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THE REUSING FEASIBILITY OF WASTEWATER TREATMENT PLANT (CONVENTIONAL ACTIVATED SLUDGE) EFFLUENT OF TOMATO PASTE FACTORY FOR AGRICULTURAL IRRIGATION - A CASE STUDY

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Abstract

Reusing of treated waste water could be considered as a solution to overcome the water shortage problem. The aim of this study is to evaluate the feasibility of reusing waste water treatment plant's effluent of Kermanshah's Rozhin Tak tomato paste factory for agricultural irrigation. This study conducted cross-sectional and measure some parameters such as pH, COD, TSS, TDS, and DO, Nitrite, Nitrate, Ammoniac, Phosphate and turbidity and finally coordinated them with environmental standard in order to reuse them in agricultural irrigation. The results showed that the effluent's average parameters of DO and TSS in all months of the year (except July, August, September and October) and the turbidity rate in all the year (except June) is lower than reuse standard in agriculture ($P<0.05$). Also the effluent's average level of DO in all months of the year (except July, August, September and October) is higher than reuse standard in agriculture ($P<0.05$). The pH level of effluent in all months of the year was consistent with reuse standard in agricultural irrigation. The results of the evaluation showed that in some months which effluents were used for irrigation, they weren't consistent with standards. Therefore, improvement of the present treatment system for achieving to an effluent standard is necessary.

Keywords: treated waste water, waste water reuse, irrigation with effluent, waste water quality, tomato paste factory

Introduction

The everyday growth of population and the development of industrial and agricultural activities for producing food and in other hand, successive drought in recent years has caused the present sources of surfaces fresh water to be in

their highest operation in most of the countries which are in arid region. Therefore, too much pressure are come on the water sources, so reusing the treated effluent of waste water is one of the solutions which could overcome on the aforementioned problem (1, 2). Among the reusing effluent's wastewater field, perhaps its use for agriculture have more importance (3, 4). Reusing waste water, particularly in agriculture have numerous benefits such as primary benefits (the profits from selling effluents, reducing the dust waste by irrigation, using nutritional substances such as phosphate and nitrogen which are exist in waste water and also, reducing the use of chemical fertilizer, reducing the costs and using healthier water) the secondary benefits (the subsequent effect of reusing waste water project) and public benefits (protecting environment and improving its quality and aesthetic) (5-8). Increasing the level of agricultural crops by waste water effluent irrigation in comparison with well's water could be one of the most clear benefits of using effluent in agriculture (9, 10). When the effluent used for agricultural irrigation, an accurate attention should be taken to its organic and inorganic compound's effect on the plant's growth and structure's change and chemical properties of soil (nitrate accumulation, phosphor and heavy metals) and also, increasing the level of toxic materials in soli, plants and animal tissues and finally entrance of it to the human's food chain and leaching of the materials such as nitrate and solvent toxic substances from soil and entering it to the ground water (6, 11, 12). Therefore monitoring the waste water effluent quality before using it in agricultural irrigation is necessary. Kermanshah's Rozhin-Tak tomato paste factory with the daily capacity of 2200 ton tomato paste would produce desired products. This factory have two waste water treatment plant which are conventional activated sludge system with the capacity of 3000 ton m^3 /d and in the producing and harvesting season of tomato (peak season) just the first treatment plant by the capacity of 1200 m^3 /d is active.

The output effluent of Rozhin-Tak tomato paste factory's waste water treatment plant was used for agriculture farm irrigation which is near the factory. Also for achieving the environmental standard and evaluating the performance of the factory's waste water treatment plant, awareness about the quality of its output effluent is necessary. This study is conducted for the feasibility of reusing waste water treatment plant of Kermanshah's Rozhin-Tak tomato paste factory's effluent for irrigation of the surrounding farm.

Material & Methods

This study is conducted cross-sectional. The preliminary of this research was started by studying the libraries' literature and evaluating the research projects and science references which were related to this research's subject. In this study, the sampling was done weekly during 11 months of the year. For doing the tests on them the samples were

transferred to the Kermanshah's chemistry laboratory of Rozhin Tak factory. In the laboratory pH, COD, TSS, TDS, DO, nitrite, nitrate, ammoniac, phosphate and turbidity parameters were evaluated. All the sampling condition and doing the test were based on the standard method book's structure for water and wastewater tests (13). The data were analyzed by single group statistical T-test and one- way ANOVA test based on a significant level α=0.05 by SPSS and excel software and the results were consisted with the standards. Then the effluent quality was determined for various parameters in order to consume for agricultural use.

