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THE STUDY OF URBAN TREATED SEWAGE UTILIZATION IN GREEN SPACE IRRIGATION(A CASE STUDY: USING TWON GHODS SEWAGE REFINERY IN TEHRAN)

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ABSTRACT

In water shortage conditions, using treated urban sewage in irrigating green space can be a good solution. In order to study urban waste water utilization in green space irrigation, we selected the area of Twon Ghods Sewage Refinery in Tehran in this research. Lands treed with pinus nigra and under irrigation with waste water was selected as the experimental area and lands treed with pinus nigra and under irrigation with well water as the control group. Three 20 m x20 m plots were selected in a systematic random way in both areas. Leaf samples, soil samples (at a depth of 0-15 cm and a depth of 15-30 cm) and well water and waste water samples were collected in each plot at four times with 20 day intervals from early March to early May. The growth factors of the trees (height, trunk diameter, and diameter) were measured in mentioned plots. Results showed that treated sewage was better than well water in terms of irrigation quality. Overall, using urban treated sewage increases the performance of trees rather than using well water.

KEYWORDS

utilization, urban treated sewage, irrigation, green space.

1 INTRODUCTION

While municipal wastewater as a source of infection is considered, in the world now as a new source of water supply is discussed. Considering the dual nature of water supply and sanitation means a source of pollution sources, water recycling as one way to work and key opportunities to improve the water situation is considered [17]. Population growth and concentration in large cities increased household waste volume has been severe [14]. Concerns resulting from environmental impacts of waste and lack of resources, fresh water hand the other hand, the need for optimal utilization of the effluent will tell [11]. In this location, especially sewage, because there need green space around the crowded cities and the need for water supply for irrigation of green space, the importance of taking purified sewage in the urban sector has increased [23]. Quality and quantity of chemical waste in different

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cities are different and largely depends on economic conditions, social, labor and business community and urban living standards of people there [9]. [22], with the application of pollution caused by urban and industrial wastewater in the agricultural lands south of Tehran with the experiment and chemical analysis of soil, plants and measured amounts of total and available metals cadmium, copper, lead, chromium and nickel three years, concluded that the concentration of these six elements in land irrigated with wastewater was higher than the control area and the total amount absorbed and the above metals in soils irrigated with waste water absorbed by these metals in plant research in the area has been increasing. [20], with the effect of wastewater quality in the accumulation of heavy metals in soils south of Tehran with testing and chemical analysis of soil, plants and water drainage outlet and measuring the elements zinc, lead, cadmium and nickel concluded that elements in the drainage outlet water to waste water with very low and long terms use of wastewater for irrigation, soil Firouzabad Creek south of Tehran, the rate of heavy metals zinc, cadmium, lead and nickel in soil is higher than standard.

The highest accumulation of 90-60 cm soil depth to be seen. [18], with consequence of urban wastewater irrigation on some chemical characteristics of soils and accumulation of Isfahan Borkhar some elements in shoots and roots of alfalfa plants concluded that seven years has managed to land irrigated with wastewater salt sodium and other treatment area without a proper soil for conversion to agriculture. Irrigation with wastewater a significant effect on reducing sodium salt solution and exchangeable sodium and total soil and has been able organic carbon and total organic nitrogen, available phosphorus and total soil CEC and especially in the upper layer increases does. But is not pH, soil total N and K will change. Irrigation with effluent levels of heavy metals in plant tissue was notBrought harmful to the border. Zinc and potassium in shoots of alfalfa plants showed accumulation of elements potassium, manganese and zinc in plant shoots was significantly higher in roots and iron and sodium in roots than shoots are.

