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Review the Environmental Effects of Using Industrial Wastewater Effluent (Case Study: Iran Qom Shokouhie Industrial State)

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Abstract

The overall goal of this study is investigating the environmental impacts of using wastewater effluent of industrial states in irrigation of green space. For this purpose, industrial state of Shokouhieh in Qom Province in central of Iran was selected as a case study. Firstly, the quality and quantity of inputting wastewater into refinery and outputting wastewater effluent were measured on important parameters of pH, TDS, TSS, COD, BOD and wastewater temperature in refinery laboratory of industrial state of Qom Shokouhieh during 12 months from March 2012 to March 2013. Then analysis of chemical, biological and physical indicators of irrigation wastewater (effluent) and measurement of heavy metals were done in June 2012 and January 2013 according to the standards instruction for the water and wastewater treatment. Also, heavy metals, EC, pH, and Mg^{2+}, Ca^{2+}, Na^{+}, k^{+} of soil of industrial estate of Qom Shokouhieh were studied. Then, Rapid Impact Assessment Method (RIAM) and Entropy Method were used to analyze the data. In Rapid Impact Assessment Method, socio-cultural, physicochemical, biological and economic environments get the highest negative impacts respectively. In Entropy Method after weighting the environmental factors, public health and other disease parameters with the weight of 0.147, soil chemical properties with the weight of 0.136, soil toxicity with the weight of 0.126 were allocated the first rate up to the third rate respectively. After comparing the results of these two methods with each other, the main limitation of using wastewater effluent of industrial estate of Qom Shokouhie in irrigation of green space is entering chemical pollutants (nitrate) into groundwater, salinity and toxicity of soil of industrial state and endangerment of workers and labors public health who work in industrial state of Qom Shokouhie (specially the labors who exposure directly with the wastewater

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effluent and labors work in refinery).

Keywords

Industrial Wastewater Effluent, Irrigation, Green Space, Environmental Impact Assessment, Rapid Impact Assessment Method, Entropy Method, Industrial State

1. Introduction

During the past decades, rapid industrial developments in different countries have been putting an increasing pressure on the water resource requirement in the island country [1]. The demand for quality water resources in the industrial and agricultural sectors will be difficult to meet in the foreseeable future because of dwindling supply [2]. The imbalance in the demand and supply of water resources will become a common major issue confronting many countries around the world as well in the next few decades [3]. Throughout the last decade, industrial wastewater reuse has emerged as an important and viable means of supplementing dwindling water supplies in a large number of regions throughout the world [4]. In many instances, reuse is also promoted as a means of limiting wastewater discharges to aquatic environments [5]. Wastewater use occurs either indirectly, when partially untreated effluent is discharged into rivers that supply water for agriculture, or directly, at municipal farms when partially treated sewage effluent is conveyed into some gardens [6]. Past experience had shown that these developmental projects, created with the aim of producing socio-economic benefits, have also produced adverse environmental impacts [7] such as land degradation. The long term's irrigation influence by sewage was studied in China and California State in America. [8] determined that irrigation with sewage would change some physical and chemical attribute of soil and some of this changes increased soil's quality. Also, sewage has nutrient and mineral substances that increase crops and soil productivity. So, this method is an important and suitable way to increase soil's product at dry and semi-dry areas. The only worry is heavy metals that will remain their bad effects after long time, so the risk assessment must be done for sewage using. The potential reassessment was performed in Greece to survived sewage quality [9]. It's shown that secondly sewage using for irrigation is suitable for crops that do not use raw. [10] studied about secondly sewage irrigation impact on soil's geochemical features in east Tunisia. They found that developed irrigation by infiltration sewage will increase salinity of soil and this salt will change soil's structure. [11] studied about related risks of sewage reusing for environment in Greece and Cyprus. They found that the human's health and environmental ecosystems are more important than water balance and water management. The irrigation by sewage influence on crop's quality was studied in Tunisia [12]. They found that though this method is a very effective way but it is a big risk for agriculture's crops and green environment also and changing crops and food quality is the biggest risk among them. [13] also studied about irrigation by sewage and environmental hygiene in Australia and showed that because of world's limited source, sewage reusing and resumption are an urgent way but public health and environment must be preserved.

