EFFICIENCY OF NATURAL PRODUCT IN REMOVES POLLUTANTS FROM WASTEWATER

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Abstract - The current study was conducted to evaluate the effectiveness of zeolite stone as a cheap and environmentally friendly natural materials to reducing pollution of pharmaceutical wastewater in General Company Manufacture Medicines and Medical Supplies in Samarra, Salah al-Din Governorate- Iraq. The experiment applied plastic filter system used natural zeolite with different dimensions size (11,13,25 mm), (7, 13 16 mm) and(4,6,8 mm) with three layer respectively compared with raw wastewater. The percentage of pollution load removal percentage in the filtered industrial water was adopted as a measure of the chemical and physical properties of the treated water. The results showed decreased removal turbidity with rate reached 51%, while factors of BOD5, TSS, T.D.S and CACO3 registered values of removal rate 60.5%, 30%, 55% and 73% respectively, compared with untreated wastewater . The results showed possibility of treated raw wastewater using stone Zeolite as a promising method using a natural processing resource.

Keywords - Pharmaceutical Wastewater, Zeolite, Filter System, Physical And Chemical Properties

I. INTRODUCTION

Environmental pollution poses a major threat to human, animal and plant health and has local, regional and global effects. Pollution has harmful effects on land, water and its vital and vital components. Effluents from industries are usually major industrial pollutants containing both organic and inorganic compounds[1].development, a large amount of wastewater was produced, and this water contains various pollutants such as heavy metals, oils and toxic organic substances, all of which greatly affected the environment [2]. Pharmaceutical, cosmetic and detergent factories, in addition to wastewater, which comes from as hazardous and pollute environment waste [3,4] . In recent years, and because of the continuous water storage operations in the neighboring countries of the country, in which the sources of Iraqi rivers are located, there was a clear decline in the discharge rates of Iraqi rivers and streams, which negatively affected their ability to contain and absorb industrial and civil waste water that is thrown into it, so it is necessary to collect and deliver pollutants. The liquid from its sources to the treatment plants to be treated before it reaches the rivers in order to avoid damage or danger to the environment in general and to humans in particular, since this water contains various toxic substances, oxygen-depleting substances, organic pollutants, microorganisms and compounds based on nitrogen, phosphates and dyes [5]. Many materials have been used as adsorbents to remove pollutants from water, such as clay minerals, biochar, and activated carbon. These materials have advantages, including high surface area and negative electrical charge. A relatively new class of adsorbents has emerged that has been used to treat wastewater, including zeolite, which is one of the materials that have The ability to treat pollutants present in liquid waste, which are found in nature and have fine pores, and have several applications such as separation of gases and water hardness through some treatment mechanisms [6]. Natural and industrial zeolite is widely used in the absorption and filtration of matter to purify water and wastewater. Zeolite is also used in removing color, toxins, disinfection, separation and concentration water and gas as a mixture to remove harmful components. It is also used in the treatment of various types of pollutants in wastewater, especially metal ions and ammonia, nitrates, phosphates, hydrocarbons, oils and organic materials. As well as one of the most important uses in biological treatment against pathogenic bacteria, odor compounds and color dye, waste dyes from the textile industry [7]. Therefore, this study came with the aim of evaluating the effectiveness of zeolite stone as a natural, easy-to-prepare product and low-cost in the field of wastewater treatment.

II. MATERIALS AND METHODS

2.1Study site

The study was conducted in the General Company Manufacture of Medicines and Medical Supplies in Samarra for the period from September to October-2022 to evaluate activity of using zeolite stone in removal load pollution for excreted waste water from the primary treatment system .

2.2 Sample Collection

2.2.1 Sewage samples

The experimental samples were collected directly from the station in clean and sterile plastic bottles capacity 250ml that washed with three time by sample water . The collected samples taken below 10 cm of the surface of water to avoid the effect out factors environment , after that the samples transferred to laboratory and stored in the refrigerator to perform subsequent analyzes.

2.2.2 Zeolite Stone

Natural zeolite stone Fig.1,was obtained from the Green Zeolite Agricultural Company - Amman, Madinah Al-Munawwarah Street. Sizes of stone were prepared by using a special laboratory electric mill, and then the stones were placed in tightly sealed plastic bags until use. Aluminum sulfate was used as a control obtained from the Samarra local market.



