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Necessity of monitoring important parameters in treatability and stability of biological treatment plants in different seasons of the year (Case study: Aq Qala's compost plant in Golestan province)

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Abstract

Composting technology is an important method for the recycling of municipal solid wastes. The essential requirement of compost for safely and useful used in soil is a high degree of its stability or maturity. At the present study, the maturity and stability of composted municipal solid wastes at a biocompost plant was evaluated by Monitor of the important parameters of the leachate and how it changes to predict the performance and efficiency of the treatment plant, is necessary. The aim of this study was to monitor the changes in EC, COD, pH and TSS parameters in raw leachate of municipal waste by considering the possibility of leachate treatment at 5 stations (raw leachate, anesthesia unit, primary aeration, secondary aeration and final output) of the compost plant. Gorgan's Aq Qala was in different seasons of the year. For this purpose, 135 sampling times were performed in 1258 days from 2016 to 2020, and the changes of the mentioned parameters were investigated. The results of comparing the average EC concentration of raw leachate and output yielded 67.7% elimination efficiency, and the refinery's anaerobic reactor continued to operate without any problems, despite the high EC. The results of comparing the average TSS in the raw leachate and output unit with the elimination efficiency were 97.5%. The mean COD results in raw leachate and outflow units showed a 99% elimination efficiency and the best efficiency was obtained in the final and late fall outflows, which was related to ambient temperature and optimal bacterial activity. The results of the mean pH in the raw leachate unit and output showed high efficiency and optimal performance equal to 99.7, which reached its lowest value in the first half of spring in order to reduce the alkalinity of raw leachate. The anaerobic reactor station had the best efficiency among the measuring stations.

Keywords

Key words: crude leachate, anaerobic reactor, aeration, COD, TSS

Introduction

Leachate is a liquid that passes through the waste and leaks out of the solid waste and contains soluble, suspended substances and particles derived materials and numerous chemical and sometimes toxic elements Rashidi et al. 2014). The special characteristics of urban waste composition in Gorgan, including the high percentage of decaying substances and special climatic conditions such as high humidity and high evaporation, have caused the resulting leachate to have a high pollution load compared to other countries (Kaboli, 2013).