2. Case Study

Iran Qom Shokouhie industrial state by 995 hectare extent located at 12 kilometers of Tehran-Qom old roads at center of Iran. This industrial state located at 42 - 34 geographical longitude and latitude at north and 51 - 50 at east and it is the nearest town to Qom in Iran. The state's refinery based on two modulus and working with 2000 square meter average capacity at day. The refinery method of this industrial state is synthetic. Some part of the refined sewage of this industrial state are using for green space irrigation and the rest of that are using for industrial section after some advanced refinery stages. The green space of this industrial state contained green belt around town, boulevard, sidewalk that have 125 hectare extent. The used water in green space of industrial sate is about 1500 square meter. The source of used water of industrial state's green space is industrial state's water network. Also, state's green space irrigation system is drop wise model. There are 10 kinds of non-productive broadleaf trees in the industrial sate. The total number of these trees is 41,854 and none of them is in endangered red list. The fruitful trees in this state are 4 trees and total of them are about 14,970 trees. The vinifera visit and punicagranatum are at low risk of extinction. The oleaeuropaea and pistca trees are not at endangered list. The perennial shrub of Qom Shokouhie industrial state is 11 trees and total of them are about 69,045 and among them, tamarix has a low risk of extinction in the red list, but other shrubs are not at red list. The needle leaf trees in Qom Shokouhie industrial state are 5 trees and total of them are about 10,540. The *Cupressus arizonica* and *Juniperus horizontalis* monech are at low risk. The produced water volume of existent wells are 50 liters at second and mentioned wells are activated during 26 days of months and the produced water volume are about 3745 square meter at day and some part of that considered as losses (due to aging of state network, about 20 percent of water network considered as losses). 1400 meter of water are using in industrial state. Rest of that are using for green space irrigation and this amount is about 1500 square meter. **Figure 1** shows the geographic location of Iran Qom Shokouhie industrial state.

3. Materials and Methods

The purpose of this study was to assess the environmental effects of Iran Qom Shokouhieh industrial state of wastewater effluent in irrigation of green space. Firstly, the environmental impacts of the project was identified, according to studies on environmental effects of using industrial wastewater effluent for irrigation of green space and agriculture in Iran and in other countries and based on technical, environmental and field studies including visiting and identifying the site and its affected environment. Then some interviews were done by industrial organization employers and workers and labors of Qom Shokouhie industrial sate, respectively. The entering and existing of wastewater effluent quality and quantity of state's refinery was determined on important parameters of BOD, COD, TSS, TDS, PH and the wastewater temperature from March 2012 until February 2013. Then chemical, biological and physical analysis of important parameters of wastewater effluent and heavy metals measurement was done from July 2012 until January 2013. Measuring stations are inputs and outputs of wastewater that are measured once per month. Finally, the heavy metals, EC, pH, and some anions and cations in the soil like Na^+, K^+, Mg^{2+}, Ca^{2+} were measured at Tehran Research Institute. The spectrophotometer tool was used for anions measurement, flame photometer was used for cation's measurement and atomic absorption tool was used for measuring heavy metals. All testing and sampling condition are done based on standard methods for water and wastewater treatment. Rapid Impact Assessment Method with RIAM BASIC Software and Entropy Method was performed to review the environmental effect of using industrial wastewater effluent of Iran Qom Shokouhie for green space irrigation. **Diagram 1** shows the processes of measuring environmental effects of using industrial wastewater effluent in Qom Shekoohie industrial state—Iran.

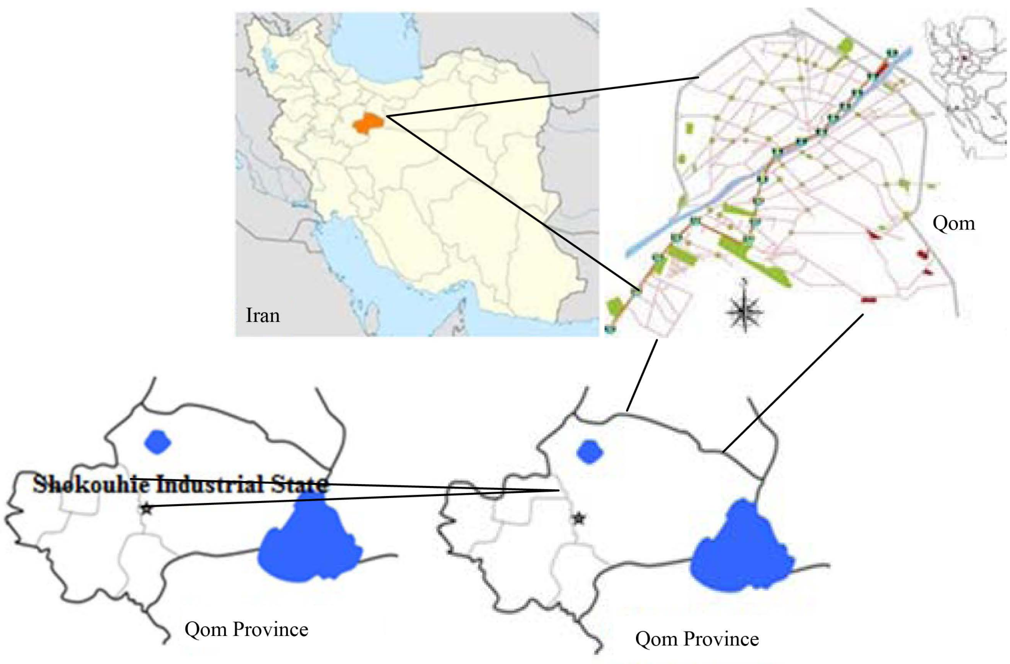

Figure 1. Location of the studying area.

