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A COMPARATIVE STUDY OF PHYSICAL AND CHEMICAL PARAMETERS IN SISTAN AND BALUCHISTAN UNIVERSITY WASTEWATER AND IT'S RE-USE OF WASTEWATER

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ABSTRACT

Following the university's needs and current draughts, the university decided to establish a waste water treatment plant for proper management of its exotic waters. The recycled water of the plant is used for irrigation of its green space as well as providing water for its garden plants through drip irrigation method. The tests were performed during a 6- month period using input- output measuring devices. These tests were according to standard methods book. The photometer, spectrophotometer, and atomic absorption machines were applied for measuring cations and anions and heavy metals, respectively. The test results were analyzed by EXCEL/SPSS software. Finally, the acquired data were compared with the standards of EPA and FAO's and it was concluded that they are in accordance with these standards and proper for irrigation of the green space and the greenhouse products.

Key Words: Management, Recycled wastewater, Agricultural water, Green space water, University.

INTRODUCTION

It is clear that the amount of water is fixed in the world, but it is not distributed in a uniform way, so, there is sufficient water in some areas whereas it is not enough in other areas to meet the human communities' needs. Water resource management is defined as the consumption management for minimum effluent and recycling of waste water for its environmental issues. As far as the global per capital water in Iran is 191 liter and 150 liter all over the world, it can be inferred that each Iranian consumes 40 liter more than the global per capital water.

Also, all over the world, it is possible to get 2 kg agricultural products with 1sqm water, but in Iran it is 900 g for the same amount of water. Regarding these statistics, we lose one- third of

nonrenewable water resources in form of wastewater and it needs to be noted that the maximum volume of these wastewaters belong to the agricultural sector, i.e. 27,000,000,000 sqm which of course illustrates a great disaster.

Based on these statistics, it is necessary to increase the productivity in waste water sector. Also, we should put more emphasis on consumption of agricultural water.

METHODOLOGY

The first step for analysis of the reuse action of Sistan and Baluchistan university wastewater plant for

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irrigating its agricultural fields and its green space is to study and determine the plant's efficiency foreliminating different microbial, physical and chemical contaminants. In other words, methodology and analysis of the samples were performed during 6 months.

The measuring instruments for analysis are spectrophotometer for anions, flame photometer for cations, and atomic absorption machine for heavy metals. All sampling conditions and tests for water and effluent were performed based on the standard methods book's instructions. Finally, the achieved results were compared with the current standards and different parameters of the wastewater quality were determined for irrigation of agricultural fields, green space, and etc.

THE RESULTS OF THE DATA

Table-1. average and amount of physical and chemical parameters in input/ output wastewater and effluent in Sistan and Baluchistan wastewater treatment plant during different months (mg/ lit).

Parameter	**EC(S/ cm)**		**COD**		**TDS**		**BOD**	
Current	input	output	input	output	input	output	input	output
Average	936.5	789.5	396	64	891.6	577.16	256.5	29.3
Removal Efficiency (%)	15.69		83.83		35.26		88.57	

Table-2. Average and amount of physical and chemical parameters in input/output wastewater and effluent in Sistan and Baluchistan wastewater treatment plant during different months (mg/ lit).

Parameter	**Sodium**		**Potassium**		**Calcium**		**Magnesium**	
Current	input	output	input	output	input	output	input	output
Average	126.8	115.1	654	485.8	77.3	56.8	30.86	22.23
Removal Efficiency (%)	8.73		25.71		26.52		27.96	

Comparing physical and chemical refined effluents with EXCEL software in order to achieve significant differences between various months.

DISCUSSION AND CONCLUSION

After applying the standard refinement processes, the best way to remove the wastewater effluent is to use it for agricultural purposes. This effluent is considered as unconventional source of water and its application in agriculture requires specialized management in order to use it properly and avoid its environmental and health hazards for the soil, the plants and surface water as well as ground water and ground water resources .Moreover, the reuse of effluents with regard the environmental and biological conditions is one of the best strategies for sustainable development in agricultural development Al – Shammiri M. and act. (2005). Selecting irrigation method for decreasing the health hazards of the irrigation on agricultural plants is much more than the plants which are irrigated with freshwater and fertilizer. Through effluent irrigation, nutrients are added to soil. Also, minerals present in effluent will be depleted by micro-organisms. It will add the humus of the soil and ultimately, improve the soil physical and chemical properties and fertility. Wastewater can be considered as a proper item for the soil amendment and will increase the storage capacity, whereas it can decrease the soil bulk density. The selected irrigation method for the current research is dripping irrigation which is one of the latest methods for achieving high efficiency in arid and semi- arid regions. In this method, the best utilization of the effluent is gained the least chance of water pollution. In dripping irrigation, only the areas around the roots are moistened and in fact, the required water is provided by the least amount of water consumption. The green spaces at the university as well as its greenhouses are watered with a mixture of revived wastewater and tap water. Plants available in these greenhouses include summer and winter seasonal flowers and ornamental trees and shrubs Bixio . D. and act. (2006) .