2 MATERIALS AND METHODS DESIGN

2 study area in the region of Tehran Municipality and the geographical location of approximately 51 degrees 21 minutes east and latitude 35 degrees 46 minutes North Grfthast. Altitude of about 1535 meters, the average annual rainfall 405 mm and mean annual air relative humidity is 45 percent. Species of plantation land by nigra Pinus, with 2 × 2 m planting Fvsl wastewater Ghods that Tehran for eight years as a regional wastewater irrigated land and plantation treated with regular park Pardisan species in Tehran During the same period of water for irrigation have been seen as a region, were selected (Figure 1). Sampled during two months was carried out as follows. This study randomly m20 × 20 plot number 3 in the treated area and 3 m 20 × 20 plot in the control area was implemented. In these plots, height, height of 10 cm diameter trees from the ground and canopy trees in late March to late May was measured [6]. Treatments in each of three pieces of systematic random sample was selected with the distribution. In each of the components, samples and healthy leaf without any stress and disease, as well as soil samples in the depth of 15-0 and 30-15cm, well water and effluent samples, for analysis were taken in four replications. Soil samples in vitro, then dried in a porcelain mortar clod with a pestle into crushed to sizes smaller than one mm2, isolated from soil pebbles of wisdom to help mm2 sieve has been done in the laboratory. For samples extracted from the plants studied, after transferring the samples to the laboratory and washing leaves, dry leaves in the mortar has some ground to become powder. After weighing the samples at temperatures 70 to 80 ° C were dried for 72 hours [3]. Powdered samples (5 g

of each sample 1 g of soil and leaf samples) to prepare solution digestion and extraction methods were used. To determine the concentration of all elements in well water and wastewater, soil and leaf Aspktrv Photometers atomic absorption method (flame) is used. Except that nitrogen and phosphorus Kjldal N method that colorimetric methods using spectrophotometry during the wave of 470 nm was measured.In gauging method to determine soil texture and soil moisture standard method for determining the (weight) is used. Analysis of data from different stages of this study statistical software SPSS11.5, Excel6.0 were used. To compare the elements of water and wastewater, compared to the same soil depth of two regions compare two samples of leaf area irrigated with wastewater and water wells in the first stage of their normal Kolmogroff-Smirnoff test was studied.In case of normal data for comparison Ghyrjfty t test was used. The parameters for comparison to world standards on irrigation test sample test-t One was used.

Figure 1 - Satellite image study area (Park campus and wastewater Qods Tehran)

3 RESULTS AND DISCUSSION

Properties of urban waste water and well water As in Table (1) is shown, the measured rate of elements (Zn, pb, Mn, Mg, P, Na) in well water and municipal wastewater treatment plant that was used for irrigation of green space are indicated All elements except the element of sodium and lead in urban treated wastewater is more than well water. That this difference statistically significant. Lead elements of the well water than in urban treated wastewater, but the difference was not significant. Also the element sodium in well water were higher than in urban wastewater. The difference in statistical significance level was 99%. Most of these elements exist in the effluent due to the material in municipal wastewater treatment plant that is appropriate to limit the amount has diminished. Differences in the rate of substances in municipal wastewater represents the type and amount of these materials by the city is that even this amount of material in different seasons can be different. The results of heavy metal wastewater samples indicate that metal concentrations are not higher limit and in some trace elements and even to zero is [16]. [13], of nickel, lead, cadmium and chromium in the treated wastewater used for irrigation than the well water used, the difference was not significant. [15], with a study of hospital wastewater for irrigation of green space, with parameter Na, SAR, treated wastewater and their values 5 / 2 and 5 / 37, to the conclusion that achieved the

desired quality of sewage water irrigation water in the middle row is located.Also based on comparison with treated wastewater quality standards of environmental quality of all the parameters in the agricultural reuse standards conform. [20], in the parameter results lead on to study achieved similar results.

Table (1) compare the quality of municipal wastewater and well water in terms of measurable parameters (mean ± standard error)

Parameters	Irrigation sources	Values measured	WHO Hach(2002)
Zn (ppm)	Wastewater	a0.006 ± 0.06	ns 2
	Well water	b0.0006 ± 0.002	ns 2
Pb (ppm)	Wastewater	a 0.003 ± 0.013	ns1
	Well water	b0.07 ± 0.13	ns1
Mn (ppm)	Wastewater	a 0.07 ± 0.25	ns1
	Well water	b0.0006 ± 0.003	ns1
Mg (ppm)	Wastewater	a 0 ± 0.9	ns100
	Well water	b0.04 ± 0.6	ns100
P (ppm)	Wastewater	a 0.2 ± 3.8	----------
	Well water	b 0.02 ± 0.12	----------
Na (ppm)	Wastewater	a 2.09 ± 44	ns 200
	Well water	b 0.7 ± 59	ns 200