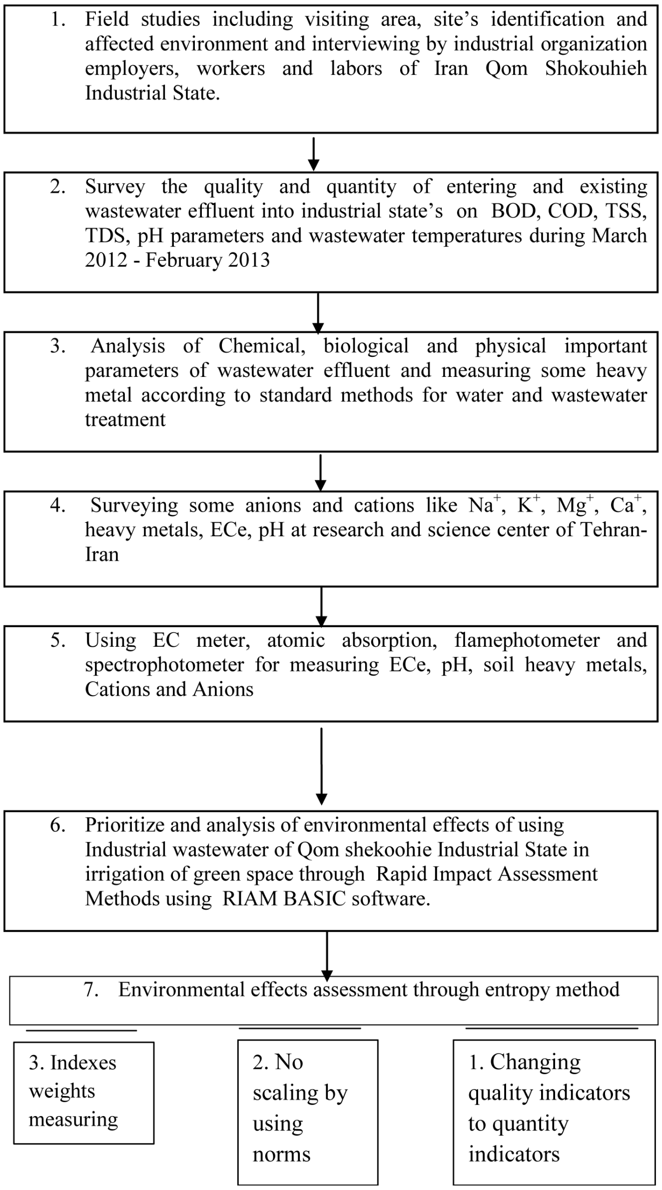

Diagram 1. Processes of measuring environmental effects of using industrial wastewater effluent in Qom Shekoohie industrial state—Iran.

3.1. Rapid Impact Assessment Method (RIAM)

This method was performed by Pastakia in 1998 and some specific standards were used in this method as an important criterion [14]. The RIAM method contains all 4 environmental factors (physic-chemical, bio-ecological, socio-cultural and economic-executive). The project activity's effect was measured based on environmental factors and a presented classification was prospect for each condition [15].

3.2. Entropy Method

Entropy method has an important implication in social science, physic and information theory. When the decide matrix's data are completely distinct, so we can use entropic method weight's measurement. Above idea based on this fact that however an amount dispersal of an index is more, so that index is more importance. The information theory's entropy is a misgiving measure that stated by distinct possibility distribution p_i [16]. Decide matrix contains some information that can be used as a criterion for measurement. This matrix contains *n* parameters an *m* options (*n* row and *m* columns). The number of each rows and columns are based as *sd hock* replacing method. The numbers domain is from 1 - 10 and 9 is the maximum value and 1 is the lowest value [17].

Firstly, the quality indexes were changed to quantity indexes, then, existent information in matrix was changed to p_i as below formula.

First step: no scaling by norms

$$P_{ij} = \frac{a_{ij}}{\sum_{i=1}^{m} a_{ij}}; \ \forall_{i,j}$$

Then E_j calculated as fellow:

Second step: indexes weights measuring

$$E_j = -k\sum_{i=1}^{m}\left[p_{ij} \ln p_{ij}\right]; \ \forall_j$$

Now, calculating the deviance degree:

Third step:

$$d_j = 1 - E_j; \ \forall_j$$

Deviance degree $\left(d_j\right)$ of obtained information for *j* index stated that how much information was obtained from mentioned index $\left(d_j\right)$ for deciding.