Contamination of organic matter, suspended solids, nitrogen, phosphorus, and heavy metals in municipal waste leachate creates a high potential for leachate contamination (Shushtari *et al*., 2007) (Alizadeh Shushtari, 2010). Therefore, establishing leachate management is a key process in avoiding the risk of polluting underground water resources (Chupanglos and Krith, 2010).There are several methods for wastewater treatment, all of which are divided into three main physical, chemical, and biological forms. In general, biological treatment methods include aerobic groups (aerobic bacteria soluble in oxygen or injected into sewage, converting them to carbon dioxide, water and new microorganisms) and anaerobes (anaerobic bacteria using oxygen in Chemicals compounds, such as sulfate and nitrate, convert organic compounds to methane, hydrogenic acids, carbon dioxide, water, and new cells).The anaerobic treatment system is usually used as a pretreatment stage due to its low efficiency. Therefore, for more consolidations of the wastewater, anaerobic systems should be followed by aerobic ones (Rashidi et al. 2014).According to the research conducted in 2009 by Hassani et al., during the operation, during operation, the average EC input concentration to the anaerobic reactor in the study (with downward and upward flow)was 32.5 cm ms / cm. The maximum and minimum ECs were 49, 22, and the mean EC output of the aerobic reactor was 23.5 and the maximum and minimum EC outputs were 35 and 15, respectively. The mean EC removal efficiency in this reactor was 28.15%. It is noteworthy that the reactor experienced high ECs at 49 ms / cm and continued to operate without any problems.This work is dealing with the performance of a sequential Electrocoagulation (EC), Electroflotation (EF), and sedimentation method for the treatment of landfill leachate of Gachsaran city. Various water treatment criteria such as Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), Oil and Grease (O&G) and turbidity were used to assess process efficiency. the removal efficiency of COD, TSS, O&G, Turbidity, TKN, total phosphorus, Cr, and Pb were obtained 86.9%, 88.7%, 90.2, 93.7%, 81.8%, 90.3%, 70%, and 66% respectively (Ghasem Hassani, et al, 2016). Suspended particles in wastewater are part of the TSS, the measurement of which is crucial for predicting the amount of sludge resulted from wastewater treatment. The suspended solids found in the wastewater are either settleable or non-settleable. As for the material, suspended solids are either organic (putescible) or inorganic (mineral). Almost 40% of the solved substances in the urban sewage system 72-75% of its suspended solids are organic and the rest is mineral (Monzavi, 2007).Wastewater treatment requires large land areas, long process lines, as well as large ponds for treatment plants. The dosing of reagents (coagulants and flocculants) to promote aggregation can be advantageous for wastewater treatment. This method reduces settling times in a cost-e ective manner and, thereby, can save space, (Nurul Shuhada Mohd Makhtar,2020).The leachate produced during the acidic phase of waste decomposition contains a large amount of volatile fatty acids, which form the organic matter in leachate and are also biodegradable easily (Bigdeli, 2012). It seems that the Incoming leachate due to the presence of organic acids such as acetic acid and lactic acid, as well as the amino acids found in fruits and cooked foods, and probably the mineral acids that enter the plant with waste have an acidic pH. The high electrical conductivity of the leachate is not only attributed to the high amount of soluble salts in the leftover of cooked foods, but also to the high amount of minerals in the leachate that result from the mineralization process during the anaerobic decomposition of the waste (Al-Yaqout and Hamoda, 2003). Leachate treatment (often biological) is one of the solutions in its management systems. The equipment used for treatment depend on the characteristics of the leachate in the first place (Chupanglos and Krith, 2010). Chemical and biological properties of the leachate, in general, depend on the type of waste and its degree of degeneration (Alizadeh Shushtari *et al*., 2007).There are two parameters in analyzing the accepted factors of leachate quality in the cited regulation in Japan: 1) considering the essential factors in leachate analysis such as temperature, pH, COD[a], BOD[b], 2) leachate analysis if necessity, such as the total nitrogen, EC[c] and TSS[d]. The emphasis is on continuous monitoring for studying the quality of the leachate if the goal is determining the leachate treatment process and intermittent checking would not suffice (Yasumasa, 2013).

According to the research conducted in 2017 by Issa Alabiad *et al*.,Treatment of Landfill Leachate: COD,BOD and TSS Removal in Padang Siding Perlis Using Bio-Electrochemical Process.The final values of the ammonia, COD, BOD and TSS, were(97.66% removal), 125 mg/l (96.45% removal), 249mg/l (77.98 % removal) and 106mg/l (42.20% removal) respectively. This study investigated the application of an up-flow anaerobic sludge blanket (UASB) reactor followed by a self-aerated sponge (SAS) unit as a combined system for the treatment of hazardous landfill leachate (HLL) for 310 days. The removal efficiencies of the integrated UASB/SAS system were 34.5–59.2% for COD total, 19.6–50.8% for COD soluble, 72.3–92.8% for NH4-N, 41.3–58.6% for TSS, and 32.9–49.4% for VSS. The performance of the treatment system was found to be hydraulic retention time (HRT), salinity, and C/N ratio dependent. The profile analysis along the SAS height revealed that the COD fractions (COD total, COD soluble, and COD particulate) were initially consumed, followed by the nitrification process. An initial investment of 212.7 US$/m3/d and an annual cost of 11.3 US$/m3/d were estimated for the combined UASB/SAS system treating HLL. This study provided an environmental-eco-friendly and feasible sustainable solution for handling the HLL issues, particularly in developing countries.

