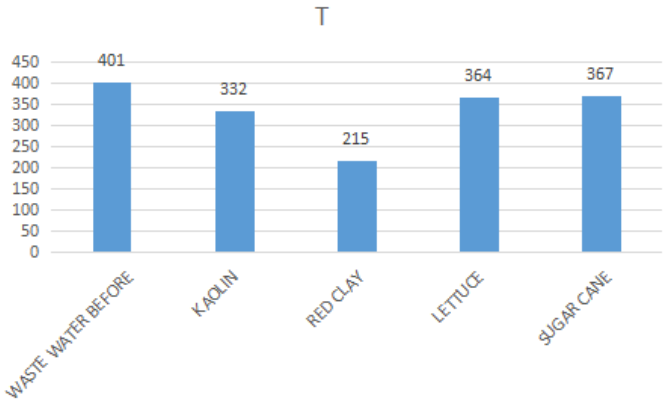

Figure 8. Showed Turbidity in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

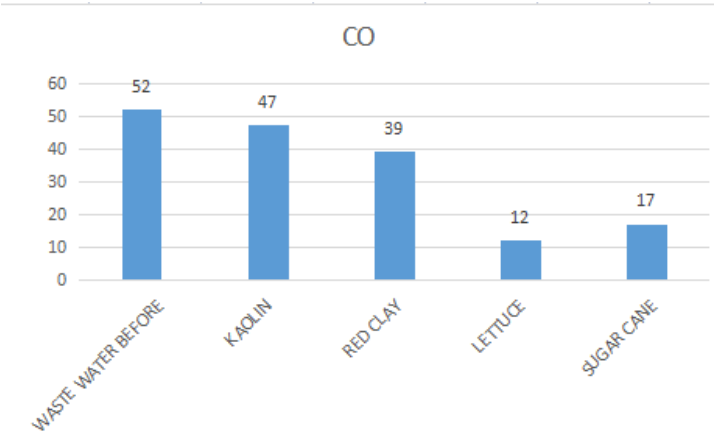

Figure 9. Showed (Cobalt) from heavy metals in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

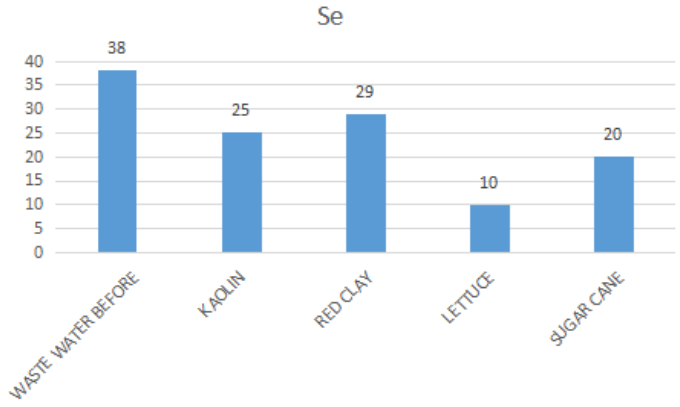

Figure 9. Showed (selenium) from heavy metals in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

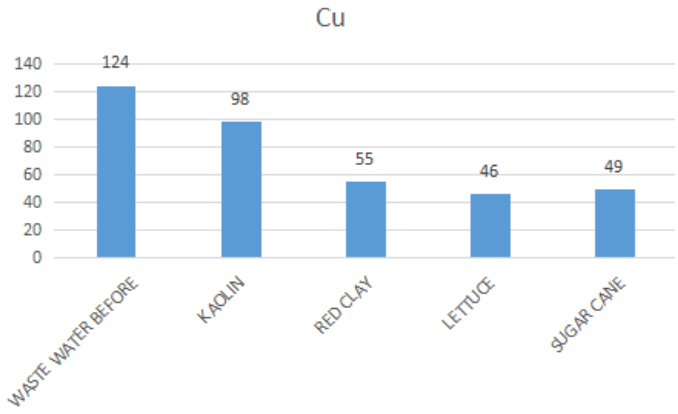

Figure 10. Showed (Copper) from heavy metals in Waste water before and after treatment by used kaolin ,red clay, lettuce and sugar cane plant (mg/l).

4. Conclusion

Many indicators were tested and it was noted that all of them changed at room temperature before and after the treatment through the use of the jar and mud device and it was noted that the red clay was more efficient in reducing the indicators BOD, COD, DO, PH, EC, T.D.S, T.S and they were respectively after the treatment 378,274,6.2,7.4,322,462,253,215,39,29, and 55 while they were very high in the wastewater outcame by the hospital and dumped into the Tigris River without any biological or abiotic treatment.

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