PHYSICAL AND CHEMICAL PROPERTIES OF SOIL

Strength and reliability of heavy metals in the soil than the other pollutants were very long and soil pollution by heavy metals is approximately constant [10]. As shown in Table 2, the concentration of all elements (pb, Mn, Mg, P) measured in deep soil irrigated with wastewater 15-0 to the elements zinc and sodium than the soil irrigated with well water This difference is only in the elements (Mg, P) was significant. The depth of soil irrigated with wastewater rate 30-15 All elements except Mg and Na elements, most of the soil irrigated with well water depth was the difference in the concentration of manganese, magnesium, phosphorus and sodium than is statistically significant . Percent Organic matter soil irrigated by well water than the soil irrigated with wastewater that is not a significant difference. Analysis of soil heavy metals Baghmlk city shows that the concentration of cadmium in most treatments are not permitted concentration of lead in all treatments, but the limit is higher. Soil analysis showed that concentrations of heavy metals such as heads of cadmium, nickel and lead is not greater than the limit [16]. The most important effect on the sewage soil, increasing its salinity and fertility has been reduced. In studies conducted in Australia has been shown that the soil which the effluent is used for irrigation of soil fertility has increased. Long-term use of wastewater in addition to worldwide changes in the permeability of soils caused soil

salinity also has been gradual [7]. Metal concentrations ranging from (Cr, Co, Ni, Cd, pb) in areas with effluent irrigation were compared with soil water for irrigation, but was more negative effect on soil and plants have not grown [17]. Levels of heavy metals zinc, lead, cadmium and nickel in soil is higher than standard. Accumulation of heavy metals in soils of south Tehran over the years has done more in the lower parts of the soil is established [20]. The effect of effluent irrigation on heavy metal accumulation in different organs of plants, with measured concentrations (Cr, Co, Ni, Cd, pb) in two plants and plant rye Sudan, showed that cadmium and lead concentrations lower than in rye The concentration of elements in the Sudanese plant was estimated, while the concentration of chromium, cobalt and nickel in plants Sundanese less than rye is calculated [8].

Table (2) Comparison of some physical and chemical properties measured in the soil by planting trees, black pine (mean ± standard error)

Soil depth				Physical and chemical characteristics
Depth 30-15		Depth 15-0		
Wastewater	Well water	Wastewater	Well water	Irrigation sources
1.5666 0.0366 ±a	a 0.3157 ± 1.99	0.2367 ±1.92333a	a 0.39976 ± 2.366	Organic matter
a 0.085 ± 0.95132	a 0.101 ± 0.845525	a 0.0458 ± 0.883	a 0.0365 ± 0.95682	Zn (ppm)
a 0.014 ± 0.2775	a 0.0219 ± 0.25	a 0.030 ± 0.2425	a 0.0193 ± 0.195	pb (ppm)
a 0.487 ± 8.006	b 0.229 ± 5.6895	a0.373 ± 10.48025	a 0.915 ± 8.76625	Mn (ppm)
a0.21 ± 2.3025	b 0.1518 ± 3.8625	a 0.589 ± 4.075	b0.381 ± 1.275	Mg (ppm)
a 0.742 ± 12.9975	b 0.5946 ± 4.465	a 0.369 ± 7.185	b 0.229 ± 5.03	P (ppm)
a 0.468 ± 3.7075	b 0.6167 ± 11.1975	a 0.522 ± 3.5075	a 0.334 ± 4.1975	Na (ppm)

RESULTS OF ANALYSIS OF ELEMENTS MEASURED IN LEAVES

The use of green space in the wastewater effluent quality in terms of physical and chemical properties have important among these factors, elements that cause sensitivity in plants are important and must be placed precisely measured [4]. In this study elements (Zn, pb, Mn, Mg, P, Na) in leaves of plants, study areas have been measured. In experiments done on the leaves, as different elements are there. To compare the measured elements of the two regions Ghyrjfty t test was used.As indicated in Table 3, the results show that concentrations of all elements (Zn, Pb, Mn, P) to the component elements of magnesium and sodium in leaves of black pine trees irrigated with effluent than irrigated leaves black pine trees with well water is. This difference on the element, manganese, nitrogen and phosphorus, and potassium significantly Darbvdh, lead, magnesium and sodium is not significant. [5], to study wastewater use in irrigation of crops paid in accumulation of heavy metals in agricultural crops, fixed the amount of lead, cadmium, nickel and chromium were increased. This increased level was not toxic to plants. The results with the results [20], are consistent.

