The Effectiveness of Zeolite in Treating Some Physical and Chemical Properties of Wastewater Discharged from General Sharqat Hospital

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Abstract

The current study where done to evaluation of sewage water and processing it in General Sharqat hospital / Salah El Din governorate –Tikrit –Iraq on 2018-2019. The study include analysis and measurement some physical and chemical properties to processing with natural, cheap and have no side effect to reduced harmful of water pollution of Tigris river .The results of present study showed conductivity and turbidity of sewage water was decreases from (1596) µc/cm to (727) µc/cm from (343) to (19) Nut , (633) to (491) ml/L respectively , and has risen concentration of dissolved oxygen (BOD_5) (T.S.S) (T.D.S) and nitrates preprocessing (104 , 0.53 , 966 and 25.2) which varied significantly with results post processing (52, 0.03 , 361 and 12.0) respectively . The results showed efficient processing of sewage water in station when treated with zeolite rocks powder. Sharqat hospital . discharged.

Key words : *Wastewater, Treatment, Zeolite*

Introduction

The process of collecting and disposing of liquid waste from the sources of its production of sewage water and pollutants of hospitals and factories and dumping it into the Tigris River has a great impact on the general health of the human being and a great impact on the rest of the neighborhoods[(1)]. Hospitals produce relatively large quantities of wastewater which may contain various hazardous materials [(2)] It affects all characteristics and the concentration of hydrogen ions present in any medium with pH, which is considered an indicator of the nature of the medium, whether basic or acidic [(3)]. As well as dissolved materials TDS and TSS as the water leaving hospital departments contain these types of material, Likewise, its quantity is one of the main pollutants of this water, and some of it may contain highly toxic substances that are, in turn, discarded from the hospital to the Tigris River in relation to the current study site. The values of this study after treatment came less than [(4)]. in their study of wastewater in Halab city, The reason for this is the efficiency of these processors, As for nitrates, they are formed in water when dissolved oxygen is available, which leads to the oxidation of nitrates into nitrates [(5)]. And because the nitrite ion is unstable, it turns into the more stable form which is nitrate [(6)]. The low values of nitrite are a result of the decreased reduction of nitrate to nitrite in winter, and the presence of nitrite increases with the decrease in dissolved oxygen [(7)]. Hospital wastewater is one of the most important sources of drug waste in all wastewater treatment plants and its ineffectiveness in removing these pollutants permanently. Chemical pollutants, heavy materials, disinfectants and specific detergents resulting from diagnosis, laboratory, research activities and drug excretion by patients makes wastewater in hospitals Negative impact on human health and the environment [(8)]. Mineral absorption in plants presents a great opportunity to use suitable plant species to clean the environment. Although increasing studies are now examining this issue, few studies have reported the simultaneous removal of nitrogen and phosphorous in real wastewater using nanomaterials [(9)].

Objectives of the Study

1. Shedding light on the current situation and making use of wastewater in various uses, whether agricultural or for human uses in conditions of water scarcity that our beloved country is going through.

2. Finding natural and environmentally friendly alternatives in water purification at low economic costs.

Materials & Methods

Sample collection

The experiment samples included zeolite powder, Zeolite was obtained from Amman Company - Tla 'Al-Ali / Wasfi Al-Tal Street / Amman ,Then it was milled with a laboratory electric grinder until a fine powder was obtained, and then the powder was passed through a sieve with a hole diameter of 0.5 mm. Then the powder was placed in sealed plastic bags and kept until use.

How to use the hydrotherapy

Specific proportions (2,4,8) of zeolite rock powder were used per 100 ml of contaminated water and then the most efficient concentration was chosen as a result of the treatment.

