Using Treated sewage water for irrigation to Reduce Environmental Pollution

Azzam H Al-Hadithy², Wafaa Gh Al-Qaysi¹ and Luay Q Hashim²

¹Department of chemistry Collage of Science- Al-Nahrain University
²Environmental& Water. Directorate/ Ministry of Science & Technology

Email : azzam.hadithi@yahoo.com

Abstract. This study is conducted to investigate the validity of using different levels of Rustumiya sewage water for irrigation and their effects on corn growth and some of the chemical properties of the soil such as electrical conductivity and soil pH in extract soil paste, the micro nutrient content in soil and plant which are (Fe, Mn, Zn, Cu, Cd, Pb). Three levels of sewage water (0%, 50%, 100%) in two stages were used, the three levels of wastewater (without soil fertilization) were used in the first stage, Where 320 Kg N/ha+200 Kg P₂O₅/ha was added to the soil as fertilizer in the control (0%) treatment and 160 Kg N/ha+100Kg P₂O₅/ha were added to 50 and 100% levels in the second stage. Corn seeds were planted in 10 kg plastic pots in Completely Randomized Block Design in three replicates. The results show a high significant increase in plant height, fresh and dry weight for all treatments in comparison with control treatment. The low added level of sewage water in both stages gave a significant increase of plant height and fresh and dry weight. The results showed a high increased of electrical conductivity for 50%, 100% wastewater added levels for both stages compared with control treatment. The high added level 100% gave high significant increase in electrical conductivity compared with the low level of the sewage water. Whereas the values of soil pH were close to the neutral for all treatment. The results showed a significant increase in micro nutrients content (which include Fe, Mn, Zn, Cu, Cd, Pb) in soil and plant for all treatments compared with control treatment. This increase was continued with the increase of additional level of sewage water. However all the micro nutrient were within the allowable natural limits and not reached the toxic limits in soil and plant.

Introduction:
Studies of water at the present time of the basic necessities that you must do to the fact that water quality has been limited to a agricultural production both quantitatively and qualitatively. Given the limited potable water for irrigation, efforts have been focused towards a non-conventional water resources such as sewage treatment and reuse for agricultural purposes. That the main purpose of the treatment process is to get the treated water to the extent that makes the risk to public health and the environment in appropriate and reasonable level, and regardless of the type of processing units, they lead to the minimization of organic solids and remove the chemical contents that may have toxic effects on the crops, as well as biological components (pathogens), which is the most important source of concern for public health [17]. That sewage is water, which previously used to or resulting from residential areas, industrial, and
rainwater and entering the sewage system, and use the term waste water (wastewater) instead of the wastewater (sewage) to denote the water resulting from population and industrial [15].

Most studies that were conducted on the use of sewage water for irrigation purposes emphasized the different nature and contents of this water in different sources and also indicated a possible benefit of this water in irrigation and fertilization of agricultural land to the content of nutrients essential for plant growth with the need to identify the contents prior to use for agricultural purposes so as to contain in some cases, high concentrations of some elements than natural boundaries may also contain other toxic substances and disease causes directly or indirectly to environmental hazards on the plant and creatures consuming [21,19].

That the impact of waste water in the growth of plants is determined by several factors including the chemical composition of water and type of treatment which have been and the level of Addition and the type of plant growing and soil conditions and climatic conditions of the agricultural season, as indicated most of the studies to the lack of negative effects on growth and winning of plants irrigated with waste water[14, 11.3].

The level of salt in the water sewage is usually acceptable in terms of agricultural land, where the origin of this water returns to the domestic water that are quality mostly good and safe to drink] 16.12 [In general, there is an increase in the concentration of salts in the sewage treatment on the source and up to eight times [10].

The content of the sewage from the salts of the important indicators that must be taken into account when using this water for irrigation, has developed the Food and Agriculture Organization [16] the standards that apply in the diagnosis of water quality to agriculture in terms of salinity, however, that many countries use water for irrigation increases the amount of dissolved salts in which about 2000 mg / L, but followed the proper management to avoid accumulation of salts. Where you can control the salinity of the soil by controlling the movement of water within the soil and then wash salts thereof [12.11].

Constitute the contents of the sewage of the heavy elements a source of concern because of their impact on the properties of both soil and plants, groundwater and the environment in general, and the situation becomes more important and dangerous if mixed with sewage water to industrial wastewater [15] It is necessary to estimate the concentrations of minor elements in waste water and rely on it mainly in determining the validity of their use for agricultural purposes as they gather near the roots of crops, with the possibility of contaminating the parts of edible crops, and is also necessary to estimate the following micronutrients: copper, zinc, cadmium, lead, nickel [1]. The concentrations of the true elements of the smaller waste water differ from one society to another and also vary according to the nature of the transaction taking place by, however, are not these natural concentrate elements wastewater any risk when treated agricultural soils by [2], and the minor elements interact sometimes compounds with soil organic complexes to be located in the membership of a slushy or steel, and that toxicity may appear when wastewater containing high concentrations of toxic elements to the soils of the degree of interaction (pH) low [24].