-According to the research conducted in 2019 by Mainardis, M.; Goi, D.,UASB treatment of high-strength industrial wastewater allows to significantly reduce energy expenses for aeration in wastewater treatment plants (WWTP), if UASB is applied as a pre-treatment before secondary biological process. -UASB reactor is able to e_ciently treat various high-strength industrial wastewater (such as brewery wastewater [Enitan, A.M.; Kumari, S.; Odiyo, J.O.; Bux, F.; Swalaha, F.M, 2020].

-Furthermore, recently UASB has proved to be ecient also on diluted streams, such as municipal wastewater [Lim, S.J.; Kim, T.-H, 2014].-Up-flow anaerobic sludge blanket (UASB) reactor belongs to high-rate systems, able to

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a Chemical Oxygen Demand

b Biological Oxygen Demand

c Electrical Conductivity

d Total Suspended Solids

perform anaerobic reaction at reduced hydraulic retention time, if compared to traditional digesters(Matia Mainardis, 2020).

-flow Anaerobic Sludge Blanket (UASB) Reactor has been successfully implemented to treat wastewater in ourneighboringcountry, India for more than 20 years and its performance was found to be satisfactory (KUET, Khulna, 2020).

In this regard, the purpose of this study was to pay special attention to proper management, finding the most suitable conditions for biological activities with continuous and regular monitoring of parameters, EC, COD, pH TSS during the seasons in septic tank units (raw leachate), anaerobic unit , Primary aeration, secondary aeration and leachate output In this case, the feasibility of the efficiency of the treatment plant during the forecast year and its efficiency can be adjusted to reduce environmental pollution.

2. Materials and Methods

This research has been done since the beginning of the treatment plant, the compost factory in the west of Golestan province (Aq Qala) so far during 1258 days. The monitoring of parameters COD, EC and pH was carried out in 5 stations of the plant including the septic tank unit (crude leachate), initial aeration, secondary aeration and output leachate and the TSS in 3 measurement stations including crude leachate, anaerobic and final output in the laboratory of the leachate treatment plant.

In the present study, the performance of the anaerobic ponds with downward and upward flow in cubic concrete tanks with the dimensions of 13.3mm×4.2mm×4.7mm and the useful volume of 237.5 m^3 was used as anaerobic tanks in a series, so that the first output was the input of the upward flow tank. Acne (media made of construction ceramic) was used in these tanks. Fresh cow manure was used to speed up the operation of the anaerobic reactor. Primary and secondary aeration ponds with 300 diffusers and the useful volumes of 540 and 300 m^3, respectively, with primary and secondary settling units, were used for sludge return and feeding of anaerobic and aeration ponds and chlorination unit.The method was as follows; crude leachate with a maximum flow rate of 25 m^3 / d 25 and different concentrations of COD with the average 6000-7000 mg/l and the acidic pH of 5.4-6.5 (EC = 32.5 ms/cm, TSS = 3600 mg/l) were pumped daily to the anaerobic pool. Sampling was initially started from the output faucet of the septic tank, end of the anaerobic unit (overflow to initial aeration unit) and half a meter from the bottom of the aeration pool on average every 4.5 days. The analysis of the gathered data was done using Excel™.

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3. Results

In this section, the results of the study of the basic parameters studied in different plant stations and how their changes are presented.Figure 1 shows the chart of changes in crude leachate (input), anaerobic reactor, initial aeration, secondary aeration, and output for the COD parameter during operation period (1258 days). As can be seen, the average changes in this time period for the anaerobic reactor have decreased in this interval in comparison to the crude leachate, but this decrease is lessened in initial and secondary aeration units of the leachate and finally reached a relative stability in the output (Figure 1). In order to evaluate the treatment process of the leachate at 5 stations, changes in concentration were measured from the launch of the plant to the 4th year in 135 occasions and concentration averages were compared each year.The results showed that despite the relative increase in the concentration of the crude leachate, the most optimal result is associated with the anaerobic reactor and the output unit in the fourth year, which suggests the gradual development of the plant during these four years.