Fig.1 zeolite stone of the type Shapezite used in the experiment

2.3 Laboratory Experiments

2.3.2 Plastic Filter System

Three plastic filters were made and designed with three layers for each filter and different diameter Fig.2, before that the zeolite stone was washed with distilled water to remove the suspended dust and impurities, then it was placed in the electric oven at 100Co until got Complete dehydration. Special electric laboratory mill used to obtain the required sizes : (11, 13, 25 mm), (7, 13 16 mm), and (4,6,8 mm). The flow water passage was controlled to ensure good filtration by controlling the exit holes of the filter, and then the filtered water was taken to perform the required tests. The removal percentage for each trait was calculated according to the equation 100-(T1/T2 * 100), meaning the part over the whole multiplied by one hundred.

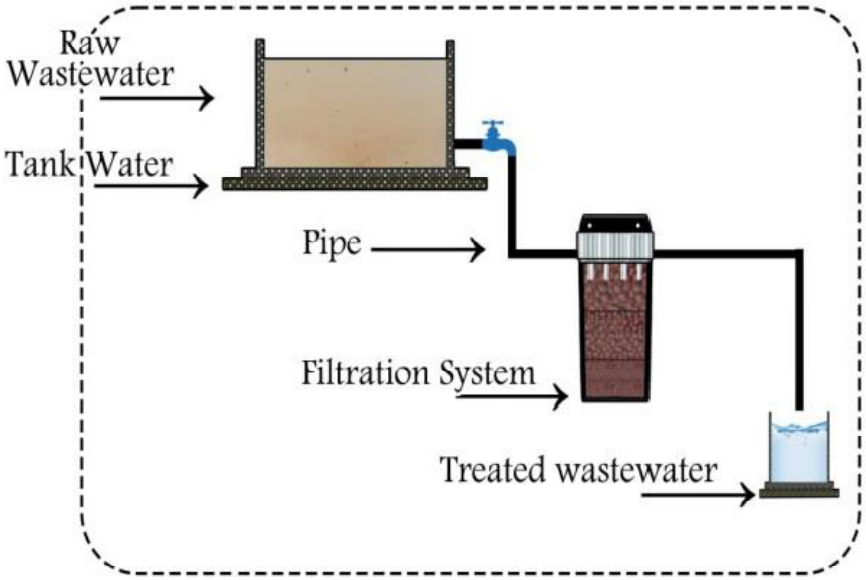

Fig 2 . Triple filter system used in the treatment

2.4 Experiment Design

Ten treatments starting from (T0 to T9) with three replicates (R1, R2, R3) as shown in table.1. The T1 and T2 used as control without treatment.

No	Code	Treatment type
1	T 0	Tap water without treatment (Control)
2	T1	Crude waste water (WW) without treatment
3	T2	Treatment with aluminum sulfate
4	T3	Treatment by making a plastic filter with a small stone measuring (8 mm, 6 mm, 4 mm) .
5	T4	Treatment by making a plastic filter with a medium-sized stone measuring (16 mm, 13 mm, 7 mm).
6	T5	Treatment by making a plastic filter with a large stone measuring (25 mm,23 mm, 11 mm).
7	T6	Treatment using a combination method (T5 + T4) with one filter, small stone + medium stone.
8	T7	Treatment by combination method (T6 + T5) with one medium stone + large filter.
9	T8	Treatment using a combination method (T6 + T4) with one filter, small stone + large stone.
10	T9	Treatment by collecting (T6 + T5 + T4) .

Table.1 Type of treatment used in experiment

2.5 Properties of Water Treatment

Properties of treated water collected after analyzed and compare with untreated and standard values of Iraqi water and World Health Organization .

2.5.1 Biological oxygen requirement (BOD)

The results were expressed in mg/L according to the standard method [8].

2.5.2 Turbidity

The turbidity of the water was measured with a HANNA- LP2000 turbidity meter, the device expresses the standard solutions in the naphthalene unit (N.T.U) as a brown unit, after the device has been filtered.