The studies pointed to the importance of soil and river water that receives wastewater to protect the environment from pollution, and that the water is working to alleviate the waste water, soil work as a filter to the waste water. As well as the viability of water and soil on the biological purification of wastewater [5].

The study aims to find out the possibility of using sewage to irrigate crops maize and its impact on some soil chemical properties and nutrient content of major and minor in soil and plants.

**Materials and methods:**

Chosen to conduct the study, soil from the station Rustamiya south of Baghdad, quoted the soil to the site of the experiment in the Ministry of Science and Technology, air dried and passed through a
sieve 4 mm and mobilized valuable potted plastic capacity of 12 kg. Took quantities of sewage Rustamiya for the purpose of the experiment and chemical analysis necessary, and Table (1) shows the characteristics of soil and sewage Rustumiya used in the search. Used three levels of wastewater is 0, 0.50, 100% and two stages, where it was added at the three levels of waste water alone (without the fertilization of soil) in the first stage. In the second phase may add chemical fertilizers at 320 kg N / ha + 200 kg P2O5 / ha to the level of added zero% waste water and 160 kg N / ha + 100 kg P2O5 / ha for the levels of added 50%, 100% wastewater with the addition of nitrogen source urea and phosphorus from a source fertilizer triple superphosphate and thus bringing the total transactions of six treatments are given symbols the following:

1. (W0) a 0% waste water (control treatment) and irrigated with river water.
2. (W0 + F) is zero% water exhaust + (320 kg N / ha + 200 kg P2O5 / ha).
3. (W1 + 0.5 F) 50% wastewater + (160 kg N / ha + 100 kg P2O5 / ha)
4. (W2 + 0.5 F) and 100% wastewater + (160 kg N / ha + 100 kg P2O5 / ha)
5. (W1 + 0.5 F) 50% wastewater + (160 kg N / ha + 100 kg P2O5 / ha)
6. (W2 + 0.5 F) and 100% wastewater + (160 kg N / ha + 100 kg P2O5 / ha)

The experiment was designed according to randomized complete block design with three replications and 10 were planted the seed of the maize variety spring reduced to five plants after ten days. I brought water to experience water and river water to reach soil moisture to 2/3 water ready at field capacity. And record the weight of each pot with its contents to compensate for the lost water and maintain humidity at the same level. Plants harvested after 75 days of Agriculture and by cutting off parts of the vegetation above the soil surface directly. And dried at a temperature of 60°C for 48 hours either by measurements conducted at the end of the experiment, it included the plant height and fresh weight and dry vegetative part. And took soil samples of transactions, all of the analysis of chemical necessary where the amount in the extract paste soil saturated all of the degree of interaction of soil using a (pH meter) and electrical conductivity using (Electrical conductivity) material and the estimated micro-nutrients [23] and the preparation of extract soil tower 10 ml of in 20 ml of a solution of DTPA (DiethylenTriamin Penta Acetic Acid) with no interaction of 7.3 after shaking for two hours and filtration was estimated iron, manganese, zinc, copper, cadmium and lead in solution using an atomic absorption were estimated micro-nutrients in the plant in the manner described in [20], using acid nitric acid digestion of samples Alberrocloret valuble plant and ground using the atomic absorption at the discretion of each of iron, manganese, zinc, copper, cadmium and lead.

**Table (1) characters of soil and sewage water and raw water**

| Character                              | Soil  | Sewage water | Raw water |
|----------------------------------------|-------|--------------|-----------|
| Texture                                | Clay loam | -           | -         |
| Clay (mgm.kg⁻¹)                        | 370   | -            | -         |
| Silt (mgm.kg⁻¹)                        | 386   | -            | -         |
| Sand (mgm.kg⁻¹)                        | 244   | -            | -         |
| Ec (ds.m⁻¹)                            | 3.2   | 2.1          | 0.88      |
| pH                                     | 7.41  | 7.48         | 7.35      |
| (CaCO₃) (mgm.kg⁻¹)                     | 285   | -            | -         |
| K⁺ (mgm.kg⁻¹)                          | 265   | 17           | 0.58      |
| P₂O₅ (mgm.kg⁻¹)                        | 7.6   | 2.7          | 0.29      |
| NO₃⁻ - N (mgm.kg⁻¹)                    | 19.7  | 18.5         | 0.45      |
| NH₄⁺ (mgm.kg⁻¹)                        | 17.5  | 21.1         | 0.36      |
| Cu                                     | 4.2   | 1.4          | nil       |
| Zn                                     | 14.3  | 4.7          | nil       |
| Mn                                     | 46.2  | 5.2          | 0.02      |
| Fe                                     | 21    | 6.3          | 0.45      |
| pb                                     | 2.1   | 0.19         | nil       |
| Cd                                     | 0.21  | 0.20         | nil       |
Results and discussion:

Effect of addition of sewage water in some soil chemical properties and its content of micronutrients:

Showed the statistical results shown in Table (2) Effect of addition of sewage in the values of electrical conductivity of the extract paste saturated soils where we note that the levels of addition of sewage 100.50% and for both cases (without fertilizer and with fertilizer) has been given to increase the quality high in electrical conductivity compared to the treatment of comparison. There is also increasing the quality of high values of electrical conductivity of the level of additive higher (100%) compared to the level of additive low (50%). That this increase in the values of electrical conductivity of the soil when increasing the level of addition of sewage due mainly to contain the water on the large amounts of salts soluble and this result is consistent with the results of tests conducted on sewage to add some plants, referred to the increasing salinity in the soil [14,13,4]

We note that the values of electrical conductivity that we obtained the result of adding sewage was under the category Soil Salinity identified by [25] We conclude from these results that the sewage may have influenced the value of electric conductivity extract paste saturated soils and led to increased to approximately three times at the level of added higher (100% sewage). It can have a bigger impact when you hold the soil in the treatment of sewage, especially in the absence of a good drainage system.

As for the Effect of sewage in the degree of interaction of soil, the results shown in tables (2,1) indicate the degree of interaction clay loam soil before the experiment and after were limited to between 7.50-7.45 it any soil basal medium [25]. Where the results of analysis of variance indicated that there was no difference in the values of the quality of the degree of interaction of soil and all transactions added. This result agrees with researchers who are representatives stressed their experiences during the field for short periods that the degree of interaction of soil during the study phase was close to a tie was not affected by different levels of sewage] 26.22 [previous research has shown that the addition of sewage into the soil may result in higher or decline in the value of the degree of interaction of soil, depending on the source and nature of the components of the sewage used. That the low degree of interaction of soil did not result from melting of calcium carbonate only, but also to the presence of organic acids and free as well as increase the effectiveness of soil biological] 9.1 [The high values of the degree of interaction of soil is attributable to an increase of calcium carbonate in the soil in addition to the high amount of sulfate added during irrigation, and the presence of a proportion of gypsum, which reacts with sodium carbonate and sediment in the form of calcium carbonate [18].

They also showed the results shown in table (2) the impact of sewage in concentrations of micro- (iron, manganese, zinc, copper, lead, cadmium) derived from the soil, where we note that the levels of added water, sewage 50.100% and both cases had given the significant increase in high concentrations elements extracted from the soil compared to the treatment of comparison, there is also a significant increase in the amount of high level of these elements added higher (100%) compared with the level low additional (50%). And attributed this increase to contain the sewage was not bad quantities of these elements and thereby increase the quantities derived from them, with the increase in the level of the addendum. However, the concentration micronutrients studied in soil extracts were within the normal limits allowed and failed to reach critical limits or toxicity caused by soil contamination of these elements. That the critical limits or toxicity for each of the element copper, zinc, cobalt, lead, nickel and cadmium in the soil is (100, 300, 50,100,100, 5, 100) mg / kg, respectively [6.2].

Effect of adding water streams in the growth of maize and content of minor elements:

Results of analysis of variance (ANOVA) to increase the presence of high-quality (a <0.01) in all growth indicators T studied (plant height and fresh weight and dry) for all transactions in comparison with control patients (Table 3). We note also that the addition of water sewage level of 50% and both
cases (without fertilizer and with fertilizer) gave the increase of high quality in plant height and fresh weight and dry weight of the plants of maize compared to the level of additive higher water sewers. And also note the absence of differences in the quality of the growth indicators studied at start a sewage level 50% in the case of fertilization than in the case without fertilization. These results are consistent with the findings of the researchers who have obtained an increase in the growth and yield of maize in the developing soil treated with different levels of sewage [15, 4, 3]. It is clear from the above results that the sewage contains quantities of La Paz with the necessary nutrients to the need of the plant to do not need add half the recommended quantities of fertilizer nitrogen and phosphate when used for irrigation purposes as well as the preferred mixing this water with river water ratio of 1:1 before adding them to the farmland and that to reduce the negative impact of this water, especially the content of soluble salts. The results shown in Table (3) and a significant increase in high quantity of minor elements (Fe, Zn, Mn, Cu, Cd, Pb) absorbed by the plant to all transactions in comparison with the comparison where the increased quantity absorbed these increase the level of the addendum to the sewage This increase was highly significant in the amount of all these elements at the level of additive higher (100%) compared to the level of additive low (50%) and both cases (without fertilization), and attributed that increase to contain the sewage station Rustumiya quantities of La Paz with the minor elements and thereby increase the amount absorbed ones with increasing the level of additive. However, the amount of these elements did not reach the border toxin in corn yellow. has pointed out 2.1 [to the border toxicity of each of zinc, copper, cobalt, lead, nickel, cadmium and chromium in the crop is (10.15, 11,35,6,19,200) mg / kg, respectively. But he must be careful when using sewage water to irrigate other crops that are eaten fresh, taking into account the comparison with all the experimental conditions related to research in order to avoid the problem of increasing absorption of those elements by crops. These results are consistent with what he found most of them researchers and [15, 8, 7, 2].