Results

Table1 showed the output effluent's chemical quality properties of Kermanshah's Rozhin-Tak potato paste factory's waste water treatment plant and table2 showed the results of the single group statistical analyzed T-test for consisting it with effluent quality by reusing standard in agriculture. The comparison of the COD, pH, DO, TSS and turbidity parameters of Kermanshah's Rozhin-Tak treatment's output effluent factory with standard in various months were presented respectively in figures 1-5.

Table-1: The chemical quality properties of Kermanshah's RozhinTak wastewater treatment plant's effluent.

Months	Parameter									
	COD (mg/l)	DO (mg/l)	NO2 (mg/l)	NO3 (mg/l)	NH3 (mg/l)	PO4 (mg/l)	pH (mg/l)	TSS (mg/l)	TDS (mg/l)	Turbidity (NTU)
April	43.6±28.5	4.7±1.1	5±1.1	5.6±0.6	1.5±0.14	3.4±1.5	7.02±0.07	55.4±13.4	705.5±77.2	71.1±5.8
May	60.2±44.7	5.1±0.98	5.6±1.2	8.2±1.4	2.2±0.34	2.5±0.6	7.49±0.4	35.1±9.2	643.3±170.6	9.8±3.8
June	90.4±53.8	5.5±0.97	9.1±1.3	12.2±1.9	3.4±0.35	1.2±0.5	7.4±0.7	52.9±14.99	708.4±204.4	60.2±143.4
August	193.4±130.6	1.7±0.27	6±1.1	8±1.2	4.4±1.7	2.5±0.8	7.10±0.03	106.1±36.3	558.4±195.1	12.1±5.3
September	686.4±589.2	1.8±0.37	7.8±2.4	10.9±3.2	3.5±0.9	0.6±0.2	7±0	91.2±126.4	368.3±395.7	42.6±7.1

October	**688.1±503**	**1.2±0.5**	**8.8±2.1**	**11.9±2.8**	**3.5±0.8**	**0.8±0.2**	**7±0**	**365.5±250.2**	**4801.9±430.8**	**92.7±13.8**
November	**289.2±140.6**	**3.7±1.2**	**6.5±1.2**	**8.5±1.4**	**2.5±0.43**	**1.6±0.5**	**7±0**	**252.2±89.2**	**919.7±261.9**	**92.4±8.7**
December	**87.7±41.1**	**5.03±0.46**	**5.5±1.4**	**7.9±1.8**	**2.2±0.6**	**2.8±1.2**	**7±0**	**47.6±25.4**	**645.5±121.7**	**31.8±8.8**
January	**40.9±8.5**	**5.2±0.53**	**5.4±1.8**	**7.5±2.4**	**2.2±0.7**	**3.4±2.4**	**7±0**	**50±1.9**	**615.9±102.1**	**3.6±1.6**
February	**21.3±27.3**	**6.8±0.43**	**4.4±0.8**	**6.1±1.2**	**1.7±0.3**	**2.7±0.6**	**7±0**	**55±8.5**	**480±61.02**	**3.1±1.5**
March	**31.1±5.9**	**6.3±0.73**	**4.3±0.7**	**5.8±0.9**	**1.7±0.3**	**3.3±1.4**	**7.087±0.29**	**95.7±10.8**	**805.3±54.3**	**5.4±1.3**

Table-2: The results of the single group statistical analyzed T-test in order to be consistent with effluent quality standard for reusing in agriculture.