2.5.3 Total Dissolved Solids (T.D.S)

T.D.S were measured according to the approved standard method[9]

2.5.4 Total suspended solids: (T.S.S)

The suspended matter was measured according to the standard method [10]

2.6 Statistical analysis

The results were analyzed statistically by applied the statistical program (Minitap) (17,ver) depending by variance (ANOVA) test, and the arithmetic means were compared by Dunkin's test with a probability level of $P \leq 0.05$ [11]

III. RESULTS AND DISCUSSION

3.1 Biochemical Oxygen Demand (BOD5)

Figure (2) showed the amount of dissolved oxygen was significantly different between the each treatments and untreated sample T1 which recorded higher value reached 81 mg. While the lowest value was recorded with used three different types of stone together (T9) with mean reached 32 mg / L compared with tap water that was 2mg/L. The reason for this increase in the vital need for oxygen may be due to the increase in the proportion of solvents used by laboratories, as well as the increase in highly toxic medical mercury residues, which are used in experiments and are discharged into the sewage network. All treatment with zeolite stone achieved reducing load pollution especially BOD percentage. This decline may be due the low readings for both treatments indicated the type of chemicals present in them, which reduced the percentage of microorganisms consuming oxygen. All so can be explained by examining the mechanisms by destabilizing colloidal particles and allowing them to agglomerate and forming larger, more readily settled particles. This result are agreements with study [13].

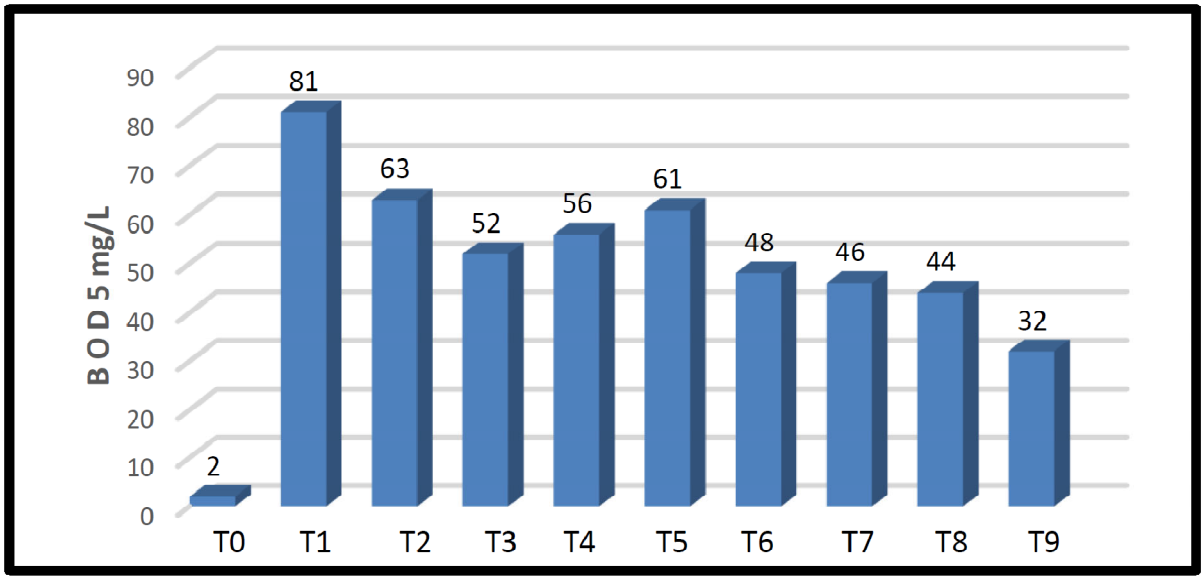

Figure2: Effect of triple filter system including Zeolite Stone in BOD value of wastewater treatment.

3.2 Turbidity

The results in Figure (4) show there are significant differences at (P≥0.05). between the treated, untreated and control treatments . The highest value of turbidity recorded in raw wastewater (T1) with value reached 100 NTU . While the treatments T2 and T9 recorded lowers values were 24 and 23 NTU that significant different with other treatments and tap water treatments.