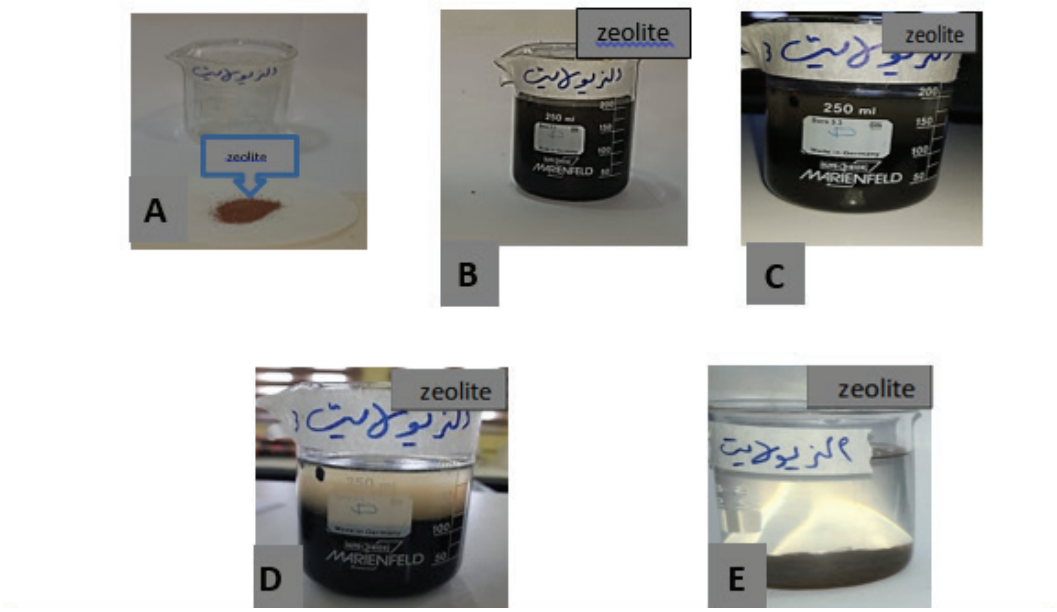

Figure (1) shows the stages from A to E of wastewater response to zeolite rock powder

Electrical Conductivity

The Multi parameter analyzer (Lovibond) model (con200) was used to measure the electrical conductivity of the samples after calibrating the device, and the results were expressed in (Microsiemens / cm) µc / cm.

pH

Use a pH meter (C830)type Consort after calibrating the device with Buffer solutions with a pH of (4, 7, 9).

Biological Oxygen Demand

The same method of measuring dissolved oxygen was used, and the BOD bottles were filled with a volume of (250) ml of the sample, then transferred to the laboratory, and kept for five days in a water bath at a temperature of (25 ° C), and the results were expressed in milligrams / liters depending on [10].

Turbidity

Water turbidity was measured by a HANNA-LP2000 Turbidity meter, as the device expresses standard solutions in (N.T.U) Naphthalene unit as the brownish unit, after the device is zeroed.

Total dissolved solid (T.D.S)

The dissolved materials were measured according to the method mentioned in [11].by filtering (100) ml of the sample on a filter paper (0.45) micrometer and collecting the filtrate in a vessel of known weight (B), then evaporating the filtrate in an oven at a temperature of (103-105). M) for a period of (24) hours, after which we were weighed (A):

Total solid suspended (T.S.S)

The suspended solids were measured by filtering (100) ml of sample on a filter paper (0.45) micrometer with a given weight (B), then evaporating the filtrate in an oven at a temperature of (103-105) m for a period of (24) hours, after which it was weighed (A).

$$T.S.S(mg/L) = \frac{(A-B)\times 10^3}{Volume\ of\ Sample\ (ml)}$$

Nitrate

Nitrate was measured using Ultraviolet Spectrophotometer Screening Method [12].using the Ultraviolet Visible Biochromic, LKB Spectrophotometer, as the absorbance was measured for each sample at the wavelengths of 220 nm and 275nm, and through standard solutions, the nitrate concentration was found from the equation for each curve. It is expressed in mg / L.

Choose a zeolite treatment

Zeolite is a 100% natural product that was created as a result of geological processes millions of years ago by the decomposition of volcanic glass and its interaction with alkaline water [13].Zeolites are mainly composed of aluminum silicate minerals and are distinguished by numerous qualities due to their unique structural composition [14].They are among some of the most popular and widely available natural ion exchanger, which consist of an aluminosilic molecular structure with weak positive bonding sites [15].