Qualitative Analysis

Qualitative analysis of wastewater effluents for the purpose of irrigation and agriculture: in order to study the possibility of applying Sistan and Baluchistan university effluent for irrigating its green space and agriculture, one must primarily determine several parameters such as sodium absorption, sodium percentage, sodium exchange percentage and electrical conductivity.

Determining sodium absorption ratio

We can calculate the sodium absorption ratio by SAR in which Mg, Ca, and Na will be the concentration of magnesium, calcium, and sodium per meq/ ml, respectively. The required amounts are derived from the table and based on the above- mention equation, the sodium absorption ratio for the effluent of Sistan and Baluchistan wastewater treatment would be 3.28.

Determining sodium ratio

Below equation represents sodium ratio in which K, Mg, Ca, and Na are the concentrations of potassium, magnesium, calcium and sodium per meql lit. The necessary amounts are taken from the table and according to the above equation the sodium percentage would be 23.37 for the effluent of the university waste water treatment.

Determining sodium exchange ratio

It is achieved by below equation and it is necessary to put this amount in the equation to show the percentage of sodium exchange. Also, it is possible to determine the amount of E.S.P. based on the amount of SAR and with the computational diagram (figure 1) which can estimate E.S.P. as 6. 03 Bixio . D. and act. (2008).

Determining electrical conductivity

According to table 3, the average amount of the electrical conductivity for the effluent of Sistan and Baluchistan university wastewater treatment plant is 789.5 micro Siemens/ cm. The classification of the wastewater treatment effluent for irrigation and agriculture

This classification can be performed based on the electrical conductivity, sodium absorption ratio, and sodium percentage.

Classification based on electrical conductivity

Regarding the electrical conductivity ratio and applying Will Cook diagram, the effluent of the university is categorized in group no.3. It includes those waters with high salinity and its electrical conductivity is between 750 – 2250 S/ cm.

Classification based on sodium absorption ratio

Regarding the sodium absorption ratio and applying Will Cook's diagram, the effluent of the university is categorized in group no.1. It includes waters with less than 10 sodium absorption ratio.

Table-3. water classification based on sodium absorption ratio and sodium percentage for irrigation Bouwer H. (1994)

Classification	Group	SAR	%Na
excellent	S_1	<10	<30
good	S_2	10-18	30-40
average	S_3	18-26	40-60
Improper(weak)	S_4	>26	60-80

Table-4. Water classification based on electrical conductivity for irrigation (11)

classification	Salinity	Group	EC
Usually harmful	low	C1	100-250
fair	average	C2	250-750
With the washing conditions, soil drainage, and plant resistance	Much	C3	750-2250
Inappropriate but not in exceptional cases	Very Much	C4	More 2250

Table-5. Total classification of waters for irrigation Brady N. (1990)

Classification	Class	Considerations
Very good	C1S1	-
Good	C2S1,C2S2,C1S2	-
average	C3S3,C3S2,C3S1,C2S3,C1S3	In case of Agricultural land suitability of the aggregation and permeability of water in the soil
inappropriate	C3S4,C4S2,C4S1,C4S4,C2S4,C1S4,C4S3	Available to plants only under certain conditions

CONCLUSIONS

Thorough analysis of the results of microbial, physical, chemical tests as well as heavy metals show that the average amount of the tested parameters available in Sistan and Baluchistan university wastewater plant is consistent with Environmental Protection Agency (EPA) the effluent exit foe irrigational and agricultural purposes in Iran . the removal efficiency % 99.99 is for total coli form parameters,% 99.99 for fecal coli form, %61.18 for total suspended solids, % 88.57 for needed biological oxygen, % 32.26 for total dissolved solids, %75. 76 for nitrate, %51. 41 for phosphate, % 49. 66 for bicarbonate, %19.292 for chloride, %48.43 for volatile suspended solids, %20.77 for volatile solids, % 87.94 for nitrate, %27.96 for magnesium, %26.52 for calcium, %25.71 for potassium and %15.69 for electrical conductivity.

Therefore, it can be inferred that the required criteria in planning Sistan and Baluchistan university wastewater plant system based on activated sludge process are properly selected and performed and the right and short- term exploitation strategies have had significant effects on its suitable performance and efficiency since 2007. Comparing the average amounts of the Sistan and Baluchistan treatment plant parameters with WHO, EPA, & FAQ's standards has emphasized on this consistency. The result of this research shows that the effluent of this wastewater treatment plant is suitable for irrigation of agricultural fields and green space. Cairccross .S. (2005)

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