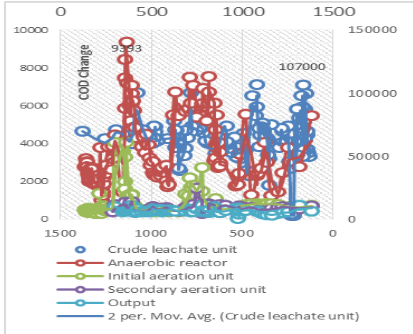

Figure 1. The scope of linear variance of COD at five stations during the time.

- Also, in different units of the treatment plant, the COD parameter is represented based on the mean, maximum and minimum concentration during the research period in Figure 2. The maximum concentrate is in raw leachate with COD = 107000 mg / l and the lowest amount in leachate. The final output with a COD of 56 is the best desired result, and the concentration in raw leachate is on average COD = 61852 mg / l, which in the output leachate is on average COD = 462 mg / l with a elimination range of 99 % Has been calculated**.**

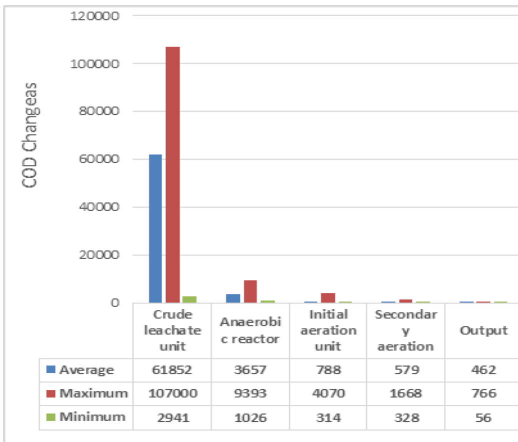

Figure 2. Average variance of COD in different stages of treatment during the operation.

- According to Table 1, the maximum concentrations in anaerobic, initial aeration and final output were recorded in winter, which seems to decrease in temperature and the population of bacteria and thus leads to a decrease in the efficiency of the plant. Other seasons make it up for winter and the best result (COD = 56 mg/l) was obtained in autumn due to the ambient temperature suitable for the optimum activity of the bacteria (18-25°C).

Table 1. Maximum and minimum COD concentration at sampling stations in different seasons of the year.

Parameter	Maximum		Minimum		Average	
	Concentration	Season	Concentration	Season	Concentration	Season
Crude leachate unit	107000	Late summer	2941	First half of autumn	61852	First half of spring and late autumn
Anaerobic reactor	9393	Later winter	1026	First half of autumn	3657	Late spring and summer
Initial aeration unit	4070	Late winter	314	First half of autumn	788	First half of spring and late summer
Secondary aeration unit	1668	Second half of spring	328	First half of summer	579	First half of spring and autumn
Output	760.7	Second half of spring and second half of winter	56	Late autumn	462	Spring and autumn

- The results of the salinity parameter changes in 5 stations during operation (1258 days) are presented in the figure below. In this section, the leachate treatment process was evaluated at 5 stations by monitoring EC concentration changes at 135 times and comparing the average concentrations each year. The results (fig 3) showed that despite the relative increase in concentration in raw leachate until the third year, the best desired result was still achieved in all stations in the third and fourth year, which indicates an improvement in the treatment plant for EC parameter over a period of 4 years. Especially in the fourth year, the decrease in concentration (more favorable result) in 4 treatment plants, ie from the anaerobic reactor to the final output has been very noticeable.

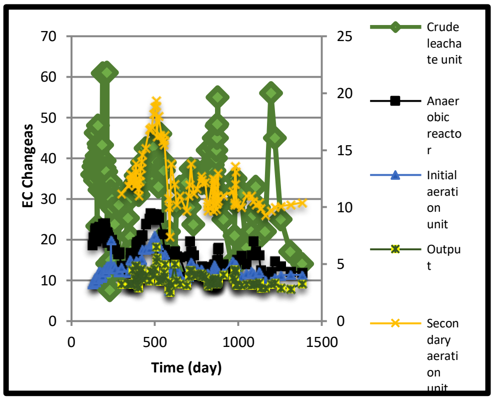

Figure 3. The scope of linear EC variance at the five measurement stations during the time.