Zeolite was used as a major step in this type of treatment in getting rid of and reducing some of the physical and chemical characteristics that cause pollution. The zeolite was milled and used on samples taken from the wastewater plants of the Sharqat General Hospital and left for a period of time to reach the maximum treatment.

Figure (2) shows the outward appearance of the zeolite

Results and Discussion

pH

The results of the study shown in Table (1) for the pH characteristic indicated that there are significant differences in the values of this characteristic with regard to the water wastes discarded from the hospital under study, as it is noticed that the type of treatment had an effect on reducing PH, and [16] agreed with this study in Zeolite efficiency as the maximum removal efficiency has been found up to 85% pH.

EC

The electrical conductivity represents the positive and negative ions present in the discarded water from the sites covered by the study. It is noted from the results of the current study that the discarded water from the different sites under study differed in the values of electrical conductivity in a high significant manner, Table (1). The value of electrical conductivity in the water discharged from the hospital increased and it gave a value of 1596 microsmins / cm, while the value of this characteristic in the liquefaction water, which recorded 276 microsmins / cm.

The reason for this rise is due to the fact that the water leaving hospital departments contains various dissolved substances as a result of the effectiveness of work in these sites, and the presence of these dissolved materials leads to an increase in the solution degree and

thus increase the conductivity values. As for the effect of treatment methods, the studied results in Table (1) indicated the effectiveness of treatment with zeolite powder in reducing these values, as the conductivity value in this method reached 727 microsiemens / cm for hospital water and liquefaction water, which gave a value of 168 microsiemens / cm.

Total dissolved solid(T.D.S)

Total dissolved materials are one of the main components of the water discharged from hospital departments. As it represents the waste material of the raw materials during the conduct of operations, laboratory analyzes, or patient lounges. As the results of this characteristic shown in Table (1) indicated that there are differences in the values of total dissolved substances at the study site, Sharqat General Hospital. If it was found that the highest value in total soluble substances was in the wastewater from the general Sharqat, it was 966 mg / liter, and after treatment it was 361 mg / liter, While the value of these materials in the water sample of the liquefaction plant was 182 mg / l. The high concentration of dissolved substances may be caused by the large number of wastes produced during the conduct of the operations, as well as the waste after the end of the operations and the cleaning of the polluted hall. As for the effect of treatment methods for these materials, the results are shown in a table. (1) The water treatment with zeolite powder achieved positive results in reducing the concentration of total solids. The concentration of these substances decreased to 361 mg / liter for zeolite powder. The concentration of dissolved salts in the water of the present study treated sites is in agreement with [17]. It is similar to the results obtained from US Environmental Protection Agency [18].

Total solid suspended (T.S.S)

This characteristic in environmental studies represents the amount of solid plankton in the water, whether it is drinking water or wastewater, and the presence of these plankton in a large proportion in the water leads to it being unfit for human uses if its increase is due to the frequent use of formaldehyde as it is considered the most dangerous pollutant of wastewater by virtue of Its use in pathological laboratories and surgical departments for preserving samples and sterilizing medical devices and tools

Therefore, environmental research has been concerned with measuring the concentration of these substances and how to treat them to get rid of them or reduce them in the water. From the waste water, treatment with zeolite powder showed high efficiency in reducing the amount of these substances present in water outside the hospital. It became clear that the treatment method with this substance reduced its concentration from 0.53 mg / liter to 0.03 mg / liter. Reducing the concentration of these substances from the water leaving the hospital that is destined for the waters of the Tigris River will lead to contamination of that water and the arrival of suspended materials to the water liquefaction stations. Water is pumped to vital homes and facilities. Reducing them means preventing these materials from reaching drinking water.

Biological Oxygen Demand (BOD_5)

The results shown in Table (1) showed that the highest concentration of bio-oxygen in hospital wastewater was 104 mg / liter, while its concentration after treatment was 52 mg / liter. The reason for this increase in the vital oxygen requirement may be due to the increase in organic excreta due to the vital activities of the patients. The increase in the BOD value in the wastewater discharged water is an indication of pollution (1). As for the treatment parameters for water, Table (1) showed that treatment with zeolite powder achieved the best results in reducing this requirement. The concentration of the oxygen vital requirement after treatment for liquefied water was 52 mg / liter compared to the water before treatment. The reason for this decrease may be due to the chemicals in it that have the ability to bind with biological oxygen, which leads to a decrease in its concentration in the aqueous medium ,Or because of the increase in the percentage of solvents used by hospitals and medical laboratories, as well as the increase in medical waste mercury, which is highly toxic, which is used in medical clinics and is discharged into the sewage network. The results of the BOD of the treated samples matched [19]. and also did not match [17].