Table (3) comparing the measured elements in the leaves of black pine trees (mean ± standard error)

Irrigation source		Nutrients measured in leaf
Irrigation with wastewater	Irrigated with well water	
0.0709 ± 0.55825 a	0.064317 ± 0.29905b	Zn (ppm)
0.047675 ± 0.4775a	0.0312249 ± 0.175b	P (ppm)
0.183275 0.013749 ±a	0.2258 0.0280995 ±a	Na (ppm)
0.018357 ± 1.559a	1.522 0.01509 ± a	Pb (ppm)
1.06965 0.061099 ±a	0.060202 ± 0.69997 b	Mn (ppm)
0.014358 ± 0.24a	0.0144625 ± 0.256a	Mg (ppm)

THE RESULTS OF ANALYZING THE BLACK PINE TREES GROWING

As the diagram (1, 2, 3) is observed, the rate of growth factors measured trees (height, stem diameter, crown diameter) in the effluent irrigation than water for irrigation is. This difference is statistically significant. Because more than likely that concentrations of elements in municipal wastewater and accumulate these elements in soil is irrigated with wastewater. Afyonei, 1377, expressed, organic substances in wastewater may improve soil physical conditions for plant growth are better. [19], the gradual increase of nutrients through the soil irrigated with wastewater is given greater plant growth compared with the addition of these materials as fertilizers is. [2], reported that the effect of irrigation on tropical grass Bermudagras with domestic wastewater in Florida, the amount of uptake throughout the study period has increased. [12] have expressed, because the nutrients in sewage, agricultural production may amount to a significant increase. Suspended solids, dissolved substances and waste containing colloid major plant nutrients (N, P, K) and copper, iron and zinc are. For this reason, irrigation with sewage fertilizer rate required to reduce bloom growth and survival rate of plants increases. Using the effluent from a sewage discharge prevents the environment and the other is due to reduced Organic matter and abundant mineral fertilizer in agriculture and as a rich source of nutrients for plant growth and development is [21].