Months	**Parameter**				
	COD (mg/l)	**DO (mg/l)**	**TSS (mg/l)**	**Turbidity (NTU)**	**pH (mg/l)**
April	✓	✓	✓	✓	✓
May	✓	✓	✓	✓	✓
June	✓	✓	✓	×	✓
August	×	×	×	✓	✓
September	×	×	×	✓	✓
October	×	×	×	✓	✓
November	×	×	×	✓	✓
December	✓	✓	✓	✓	✓
January	✓	✓	✓	✓	✓
February	✓	✓	✓	✓	✓
March	✓	✓	✓	✓	✓

✓ **Consistent with standard level and reusing in agriculture**

× **Unconsistent with standard level and reusing in agricualture**

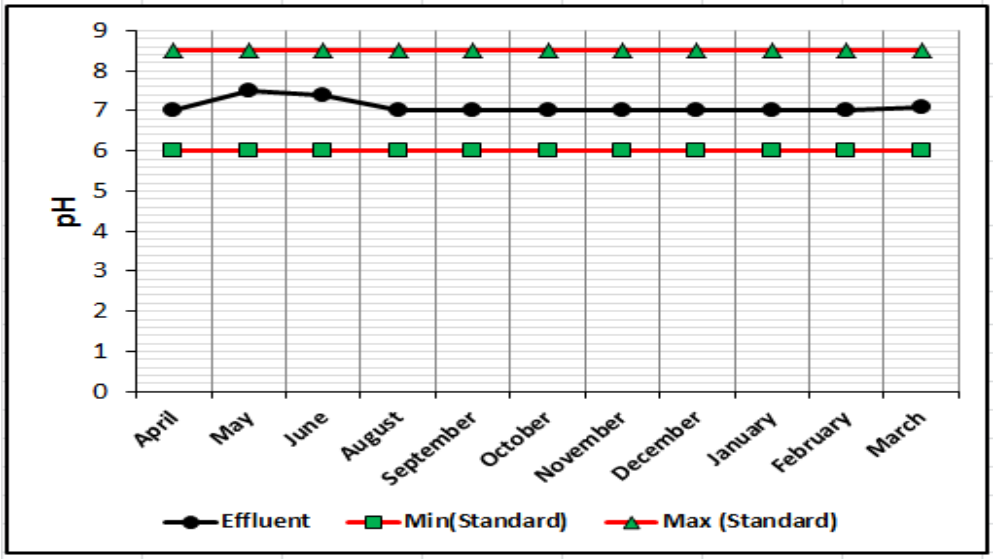

Figure-1. Comparisonof pH parameter of Kermanshah Rozhin-Tak Factory with agricultural irrigation standard.

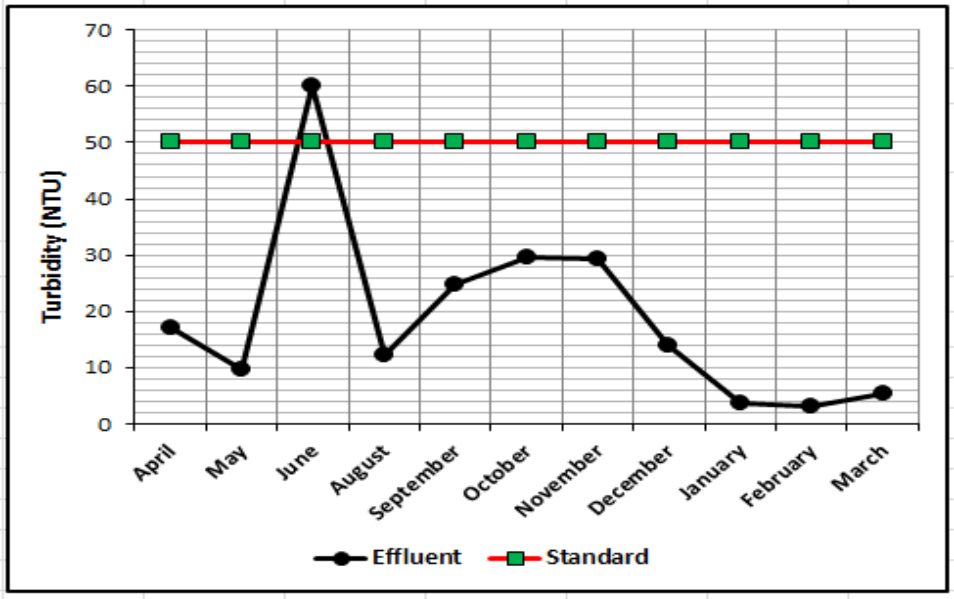

Figure-2: Comparison of turbidity parameter of Kermanshah Rozhin-Tak Factory with agricultural irrigation standard.