Conclusions:
1 - You can use the Rustumiya sewage for irrigation purposes in the soil medium tissue, taking into consideration the control of soil salinity and the amount of minor elements extracted from the soil at the end of the season.
2 - Preferably this mixing with river water ratio of 1:1 to reduce the amount of salt dissolved in it.
3 - Prefers not to add fertilizer's chemical land irrigated with sewage to achieve better productivity of the maize corn crop.

Table (2) Effects of wastewater on some of soil characters and content of trace elements

| Trace elements (mgm.kg⁻¹) | Pb | Cd | Cu | Zn | Mn | Fe | pH | Ec ms.m⁻¹ | Treatment |
|---------------------------|----|----|----|----|----|----|----|-----------|-----------|
| 1.5                       | 0.11 | 4.4 | 14.2 | 42.2 | 16.2 | 7.46 | 3.6 | %0 (W0)   |           |
| 1.9                       | 0.20 | 8.7 | 16.8 | 48.7 | 25.5 | 7.47 | 6.4 | %100 (W1) |           |
| 1.2                       | 0.29 | 13.8 | 18.9 | 52.1 | 36.7 | 7.43 | 9.8 | W0+F      |           |
| 1.6                       | 0.16 | 6.3 | 14.5 | 46.2 | 11.4 | 7.46 | 3.7 | W1+0.5F   |           |
| 2.0                       | 0.21 | 9.8 | 16.1 | 46.9 | 24.8 | 7.51 | 6.4 | W2+0.5F   |           |
| 2.4                       | 0.28 | 14.9 | 18.9 | 50.4 | 35.9 | 7.44 | 9.9 | LSD 0.05  |           |
| 0.148                     | 0.061 | 0.579 | 1.190 | 1.624 | 0.221 | 1.402 | 0.614 | LSD 0.01  |           |
| 0.307                     | 0.085 | 0.823 | 1.811 | 2.316 | 0.304 | 1.994 | 0.781 |           |           |
Table (3) Effect of wastewater addendum on plant growth and content of trace elements

| Pb  | Trace elements (mgm.kg^{-1}) | Dry weight gm | Wet weight gm | Plant length cm | Treatment |
|-----|-----------------------------|--------------|---------------|-----------------|-----------|
| 3.1 | 0.19                        | 8.6          | 30            | 59              | 116       | 27        | 89        | 76            | %0 (W0) |
| 3.8 | 0.34                        | 10.1         | 48            | 78              | 181       | 42        | 196       | 121           | %50 (W1) |
| 4.4 | 0.46                        | 12.5         | 69            | 116             | 226       | 38        | 152       | 99            | %100 (W2) |
| 3.6 | 0.28                        | 9.3          | 35            | 102             | 205       | 39        | 182       | 113           |         |
| 4.0 | 0.36                        | 10.2         | 50            | 90              | 193       | 43        | 198       | 120           | W0+F    |
| 4.4 | 0.44                        | 13.1         | 74            | 122             | 228       | 37        | 150       | 112           | W1+0.5F |
| 0.229| 0.058                       | 0.510        | 3.449         | 3.329           | 2.536     | 2.815     | 6.408      | 5.487         | LSD 0.05 |
| 0.326| 0.080                       | 1.569        | 4.909         | 4.736           | 3.608     | 4.019     | 9.114      | 6.532         | LSD 0.01 |

1. (W0) a 0% waste water (control treatment) and irrigated with river water.
2. (W1) is 50% waste water (waste water mixing with river water 1:1).
3. (W2) which is 100% wastewater.
4. (W0 + F) is zero% water exhaust + (80 kg N / acre +50 kg P2O5 / acre).
5. (W1 +0.5 F) a 50% wastewater + (40 kg N / acre +25 kg P2O5 / acre)
6. (W2 +0.5 F) and 100% wastewater + (40 kg N / acre +25 kg P2O5 / acre)

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