RESEARCH ARTICLE

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Performance of Extended Aeration Biological System in Removal of Organic Matter from Razi Hospital Wastewater during 2015, Iran

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Background & Aims of the Study: The most important compounds in hospital wastewater are antibiotics, disinfectants, anesthetics, radioactive elements, static cytotoxic agents, other chemicals and hazardous materials that caused to be different domestic sewage. The purpose of this study was the evaluation of performance of extended aeration biological system in pollutants removal from Razi Hospital wastewater treatment plant (WTP), Ahvaz city of Iran.

Materials and Methods: The hospital wastewater disposal and treatment in Razi hospital have been studied in this cross-sectional research. Total of 12 samples from effluents of wastewater treatment plants were collected and tested for pH, Biological Oxygen Demand (BOD_5), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS) and Total Coliform (TC). EPA standard method was used for conducted trials. Finally, the relationship between results at different months and stations was done, using SPSS18 and descriptive statistics.

Results: Results shown that parameters average in effluent was pH=7.46 ،BOD= 48.58 mg/l, COD=99.25 mg/l, TSS=54 mg/l, NH_3=5.65mg/l, Turbidity=29.57 NTU. Also total coliform and fecal coliform of effluent were 46.19 MPN/100 ml and 36.65 MPN/100 ml, respectively. According to results, the percentage of BOD, COD, TSS and TC removal in WTP were 85.21, 82.46, 86 and 90.15.

Conclusion: Based on these findings, Razi hospital effluent wastewater treatment plant was mitted at Iran environmental standards for discharge to recipient wasters. Based on the result of our study, Extended Aeration Biological System is a comparatively suitable process for BOD, COD, TSS and TC removal from hospital wastewater.

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Background

Numerous pollutants in recent years, in Ahvaz, Iran, are going to threat the source of agriculture, industrial and drinking water (1-7). Hospital effluents contain a variety of contaminants that its discharge to the environment can contaminate soil and water resources (8-10). These pollutants also are serious threats to the environment and important agent in spreading infectious diseases (11-16). Hospital wastewater is one of the domestic wastewaters that contain pathogens, chemicals, pharmaceuticals and disinfectants (17,18). It is one of the most concerns about environment and public health (19). Based on the annual reports which are submitted in Europe, more than 10,000 tons of antibiotics are consumed through medical care centers which are %26 of all used antibiotics. These compounds are entered into wastewater treatment systems through urine and stool and can be considered as a serious threat to the environment (13,20,21). The most important factors affecting the quantity and quality of hospitals wastewater are number of beds, type of services and amenities available in hospitals, climatic conditions and geography, social and cultural situation, state hospital sanitation, number of days of meetings, the number of referrers, a kitchen, laundry and incinerators (22-24). BOD, COD, TSS and fecal coliform bacteria are the most important factors in measurements and assessments made by hospitals which were studied the quality of wastewater (25-27). In recent years, several studies have shown a relation between the efficiency of pollutants removal and performance of extended aeration biological system from hospital wastewater (11,13,20,23,25). Qiaoling et al in a study has shown a correlation between hospital wastewater treatment and public health by the application of MBR in China (18). Wen et al, in their studies reported that using submerged membrane bioreactor can enhance the rate of treatment of hospital wastewater (13). Gautam et al studied the effects of physico-chemical treatment options for hospital wastewater in Vellore, Tamil Nadu (27). It is noteworthy that calculating the pollutants removal from hospital wastewater in a well-known polluted city is very crucial.

Aims of the study:

The aim of this study was the assessment of performance of extended aeration biological system in pollutants removal from Razi hospital wastewater treatment plant (WTP), southwest of Iran during 2015.

Materials & Methods

This semi experimental study was performed at Razi educational hospital of Ahvaz (southwest of Iran). Location of the study was in the south west of Ahvaz city, Razi hospital, with 220 beds approximately which is located between 48° and 49°29′ east of the Greenwich meridian, 31°and 45′ minutes north of the equator (28-30). This study was done in order to assess the performance of extended aeration biological system on treatment of pollutants (BOD, COD, TSS, Turbidity and NH_3) in Razi educational hospital of Ahvaz city (using WTPs system during 2015). In this study we gathering samples from the influent and effluent of wastewater treatment plants at Razi educational hospital during 2015 (Table 1).

Table 1) The influent component of the wastewater in treatment plant of Razi teaching hospitals

parameter	Unit	Wastewater(average)
pH	-	8.03
Temperature	mgL^{-1}	22.1
BOD_5	mgL^{-1}	320
COD	mgL^{-1}	555
TSS	mgL^{-1}	400
Qr/Q	-	59.65
F/M	d^{-1}	0.41
HRT	hr	5.4

24 Samples were obtained within 12 months with two glass bottles with 1000 ml volume in

this study. PH was measured in the field. All samples were performed by one of the laboratories of Ahvaz. Because of high aeration time and the HRT treatment plants, sampling was done for the moment. Sampling and testing parameters are all based on the standard method (31-34). In this study standard method was used for BOD; No. 5210-B, TSS; No. 2540-D and COD; No. 5220. The coded data were entered in SPSS version 18. Data were analyzed by applying descriptive statistical, using SPSS18.