Fourth step:

$$w_j = \frac{d_j}{\sum_{j=1}^{n} d_j}; \ \forall_j$$

4. Results

4.1. Related Findings about Environmental Effect on Receptive Environment

1) Physico-Chemical Environment

As Table 1 and Table 2 shown, because of the high amount of electrical conductivity and total dissolved solids lead to salinity of wastewater effluent. By investigating soil area, most of the pathogens and nematode parasites were filtered at few centimeters above the soil. Among all chemicals pollution, because of the high amount of nitrate, it can be moved along with water in the depth of soil and make many risks for underground water's sources. There is not Special River around Shokouhieh industrial state; the only thing is a dry stream of a river that in emergency situations the wastewater effluent is disposed there. Also, the amount of BOD_5, COD, pH and turbidity in the soil are at standard level, so there is no problem for labors who work at Shokouhie industrial state. Also with considering the amount of TSS, wastewater effluent suspended solid does not bloke the soil pores.

2) Biological Environment

After studying on rare elements, the amount of Na^+, Cl^- and B^- is more than state's plants need, so, this condition decrease plants growing and deforming them.

3) Economic and Cultural-Social Environment

Nobody lives around of this state. Phosphor, nitrogen and potassium in the wastewater effluent are at standard concentration, so instead of using chemical fertilizer that has an adverse effect on environment, it can be used from industrial wastewater effluent for irrigation green space due to its nutrients (phosphorus, potassium and nitrogen). The total coli form and fecal coli form in the wastewater effluent is about MPN/100ml > 2400. This amount is so high. The data shows that the highest risk is toward labors who work in industrial state.

4.2. Heavy Metals, Cations and Anions That Is inside the Soil of Shekoohieh Industrial State

As shown in Table 3, all measured heavy metals in state are at standard level, but after many years, a little amount of heavy metals, will aggregate in the soil and have adverse effects.

Table 1. Results of inputting and outputting of wastewater effluent of Iran Qom Shokouhie industrial state in the year of 2013-2012 (July & January).

Row	Result Examination						
	Examination	Scale	Inputting Waste (2012-July)	Outputting Waste (2012-July)	Inputting Waste (2013-January)	Outputting Waste (2013-January)	Limitation Standard
1	Ag	mg/l	0.02>	0.02>	0.02>	0.02>	0/1
2	Cd	mg/l	0.015>	0.015>	0.01>	0.02>	0/05
3	Co	mg/l	0.05>	0.05>	0.08	0.1>	0/05
4	Cr	mg/l	0.208	0.057	0.30	0.05>	1
5	Fe	mg/l	2.444	0.073>	10.703	0.241	3
6	Hg	mg/l	0.001>	0.001>	0.001>	0.001>	A little
7	Mn	mg/l	0.437	0.150	0.821	0.086	1
8	Mo	mg/l	0.01>	0.01>	0.15>	-	0/01
9	Ni	mg/l	0.03	0.028	0.085	0.074	2
10	Pb	mg/l	0.14>	0.14>	0.14>	0.14>	1
11	Al	mg/l	0.2>	0.2>	0.38	0.2>	5
12	Zn	mg/l	0.636	0.154	2.7409	0.3752	2
13	Cu	mg/l	0.085	0.042	0.02>	0.02>	0/2
14	As	mg/l	0.0003>	0.0003>	0.01>	0.02>	0/01

4.3. EC_e Measuring and pH of Iran Qom Shokouhie Industrial State

By using pH meter tool, the pH of soil was measured. This amount was about 7.55 ohm. Then, by EC measure tool, the soil electrical conductivity (EC_e) was measured and the result of it was about 7.34 ds/m.

By considering performed EC_e and pH tests, soil classification, salinity determining of soil, soil's sodium and Mg, Na, Ca, and P, as shown in **Table 4** that needing to determine SAR, the soil's type of industrial state is salinity-Na one.

The increased of soil's alkalinity that happens due to the salinity of wastewater effluent, contributed Swelling and dispersion of clay minerals and also will damage buildings structure and decrease soils permeability.

$$\mathrm{SAR} = \frac{\mathrm{Na}}{\sqrt{\frac{\mathrm{Ca} + \mathrm{Mg}}{2}}} = 14.2$$

4.4. Results of Rapid Impact Assessment Method

The research result based on RIAM method shows that irrigation of green space by wastewater effluent refinery has no high negative effects on green space and soil of state (−E). In this study, some of the effects of wastewater effluent were classified in positive groups and some of them in negative groups. Also, as shown in **Figure 2** and **Table 5**, the most negative effects are relating to underground's water quality in physic-chemical and water ecosystem in biological environment that is in meaningful negative effects area (−D). Then, the soil salinity, soil toxicity and soil permeability at physicochemical environment, rare plants types, plants location and food's chains at biological environment and public health and pathogenic parameters at cultural-social environment, are located in negative effects range (−D) respectively.