Different reducing of turbidity between treatments may be due fact of stone is composed granules of calcareous rocks. It also has the property of molecular sieving, which is small in pores and is easy to penetrate, as it contains a beehive-like structure that can absorb organic molecules with ease. The above-mentioned water treatment methods had a significant effectiveness in reducing the values of Turbidity As for aluminum sulfate, it is a safe natural chemical substance and it has a major role in sedimenting plankton and purifying water. This study agreed with [16].

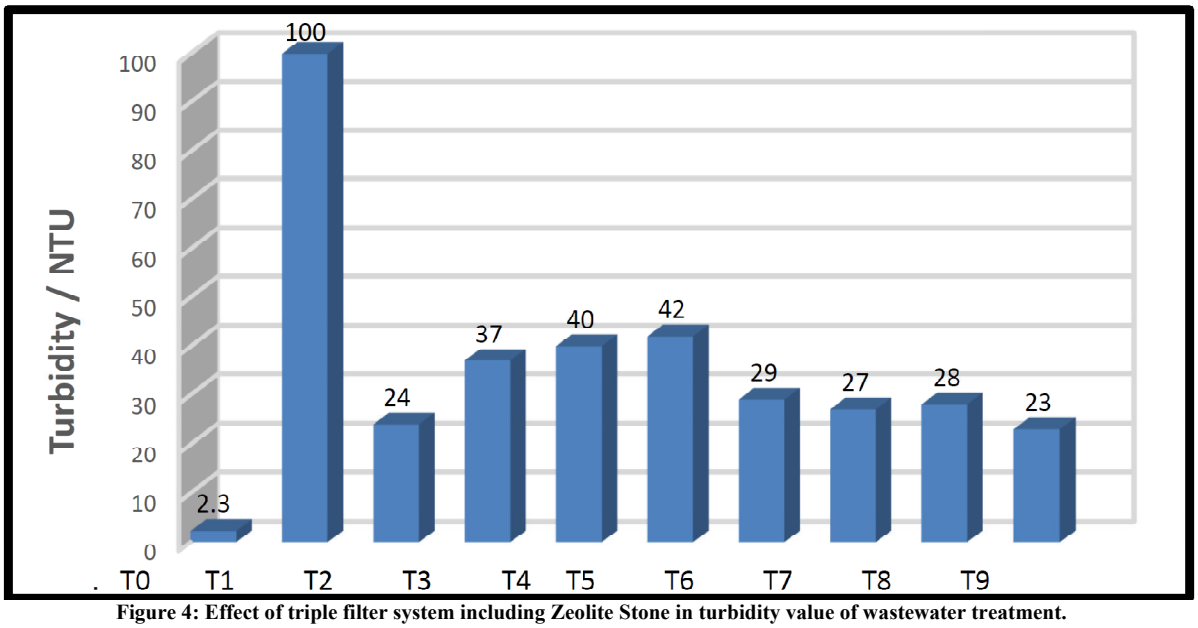

Figure 4: Effect of triple filter system including Zeolite Stone in turbidity value of wastewater treatment.

3.3 Total Dissolved Solid (T.D.S)

The results as shown in Figure (5), that the total dissolved salts in the site under study differed in T.D.S values, as they were high in the wastewater and given in raw wastewater(T1) with value reached 480 mg / L that significant differences with control treatment T0 296 mg/. While the lowest value of total dissolved salts was recorded by T9 (212 mg/L) with a removal rate of 55%. As for (T2), which is the treatment with aluminum sulfate, it did not show any significant difference at a significant level (P≥0.05) in the site under study. The rise in total dissolved salts

in the wastewater is due to the excretion of waste resulting from the preparation work in the production departments, especially the buildings that work with powders such as the capsule and grain departments that use chemical raw materials used in the preparation and production of capsules and grains such as calcium phosphate. This study agreed with whit both [17, 18].