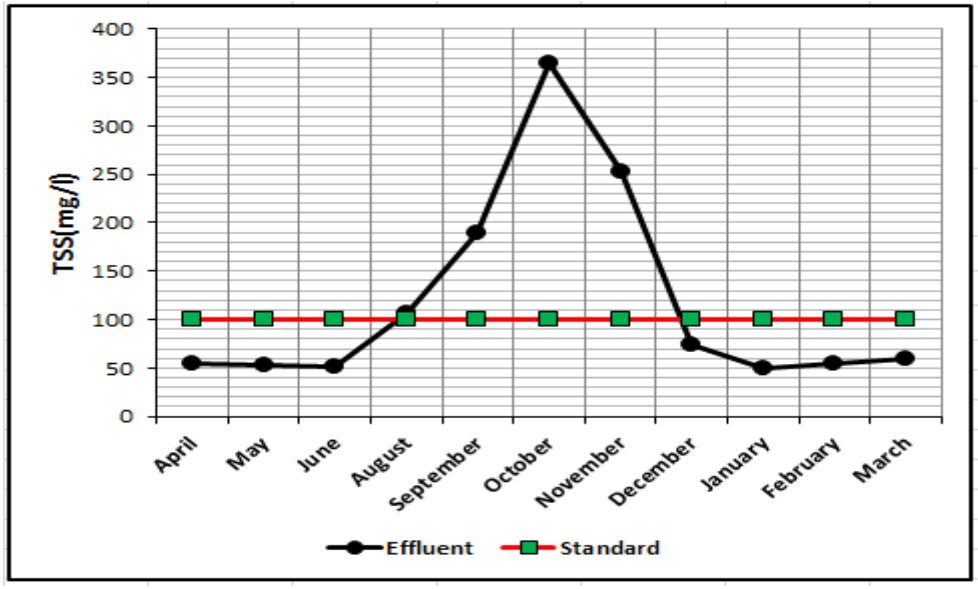

Figure-3: Comparison of TSS parameter of Kermanshah Rozhin-Tak Factory with agricultural irrigation standard.

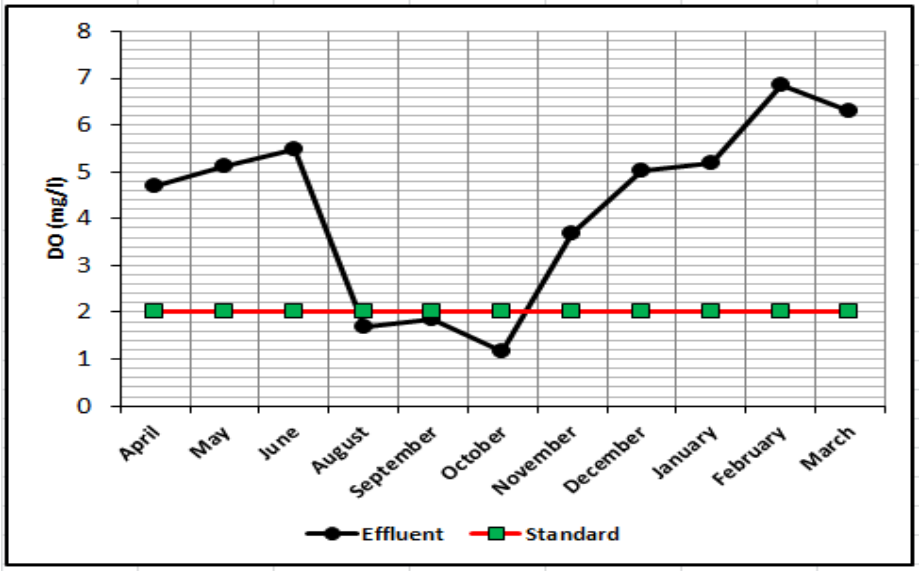

Figure-4: Comparison of DO parameter of Kermanshah Rozhin-Tak Factory with agricultural irrigation standard.