Finally, the economic costs, public contribution, public ideas, religion, population and immigration in cultural-social environment and other chemical features of soil at physic-chemical environment are located in chang-

Table 2. Physical, chemical and biological analysis of inputting and outputting of wastewater effluent of Iran Qom Shokouhie industrial state in the year 2012-2013 (July & January).

Row	Result examination						
	Examination	Scale	Inputting waste (2012-July)	Outputting waste (2012-July)	Inputting waste (2013-January)	Outputting waste (2013-January)	Limitation standard
1	pH	-	3.42	8.5	3.41	7.4	8.5 - 6
2	T	C	21	24.9	21	24.3	-
3	DO	mg/l	-	-	2.2	2.8	2
4	EC_w	μs/cm	17,510	15,460	7090	7080	700
5	TDS	mg/l	14625.3	12776.8	5172	5066.4	-
6	TSS	mg/l	385	13	1005	20	100
7	Sal	ppt	10.5	9.1	982	13	-
8	-	NTU	982	10.8	982	108	50
9	ABS	mg/l	0.372	0.229	0.015	0.040	0.5
10	T.A	mg/l	333.3	946	-	452	-
11	O&G	mg/l	18.6	4.03	24.3	3.5	-
12	CL^-	mg/l	5186.3	4774.4	1559.51	1629.49	600
13	Ca^{2+}	mg/l	276	100	204	156	-
14	Mg^{2+}	mg/l	163.48	275.7	122	51.24	100
15	Na	mg/l	-	3750	-	-	500
16	SO_4	mg/l	2160	1120	1>	780	-
17	PO_4	mg/l	11.3	6.90	1.12	3.90	-
18	NO_3	mg/l	48.9	39.3	24.7	39.3	-
19	NO_2	mg/l	5.93	5.65	0.027	1.022	-
20	NH_3	mg/l	10.75	3.7	22.5	4.20	-
21	COD	mg/l	2500	160	4326.2	156.24	200
22	BOD_5	mg/l	1940.5	69.4	1097.5	89.4	100
23	Total coli form	MPN/100ml	2400<	>2400	2400<	2400<	1000
24	Fecal coli form	MPN/100ml	2400<	>2400	2400<	2400<	400

Table 3. Soil heavy metals of Iran Qom Shokouhie industrial state.

Row	Examination	Scale	Result of Examination	Standard Density
1	Cr	mg/kg	2.75	-
2	Zn	mg/kg	38.26	150
3	Ni	mg/kg	10.7	30
4	Fe	mg/kg	4352	-
5	Cd	mg/kg	0.85	1
6	Cu	mg/kg	5.35	50
7	Ag	mg/kg	2.6	-
8	Co	mg/kg	3.75	-
9	Pb	mg/kg	18	50
10	Mn	mg/kg	199.7	-
11	Al	mg/kg	4147.5	
12	Mo	mg/kg	7	-

Table 4. Soil cations and anions of Iran Qom Shokouhie industrial state.

Row	Examination	Scale	Result of Examination
1	Ca^{2+}	mg/kg	11,600
2	Na^{+}	mg/kg	6537
3	K^{+}	mg/kg	9918
4	Mg^{2+}	mg/kg	1569.1

Table 5. Summary of scores with RIAM software-irrigation of green space with industrial wastewater effluent summary of scores.

Range	−108 −72	−71 −36	−35 −19	−18 −10	−9 −1	0 0	1 9	10 18	19 35	36 71	72 108
Class	−E	−D	−C	−B	−A	N	A	B	C	D	E
PC	0	1	0	3	1	2	1	1	0	1	0
BE	0	1	0	3	0	1	1	0	0	0	0
SC	0	0	0	1	5	0	0	2	0	0	0
EO	0	0	0	0	1	0	0	1	0	0	0
Total	0	2	0	7	7	3	2	4	0	1	0

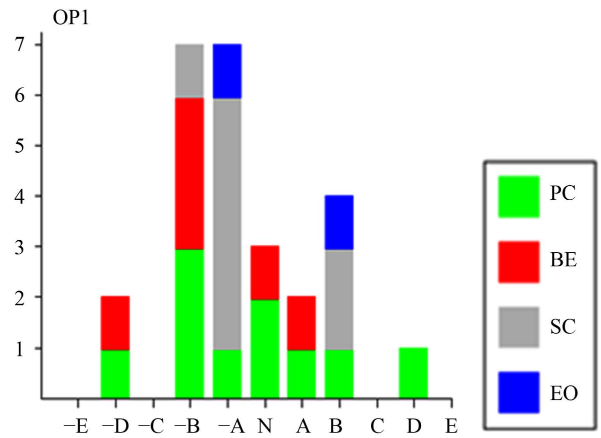

Figure 2. Summary of scores with RIAM software—irrigation of green space with industrial wastewater effluent.

ing areas of small negative effect (−A). The 3 parameters of surface waters quality, surface water quantity and rare animals' species were not influence by wastewater effluent and remained at unchanged area (N). The underground water quality is one of the positive effects of project that is in meaningful positive effects area (+D). Then, its effect on green spaces, sewage, agricultural aspects and soil productivity are located in positive effects changing area (+B). Finally, the physical features of soil and land ecosystem are located at small positive effect area (+A). As obtained numbers in different receptive environment showed, the most negative effects of green space irrigation by wastewater effluent are related to social-cultural, physicochemical, biological and economical environments respectively. This difference is not considerable.