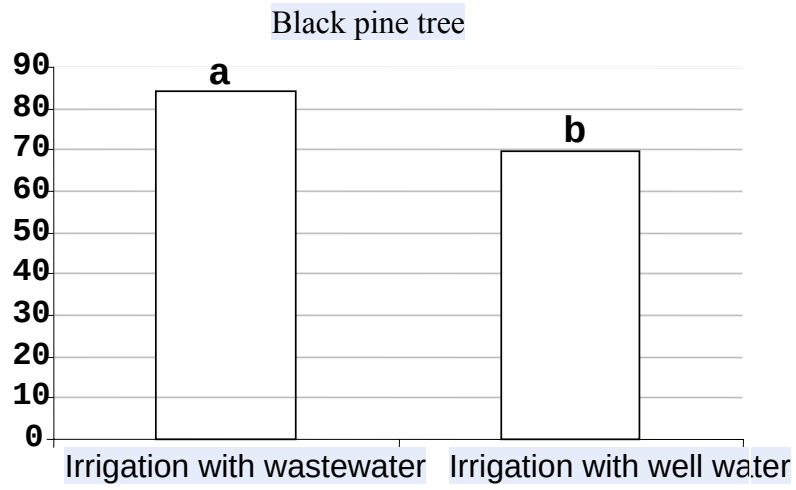

Chart 1 - crown diameter measured in black pine tree

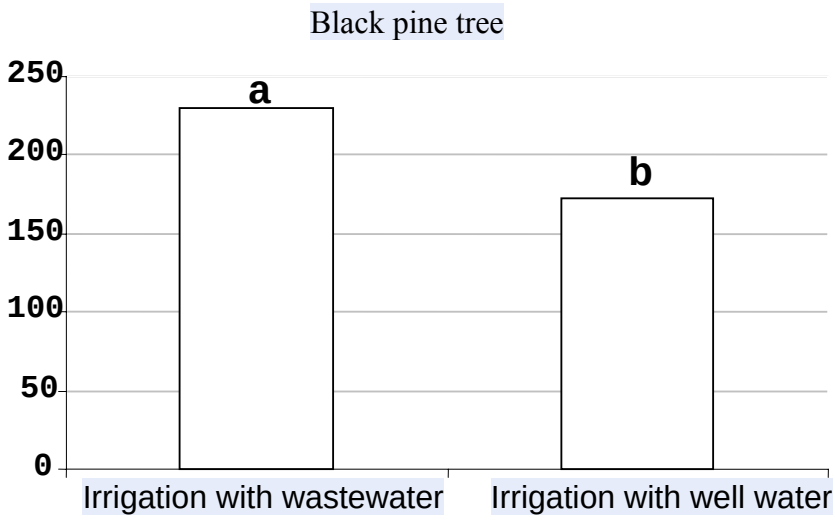

Chart 2 - height measured in black pine tree

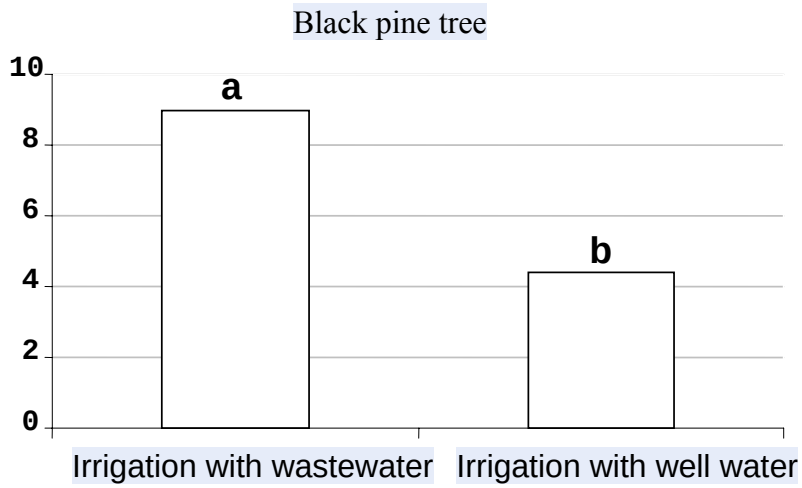

Chart 3 - stem diameter measured in the dark pine tree

4 CONCLUSION

Use of urban treated wastewater increased nutritional elements in soil and leaf pine was black. Heavy metal accumulation in leaves and black pine trees in different soil depths was observed. The concentration of elements in the leaves of trees irrigated with treated wastewater standards were lower than in urban.The growth rate of black pine trees irrigated with treated wastewater in urban compared with black pine trees irrigated with well water were higher. Black pine species good ability to absorb elements from the soil is contaminated, without any adverse effect of attracting accept. Therefore, the black pine species suitable for use on one species of green space as well as a useful and effective reform of soil contaminated with high efficiency to be used.

REFERENCES

20. Afyonei, M.., Rezaei Nejad, the., Khyambashy B., 1377. Effect of sewage sludge on yield and heavy metal uptake by lettuce and spinach. Journal of Natural Resources and Agricultural Sciences, 2: (1), pages 30-19.
21. Alhandes, M. N., Allick, S.A.,Overman,A.R.leseman, W.G. and Vidak, W.1995. Municipal water reuse at Tallahanssee, Florida. Trans. ASAE38(2) : 411-418.Quian, Z., Tan, T. C., 1998. A model for multicomponent biosensing and its application to a dead cell-based BOD biosensor. Chem. Eng. Sci. 53, 3281-3294.
22. Bahati M., and Singh G, (2005), Groth of Dalbergia sissoo in desert regions of western India using municipal effluent and plant chemistry, Bioresource Technology, 96:1019-1028pp.Liu, J., Björnsson, L., Mattiasson, B., 2000. Immobilised activated sludge based biosensor for biochemical oxygen demand measurement. Biosens. Bioelect. 14, 883-893.
23. Bandari. KH, Ghodosei, F.., Samiei, l., 1378. From vast water environmental aspects using purified sewage Drabyary Tabriz., Conference environmental aspects Drabyary From vast water use., DOE, Iranian National Committee on Irrigation and Drainage.
24. Bahmanyar, M. AS., 1386. Effects of wastewater use in irrigation of crops on some soils and plants of heavy metals., Environmental Studies, Thirty-Third Year, No. 44, Page 26-19.