Total Hardness

The total hardness values shown in Table (1) indicate that it was the highest value in the hospital water, which gave values of 633 mg / liter. While the value of harshness decreased after treatment to 491 mg / L. The

cause of the higher hardness may be due to the nature of the chemicals introduced in these waters and used in the surgical procedures. The reason is due to the waste added to the river [20].It also agrees with many studies that have indicated a high total hardness in Iraqi waters [21]. This water, after treatment, is suitable for human use according to the Iraqi Standard Specifications No. (417) as well as the specifications. World Health Organization [22].

Turbidity

Wastewater is known to be very cloudy because it contains large quantities of suspended matter, which reduce the temperature of water by dispersing and absorbing light [23].However, the treatment methods of the discarded water had a significant effectiveness in reducing the brownish values. It is noted from the results table (1) for this characteristic that the zeolite powder had a strong effect in reducing the brownishness significantly, as it gave a value of 19 NTU for the zeolite, while the value before treatment was 343 NTU. The ability of zeolite powder to reduce brownish values is due to the containment of this powder, which consists of grains of limestone and limestone, and this has the ability to catch plankton and raise its molecular weights, which leads to its sedimentation at the bottom and making the water clear. The results of the brownish values were in agreement with a study [24].

Nitrite (No_3)

The results of this characteristic shown in the table indicate that the nitrate values under study before treatment with zeolite powder were 25.2 mg / l. They differed significantly from all results after treatment with zeolite powder, which was 12 mg / L. As the high nitrate in the waste water may be due to the tests and analyzes that take place in hospitals, in which the main component of nitrogen is nitrogen, and this element when combined with dissolved oxygen in water turns into nitrates. As for the type of treatment and its effect on nitrate concentration, it is caused by the zeolite chemical powder components [25.26].

Table (1) shows the changes in the estimation of some physical and chemical characteristics for wastewater of Sharqat General Hospital

Processing type	ZEOLITE		Liquefaction plant water before and after zeolite treatment		Measurements of the Tigris River in the district of Sharqat	Allowed limits
Measurements	Before Tr	After Tr	Before Tr	After Tr		
pH	7.5	8.5	8	7.5	7.8	6-9.5
EC µc/cm	1596	727	276	168	1687	1600
TSS ml/L	0.53	0.03	0.06	0.03	68	60
TDS ml/ L	966	361	182	168	595	1000
BOD5 ml/L	104	52	10	5	140	40
Turbidity NUT	343	19	325	8	172	-
Total Hardness ml/L	633	491	138	121	540	250
No3 ml/L	25.2	12	10.2	6.3	21.5	50

Conclusions

1- The low level of contamination of the traits in the treated water, where the material used in the treatment showed high efficiency.

2- The results showed that the zeolite rock powder has achieved clear results in removing pollutants from the hospital water.

3- The study showed alternatives to traditional treatment methods with low-cost and highly effective methods of treating polluted water.

Recommendations

1- Hospital waste management should be concerned with dealing with the large quantities of liquid and solid medical waste it discards daily, coinciding with the increasing number of patients and the lack of means of treating waste.

2- Recommending the possibility of treating hospital discarded water by the method that has proven its high ability to be treated, such as zeolite rocks powder.

3- Conducting studies on finding efficient and cheap sources in treating the wasted water from hospitals and laboratories in an environmentally friendly manner without changing the properties of water and soil instead of adopting traditional techniques and chemicals.

Ethical Considerations: All Research participants haven't been subjected to any kind of harm in any way.

Funding: The work was supported by the researchers themselves.

Conflict of Interest: The author declare no conflict of interest regarding this research.

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