As shown in **Figure 3** and **Table 6**, the most negative effects of second option related to underground water quality and water ecosystem that are located in meaningful negative effect's area. After that, the soil salinity, toxicity level of soil, rare plant species, plant location and food chains are located in this period. Then, the public health and pathogenic parameters and chemical features are located at negative effects areas (−C).

The result shows that the most negative effect of irrigation without any filtration of wastewater effluent is re-

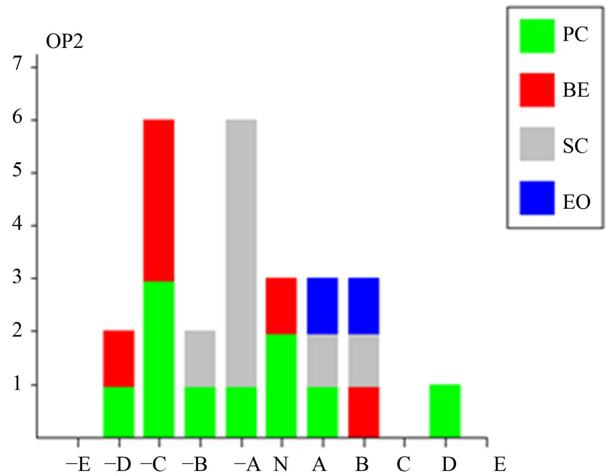

Figure 3. Summary of the scores with RIAM software—irrigation of green space without industrial wastewater effluent.

Table 6. Summary of the scores with RIAM software—irrigation of green space without industrial wastewater effluent summary of scores.

Range	−108 −72	−71 −36	−35 −19	−18 −10	−9 −1	0 0	1 9	10 18	19 35	36 71	72 108
Class	−E	−D	−C	−B	−A	N	A	B	C	D	E
PC	0	1	3	1	1	2	1	0	0	1	0
BE	0	1	3	0	0	1	0	1	0	0	0
SC	0	0	0	1	5	0	1	1	0	0	0
EO	0	0	0	0	0	0	1	1	0	0	0
Total	0	2	6	2	6	3	3	3	0	1	0

lated to physic-chemical and cultural-social environments. However, this difference is not remarkable. The wastewater effluent using has not negative effect on economic environment because this option has no any cost is spending on wastewater effluent filtration.

4.5. Results of Entropy Method

As shown in **Table 7** and **Table 8**, after considering environmental effects of wastewater effluent using at Iran Qom Shokouhie industrial state for irrigation of green space by Entropy Method, the following results were obtained. The weights of chemical features of soil, soil toxicity, soil salinity, water quality, physical features, water quantity, soil permeability, soil productivity, public health and cultural-economical effects are 0.147, 0.136, 0.126, 0.115, 0.105, 0.094, 0.084, 0.073, 0.063 and 0.052, respectively. As it shown in **Table 8**, the cultural-social environment and the physico-chemical environment have the most negative effects in this method, respectively. So, the obtained results are similar to Pastakia matrix results.

5. Conclusions

Considering environmental effects of wastewater effluent using by RIAM and entropy method and comparing both result with each other, it shows that the cultural-social, physicochemical, biological and economical environments had received the most negative effects respectively. The important limitable elements are entering chemical pollution (nitrate) to underground waters and water ecosystems, soil salinity and toxicity of industrial state, changing soil permeability and chemical features, threatening the endangered species of state including *Vitis vinifera* "*Punica granatum*" tamarix, *Cupressus arizonica*, *Juniperus horizontalis*, endangering public health

Table 7. Final result with entropy method.

W1	W2	W3	W4	W5	W6	W7	W8	W9	W10
0.073	0.094	0.052	0.105	0.115	0.063	0.084	0.126	0.147	0.136

Table 8. Final result from the last step of entropy method.

Degree	Weight	Factor
1	0.147	Public health and other parameters
2	0.136	Soil chemical property
3	0.126	Soil toxicity
4	0.115	Soil salinity
5	0.105	Water quality
6	0.094	Soil physical properties
7	0.084	Water quantity
8	0.073	Soil permeability
9	0.063	Soil fertility
10	0.052	Cultural and economic effects

and increasing disease parameters among employers specially the labors who are in contact with wastewater effluent and effect on economic parameters (cost of wastewater treatment).