25. Hopmans P., Stewart H.T.L., Flinn D.W. and Hillman T.J. (1990), Groth biomas production and nutrient accumulation by seven tree species irrigation with municipal effluent at Wodonga Australia, Forest Ecology and management, 30: 203-211.Chan, C., Lehmann, M., Chan, K., Chan, P., Chan, C., Gruendig, B., Kunze, G., Renneberg, R., 2000. Designing an amperometric thick-film microbial BOD sensor. Biosens. Bioelect. 15, 343-353.
26. Jabali, AS., 1378. From vast water world experience Hadrabyary application. Conference on environmental aspects Drabyary From vast water use. Energy Ministry, Iran's National Committee on Irrigation and Drainage, pages 45-27.
27. Kharraz, Munther, (2001). Use of Treated wastewater for Irrigation Madaba Egypt.
28. Matin, l., 1372. Irrigation with municipal wastewater solution to water shortages. Journal of Research and Construction, No. 25, Winter 73, page 22-18. t an, T. C., Li, F., Neoh, K. G., 1993. Measurement of BOD by initial rate of response of a microbial sensor. Sens. Act., B. 10, 137-142.
29. Mashkvh, M.. 1383. Effects of pollutants on soil elements. Agriculture Sadra, Yazd.
30. Najafi, C.., Moussaoui, M.., Abedi, M.., 1380. Effects of drip irrigation methods used in improving utilization of municipal wastewater effluent. Conference on the environmental effects of agricultural effluent on surface water and groundwater, Tehran, Iran, Page 90-85.
31. Naseri, SA., 1378. Methods, criteria and management of health plans to reuse treated wastewater. Water and Environment Journal, Issue 34, Page 25-13. t an, T. C., Li, F., Neoh, K. G., 1993. Measurement of BOD by initial rate of response of a microbial sensor. Sens. Act., B. 10, 137-142.
32. Panahpour, l., afyonei, M.., Homaei, M.., Howdajei, M.., 1387. Mobility of Cd, chromium and cobalt in soils treated with sewage sludge and metal salt and the vegetables in the region attracted by the East of Isfahan. Journal of Water and Wastewater, No. 67. t an, T. C., Li, F., Neoh, K. G., 1993. Measurement of BOD by initial rate of response of a microbial sensor. Sens. Act., B. 10, 137-142.
33. Pescod, M.B. (1992). Wastewater treatment and use in agriculture, F.A.O. irrigation and DRAINAGE, 47-113PP.
34. Pourdara, AH., Zyny, M.., Fallah, vol., 1383. Use of hospital effluent for irrigation of green space. Water and Wastewater, Issue 49, Page 43-49.
35. Research Project, Ministry of Agriculture, Soil and Water Research Institute. 1377.
36. Sabetraftar, AS., Shanesaz, M.., Hosseinifar, AS., 1380. Experiences of countries in the Middle East and North Africa in wastewater reuse. Conference on the environmental effects of agricultural effluent on surface water and groundwater.
37. Safari Sanjany, AS., Hajrasoliha, Sh., 1379. Quality wastewater treatment plant north of Isfahan for Agriculture, Water and Wastewater Journal, 33: 26-20.
38. Shaygan, .j, 1378. Experiences obtained from a field irrigation experiment with treated wastewater. Conference on environmental aspects From vast water used in irrigation. Energy Ministry, Iran's National Committee on Irrigation and Drainage, pages 97-80.
39. Sohaili, M.., 1373. Effect on effluent quality and employment of heavy metals accumulation in soils south of Tehran. Thesis (MA), Tarbiat Modarres University. Page 92.
40. Tavakoli, M.., Tabatabai, M., 1378. Irrigation with treated wastewater. Conference on environmental aspects Drabyary From vast water use. Energy Ministry, Iran's National Committee on Irrigation and Drainage, pages 26-1.
41. Torabian, AS., Bghvry, l., 1376. Pollution caused by urban and industrial effluents on agricultural land south of Tehran. Environmental Studies, No. 18, pages 46-32.

42. Vazquez, M.,Oscar N., Horan, J., and Duncan, D.(1996), Management of domestic wastewater for reuse in irrigation, Jornal of water Science and Technology.3: 185- 192pp.