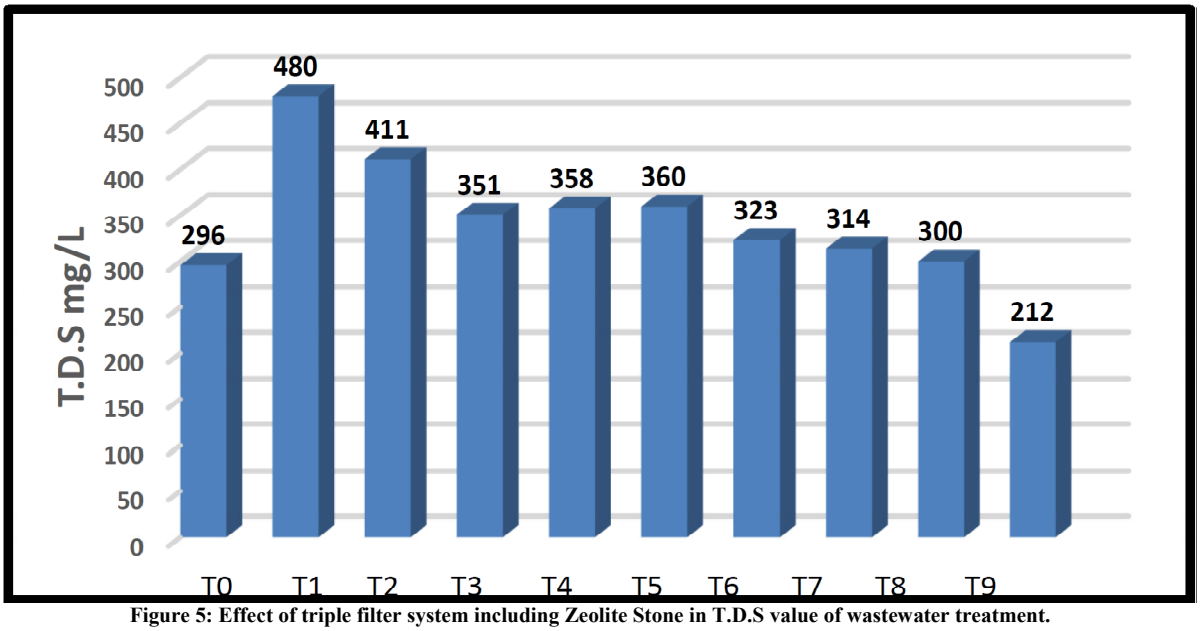

Figure 5: Effect of triple filter system including Zeolite Stone in T.D.S value of wastewater treatment.

3.4 Determination of total suspended solids (T.S.S)

The results notices in Figure (6) significant differences in the T.S.S between the treatments on one hand and control treatment on the other hand. Raw wastewater (T1) registered value (80) mg /L, while the lowest concentration of (T.S.S) after treatment (T9) recorded 42 mg/L with a removal rate of 47.5% compared with untreated treatment (T0), which had a value (40 mg/L), while (T2), which was treated with aluminum sulfate, did not show any significant difference at a significant level (P≥0.05) with other treatments. The reasons of increase in T.S.S may be used of various chemicals that help suspension in urbanization, such as suspended raw materials (Xanthan gum, guar gum), which are used in the preparation of liquid suspensions and grains, In addition to the disposal of industrial waste and sewage from the production. The treatment with zeolite stone showed high efficiency in reducing the amount of these materials present in the water exiting the sections, as it gave the treatment method a high superiority over the treatment with aluminum sulfate. This study with [19].