Table 2) Wastewater treatment plant profile in Razi educational hospital)

Treatment System	The per capita water consumption (L/bed.d)	The per capita wastewater production (L/bed.d)	Beds	Wastewater disposal system
Extended Aeration Biological System	750	650	220	Discharge the Karun River

Results

The efficiency studies of pollutants removal by extended aeration biological system were done at different characteristics. Table 3 shows the factors which were affect the influent component including pH, BOD, COD, TSS, turbidity, NH_3, total coliform and fecal coliform characteristics of the hospital wastewater in treatment plant (Table 3). Based on the results of Table 2; COD, BOD, TSS, NH_3, turbidity, total and fecal coliforms in effluent treatment hospitals were 99.25mg/l, 48.58mg/l, 54mg/l, 5.65mg/l, 29.57NTU, 46.19 MPN/100ml and 36.65 MPN/100ml, respectively (Table 3).

Table 3) The average quality of effluent from the wastewater treatment plant in Razi educational hospital

parameter	April	May	June	July	August	September	October	November	December	January	February	March	Mean±SD
BOD (mg/l)	52	46	43	49	56	49	42	45	65	45	45	46	48.58 ± 12
COD (mg/l)	104	95	86	98	107	97	85	91	129	112	90	95	99.25 ± 18.5
TSS (mg/l)	54	47	32	64	58	46	39	46	86	75	62	39	54 ±16
pH	7.9	7.14	6.86	6.9	7.85	7.55	7.99	7.46	7.7	7.11	7.52	8.02	7.46 ± 0.7
NH_3 (mg/l)	12.88	7.63	7.16	2.8	5.4	1.42	1.56	3.94	6.5	7	5.4	6.2	5.65 ±2.6
Turbidity (NTU)	38	28	16	33	31	24	19.5	39	21	15	64	26.4	29.57 ± 4.8
Total coliform MPN/100ml	45	38	32	28	67	39	35	41.3	44	53	64	68	46.19 ± 7.1
Fecal coliform MPN/100ml	30	28	23	19	58	30	27	28.8	36	42	56	62	36.65 ± 6.3

Hospital wastewater due to numerous pollutants including organic matter, detergents and surfactants can be very harmful to human and environment. Biological extended aeration system between many treatment processes having to be cost-effective for hospital wastewater treatment with pollutant wide range. Although, biological treatment requires specific

conditions that limiting the ability to treat many wastewaters such as multifaceted hospital wastewater.

Discussion

In this study, we evaluated the performance of extended aeration biological system in pollutants removal from hospital wastewater during 2015, Ahvaz, Iran. Results showed that Razi hospital wastewater treatment plant has a good efficiency in pollutants removal. Table 3 shows the average quality of COD, BOD_5, TSS, NH3 and turbidity in effluent from the wastewater treatment plant in Razi educational hospital during this year. According to the Iranian Environmental Protection Agency (Iranian EPA) standard, the maximum allowable concentration of COD, BOD, TSS, NH_3 and turbidity effluent for discharge to surface water are 60mg/l, 30mg/l, 40mg/l, 2.5mg/l and 50NTU, respectively. Based on the result of this study, the COD, BOD, TSS, NH_3 and turbidity in effluent treatment hospitals were 99.25mg/l, 48.58mg/l, 54mg/l, 5.65mg/l and 29.57NTU, respectively (Table 3). Also, Table 2 shows that the total and fecal coliforms in effluent were 46.19 MPN/100 ml and 36.65 MPN/100 ml, respectively. The result of several studies showed that, using different processing increased the hospital wastewater treatment (12,13,17,18,27). Based on the result, which was accrued in Beijing of China, the rate of treatment of hospital wastewater increased by a submerged membrane bioreactor (13). The high percentage of observed pollutants removal in this study was associated with high efficiency extended aeration biological system in Razi hospital, Iran. Takdastan et al in their study found a high correlation between the pollutants removal and performance of treatment system in hospitals wastewater of Ahvaz (17). The results of this study are different in comparison with another study because of the geographic and climate characteristics. Different research in the field of performance of hospital wastewater treatment plant and compared with our findings showed in Table 4.

Table 4) The performance of hospital wastewater treatment plant and comparison of various studies

Parameters	BOD_5 (mg/l)	COD (mg/l)	TCC (mg/l)	Total coliform (MPN/100ml)
Amouei et al (Educational Hospitals of Babol, Iran) (32)	79.6%	76.5%	74.3%	99.7%
Sadat Taghavirad et al (Hospital Mehr Ahvaz, Iran) (33)	87%	90%	84%	92%
Khorsandi et al (Imam Khomeini hospital in Uromia, Iran) (34)	89%	93%	81%	98%
Present study	85.21%	82.46%	86%	90.15%

Conclusion

Hospital wastewater can be very threaten for Ahvaz Karun River (limited dilution capacity of it), especially pharmaceutical compounds, antibiotics and disinfectants. Based on the result, efficiency and performance was in an optimal level in Razi hospital wastewater treatment plant. It is important to paying attention to this point that in future, Razi hospital wastewater treatment plant is in need of repairs and complete reconstruction to reduce both maintenance costs and make it easier to navigate. The result of this study showed that increasing efficiency of hospital wastewater treatment plant can be very useful and vital for increasing the quality of health environment.

Footnotes

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Conflict of Interest:

The authors declared no conflict of interest.

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