The most positive elements of this method are increasing and saving underground waters, creating green spaces and deserts reduction, decreasing wastewater effluent amount from outside of state, increasing soil productivity and having beautiful ecosystem. Finally, the wastewater effluent using for irrigation of green space has no effect on 3 elements: surface water quality, surface water quantity (because there is no any considerable river around Iran Qom Shoukouhieh industrial state) and rare animals' species (because there is no any rare animal in state and around that).

5.1. The Possibility of Using Industrial Wastewater Effluent in Irrigation of Green Space

5.1.1. Environmental Justification

From the environmental point of view, in Rapid Impact Assessment Method and after selecting first option (green space irrigation by refined industrial wastewater effluent), all negative effects are (20 parameters) more than positive effects (7 parameters), also, the social and physicochemical parameters have more weights than other parameters in entropic method. This means that the total effects are negative and negative effects were more than positive effects, but these negative effects, by environmental compliance and enforcement strategies will be reduced or eliminated.

5.1.2. Social Justification

From the social point of view, this project is also considered. Nobody lives around the state, so this social justification is only about state workers, guards and specially the labors who work in green spaces. After interviewing by workers, guards and labors showed that the majority of workers (87% to 90%) care about the environmental and health issues. Table 9 shows the procedures of monitoring different parameters which are affected by wastewater effluent of Iran Qom Shoukoohie industrial sate.

However the measuring of wastewater effluent reusing for irrigation of green space is new topic, but there are not enough studies performed on environmental impact assessment of wastewater effluent, especially in a specific regional. This paper has been compared with a few examples of issues and trends that are mentioned in the beginning of this article. Jian Xu *et al.* (2010) found that the important effects of using wastewater effluent in irrigation are related to soil physical and chemical change. Sami Klay *et al.* (2010) also found that irrigation

Table 9. Suggestions for monitoring of effectible different parameters in using Iran Qom Shokouhie industrial wastewater.

Suggestion	Problem	Administrative	Monitoring period	Essential laws
Measurement of TDS and EC_w	Soil salinity of Iran Qom Shokouhie industrial state	Management of Iran Qom Shokouhie industrial state	Seasonally for TDS and monthly for EC_w	Bylaw for effluent quality procedure + FAO guidelines for ions particularly
Measurement of B, NA, CL metals	Soil toxicity of Iran Qom Shokouhie industrial state	Management of Iran Qom Shokouhie industrial state	Every six month	Bylaw for effluent quality procedure + FAO guidelines for ions particularly
Measurement of N metal, total coli form and fecal coli form	Cuasing problem for underwater of Iran Qom Shokouhie industrial state	Management of Iran Qom Shokouhie industrial state	Every six month nitrogen and yearly total coli form	Bylaw for effluent quality procedure + FAO guidelines for ions particularly
Measurement of Cd, Zn, Pb and Hg metals	Effect of heavy metals on soil of Iran Qom Shokouhie industrial state	Management of Iran Qom Shokouhie industrial state	Yearly	Bylaw for effluent quality procedure + FAO guidelines for ions particularly
Measurement of nematode parasites	Plants of Iran Qom Shokouhie industrial state	Management of Iran Qom Shokouhie industrial state	Every six month	Guidelines of WHO, 1989
Clinical examinations, tests, typhoid, paratyphoid, cholera and hepatitis, parasitic worms, fungal diseases	Endanger the labors health who work in the wastewater treatment system of Qom Shokouhieh industrial state	Management of Iran Qom Shokouhie industrial state	Monthly, seasonally, every six month and yearly	Guidelines of WHO, 1989
Clinical examinations, tests, typhoid, paratyphoid, cholera and hepatitis, parasitic worms, fungal diseases	Endanger the labors health who using effluent of Qom Shokouhieh industrial state	Management of Iran Qom Shokouhie industrial state	Monthly, seasonally, every six month and yearly	Guidelines of WHO, 1989

by wastewater effluent will increase salinity of soil and change soil structure. The important difference between this research and other researches is that other researches did not use special method for measuring environmental effects and they only compared their finding by existing standards. But in this research, Rapid Impact Assessment Method (RIAM) and Entropy Method were used and the results were compared with each other.

Authors suggest that in the future studies, releasing pollution through wastewater effluent and wastewater treatment facilities and its adverse effects on air quality and public health should be considered.