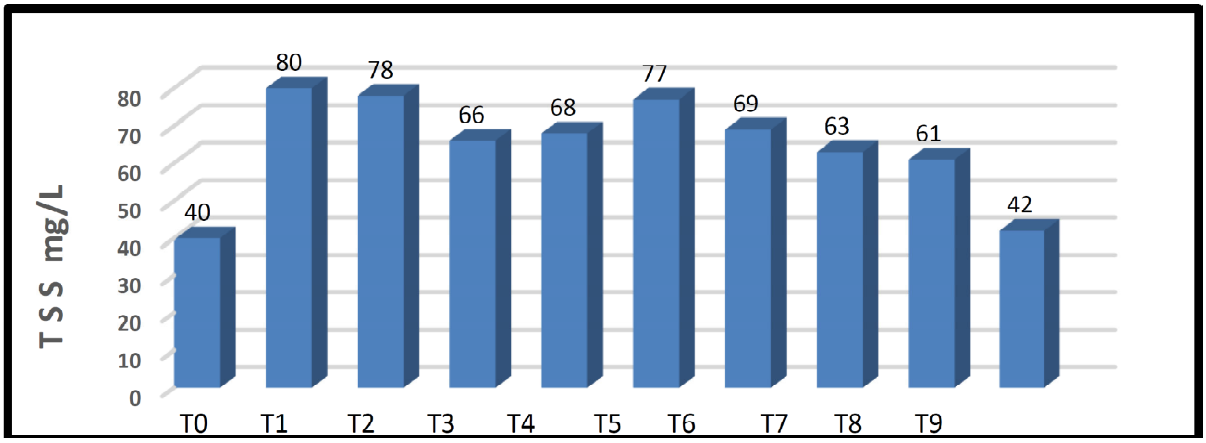

Figure 6: Effect of triple filter system including Zeolite Stone in T.T.S value of wastewater treatment

3.5 Total Hardness

The results of Figure (7) show the recording of significant differences between the treated and untreated treatments, and the control. The highest value was recorded for wastewater (T1) 200 mg / L compared with T9 that given the lower value 73 mg / L . While T2 which is treated with aluminum sulphate, it did not show any significant difference at a significant level (P≤0.05). The reason of high hardness in wastewater may be due to the chemicals

thrown out from the production departments that used in preparation. The reason for the decrease in the hardness value is due to the zeolite. May ability to hold calcium and magnesium ions and the rest of the ions significantly. It was also observed that in general performance that could have resulted from the fact using filter system has relatively small spaces to enhance sedimentation and filtration the results of the study agreed with [20, 21].

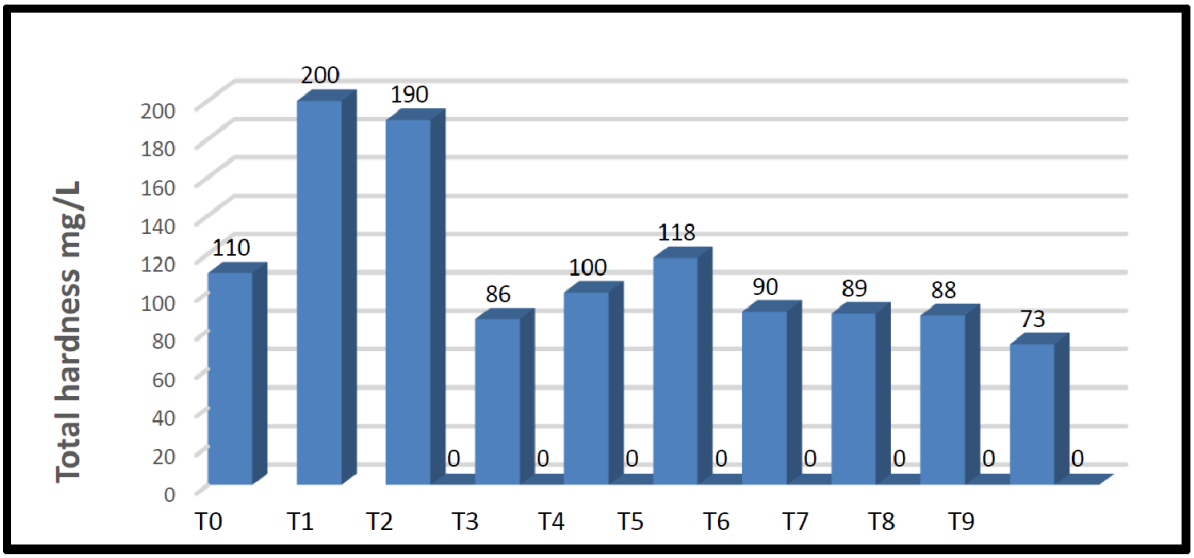

Figure7: Effect of triple filter system including Zeolite Stone in Total hardness value of wastewater treatment

IV. CONCLUSIONS

Zeolite stone achieved clear results in removing pollutants from wastewater and river water as alternatives methods compared with traditional treatment .

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