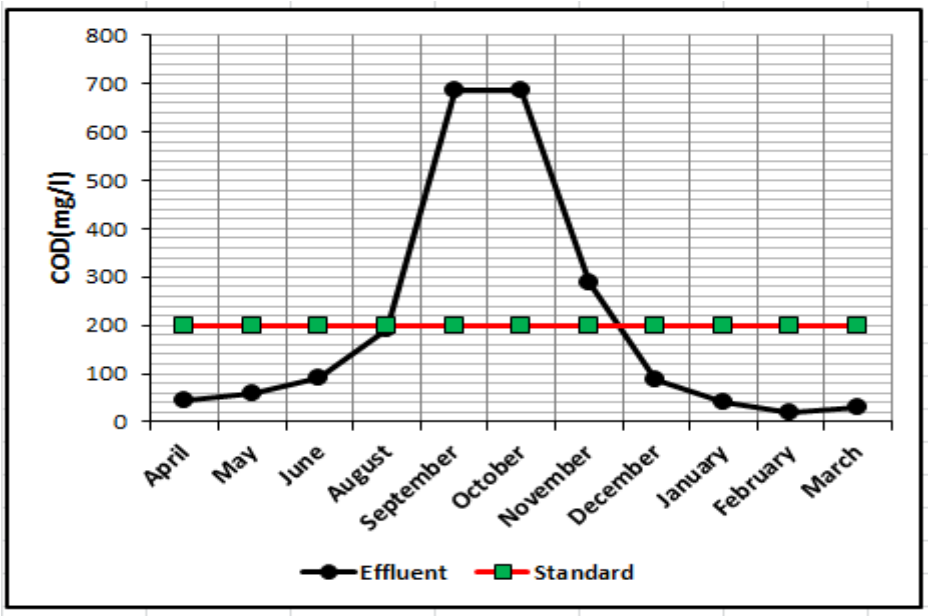

Figure-5: Comparison of BOD parameter of Kermanshah Rozhin-Tak Factory with agricultural irrigation standard.

Discussion

According to the presented results and doing the one way statistical ANOVA test with a significant level $\alpha=0.05$, it could be said that the average level which have obtained for pH, COD, TSS, TDS, DO, nitrite, nitrate, ammoniac phosphate and turbidity parameters of output effluent during various months of the year showed a significant difference ($P<0.05$) and it should be noted that the active time of the factory for producing tomato paste is from April to the end of the October and according to the presented results, it have been revealed that the average of COD, TSS and DO parameters during four months from interval times which were said (the active time of producing tomato paste) it means August, September, October were consistent with reusing standard in agriculture and this was because of the capacity's load increased of treatment plant in these months and lack of treatment system's responding is due to the polluted load reducing. By doing the single-group statistical T-test based on the significant level $\alpha=0.05$ it was

revealed that, the average of COD and TSS parameters of output effluent in all months of the year (except July, August, September and October) the turbidity level in all year (except June) were lower than the reuse standard in agriculture ($P<0.05$). Also the average of DO in output effluent in all months of the year (except July, August, September and October) were higher than reused standard in agriculture ($P<0.05$) (14, 15). The pH level of output effluent in all months of the year was consistent with reuse standard in agricultural irrigation. The Binava-Poor et al study about the waste water treatment plant's effluent of Atie-Sazan hospital in Hamadan showed that, the treated waste water quality for all the parameters except Sodium, Nematodes' cists and all the coliforms were consistent with environmental reuse standard of effluent using for park's irrigation (7). Liobilo et al in Italy found that the advanced treatment of effluent could have all the environmental standard and also could be used for unlimited irrigation (16). Ghaneian et al showed that the waste water treatment effluent quality of Kish island for all parameters except coliform and fecal coliforms were consistent with the reuse standards in agriculture (4). In an evaluation which has done by Kalveruzoitis et al (2008) in Greek, it was revealed that the phosphor, cadmium, cobalt, nickel and ferrous level in Brussels sprouts and broccoli which were irrigated by treated waste water had increased significantly (11).

Conclusion

According to the necessity of achieving reusing standards of waste water treatment plant's effluent of Kermanshah's Rozhin-Tak tomato paste factory for agriculture uses, in order to reduce the environmental effect of reusing it and also with regard to the fact that the treatment plant could not provide some of the important standard parameters (COD, TSS and DO) in a particular time of the year (irrigation time) it could be concluded that for achieving necessary standards, reengineering and improvement of the present treatment system or development of it seems necessary.

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