References

[1] Wang, J.-F., Wang, G.-X. and Wanyan, H. (2007) Treated Wastewater Irrigation Effect on Soil, Crop and Environment: Wastewater Recycling in the Loess Area of China. *Journal of Environmental Sciences*, **19**, 1093-1099. http://dx.doi.org/10.1016/S1001-0742(07)60178-8

[2] Al-Shammiri, M., *et al.* (2005) Waste Water Quality and Reuse in Irrigation in Kuwait Using Microfiltration Technology in Treatments. *Desalination*, **185**, 213-225. http://dx.doi.org/10.1016/j.desal.2005.02.078

[3] Lin, S.H., Chan, H.Y. and Leu, H.G. (2006) Treatment of Wastewater Effluent from an Industrial Park for Agricultural Irrigation. *Desalination*, **128**, 257-267. http://dx.doi.org/10.1016/S0011-9164(00)00040-0

[4] Rattan, R.K., Datta, S.P., Chhonkar, P.K., Suribabu, K. and Singh, A.K. (2005) Long-Term Impact of Irrigation with Sewage Effluents on Heavy Metal Content in Soils, Crops and Groundwater—A Case Study. *Agriculture, Ecosystems and Environment*, **109**, 310-322. http://dx.doi.org/10.1016/j.agee.2005.02.025

[5] Webera, S., Khanb, S. and Hollendera, J. (2006) Human Risk Assessment of Organic Contaminants in Reclaimed Wastewater Used for Irrigation. *Desalination*, **187**, 53-64. http://dx.doi.org/10.1016/j.desal.2005.04.067

[6] Mapanda, F., Mangwayana, E.N., Nyamangara, J. and Giller, K.E. (2005) The Effect of Long-Term Irrigation Using Wastewater on Heavy Metal Contents of Soils Under Vegetables in Harare, Zimbabwe. *Agriculture, Ecosystems and Environment*, **107**, 151-165. http://dx.doi.org/10.1016/j.agee.2004.11.005

[7] FAO (2009) Reuse of Effluent: Methods of Wastewater Treatment and Health Safeguards. Report of a Meeting of Ex-

perts. World Health Organization, Geneva.

[8] Xu, J., Wu, L.S., Chang, A.C. and Zhang, Y. (2010) Impact of Long-Term Reclaimed Wastewater Irrigation on Agricultural Soils: A Preliminary Assessment. *Journal of Hazardous Materials*, **183**, 780-786. http://dx.doi.org/10.1016/j.jhazmat.2010.07.094

[9] Bakopoulou, S., Emmanouil, C. and Kungolos, A. (2011) Assessment of Wastewater Effluent Quality in Thessaly Region, Greece, for Determining Its Irrigation Reuses Potential. *Ecotoxicology and Environmental Safety*, **74**, 188-194. http://dx.doi.org/10.1016/j.ecoenv.2010.06.022

[10] Klay, S., Charef, A., Ayed, L., Houman, B. and Rezgui, F. (2010) Effect of Irrigation with Treated Wastewater on Geochemical Properties (Saltiness, C, N and Heavy Metals) of Isohumic Soils (Zaouit Sousse Perimeter, Oriental Tunisia). *Desalination*, **253**, 180-187. http://dx.doi.org/10.1016/j.desal.2009.10.019

[11] Fatta-Kassinos, D., Kalavrouziotis, I.K., Koukoulakis, P.H. and Vasquez, M.I. (2011) The Risks Associated with Wastewater Reuse and Xenobiotics in the Agroecological Environment. *Science of the Total Environment*, **409**, 3555-3563. http://dx.doi.org/10.1016/j.scitotenv.2010.03.036

[12] Gharsallaoui, M., Benincasa, C., Ayadi, M., Perri, E., Khlif, M. and Gabsi, S. (2011) Study on the Impact of Wastewater Irrigation on the Quality of Oils Obtained from Olives Harvested by Hand and from the Ground and Extracted at Different Times after the Harvesting. *Scientia Horticulturae*, **128**, 23-29. http://dx.doi.org/10.1016/j.scienta.2010.12.015

[13] Hanjra Munir, A., Blackwell, J., Carr, G., Zhang, F.H. and Jackson, T.M. (2012) Wastewater Irrigation and Environmental Health: Implications for Water Governance and Public Policy. *International Journal of Hygiene and Environmental Health*, **215**, 255-269. http://dx.doi.org/10.1016/j.ijheh.2011.10.003

[14] Mahmoodzadeh, S., *et al.* (2007) Project Selection by Using Fuzzy AHP and TOPSIS Technique. *International Journal of Human and Social Sciences*, **1**, 3.

[15] Pastakia, C.M.R. and Jensen, A. (1998) The Rapid Impact Assessment Matrix (RIAM) for EIA. *Environmental Impact Assessment Review*, **18**, 461-482. http://dx.doi.org/10.1016/S0195-9255(98)00018-3

[16] Onut, S. and Soner, S. (2008) Transshipment Site Selection Using the AHP and TOPSIS Approaches Under Fuzzy Environment. *Waste Management*, **28**, 1552-1559. http://dx.doi.org/10.1016/j.wasman.2007.05.019

[17] Hung, C.C. and Chen, L.H. (2009) A Fuzzy TOPSIS Decision Making Model with Entropy Weight under Intuitionistic Fuzzy Environment. *Proceedings of the International Multi Conference of Engineers and Computer Scientists*, Hong Kong, 18-20 March 2009, 18-20.

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