- The following figure shows the comparison between EC variance in crude (input) leachate and output leachate during the operation. The average concentration for the crude leachate was EC = 32.45 ms/cm, while the maximum and minimum were EC = 61.12 ms/cm and EC = 7.55 ms/cm respectively, with high fluctuations due to the high dilution in the rainy season.

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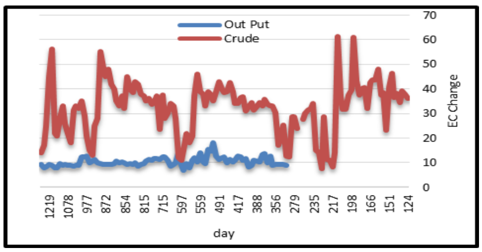

Figure 4. Comparison between EC variance for crude leachate and anaerobic during the time.

- The point to consider in this study is that the EC experienced a high purity of 61/12 (input to the anaerobic unit) and continued to operate without any problems (Figure 5).

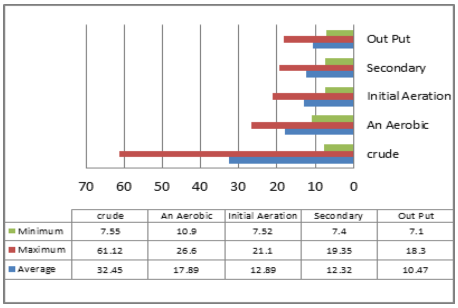

Figure 5. Average variance in EC in different treatment stages during the operation.

-According to Table 2, the average concentration of crude leachate was EC = 32.45 ms/cm, while the maximum and minimum were EC = 61.12 ms/cm and EC = 7.55 ms/cm, respectively, with high fluctuations due to the high dilution in the rainy season. As for the final output leachate, the average was EC = 10.47 ms/cm, with the maximum and minimum being EC = 18.3 ms/cm (mid-summer) and EC = 7.1 ms/cm (the first half of spring), respectively, with relatively low fluctuations. In aeration and output units of the plant, the lowest EC concentration was obtained in autumn, which can relate to the ambient temperature and the population of bacteria.

Table 2. Maximum and minimum EC concentration at sampling stations in different seasons of the year.

Parameter EC	Maximum		Minimum		Average	
	Concentration	Season	Concentration	Season	Concentration	Season
Crude leachate unit	61.12	Early autumn	7.55	Second half of autumn	32.45	First half of spring and late summer
Anaerobic reactor	26.6	First half of summer	10.9	Late winter	17.89	Late spring and winter/early spring and mid-autumn
Initial aeration unit	21.11	Mid-summer	7.52	Late autumn	12.8	Early autumn, early winter and spring
Secondary aeration unit	19.35	Mid-summer	7.4	First half of summer	12.32	Early spring and early summer/late winter
Output	18.3	Mid-summer	7.1	First half of spring	10.47	Late spring and summer/early autumn

-TSS change monitoring results for 3 stations; The raw leachate (input), anaerobic unit and output in the period of 1258 days are shown in the figure below (Figure 6, 7). As can be seen, in the raw leachate section and output, both charts represent a significant slope reduction, while the anaerobic unit has a positive slope change. In proportion to the decrease in TSS in the inlet leachate concentration, the decrease in the output leachate, after purification in anaerobic units, primary and secondary aeration has been obtained in many years and the average elimination efficiency for concentration, TSS (97.5%) shows high efficiency and The performance was good.

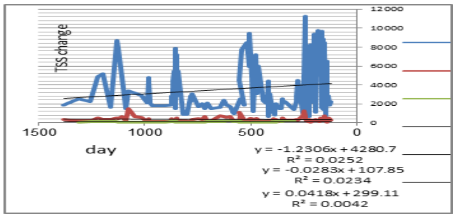

Figure 6. TSS variance for crude leachate, anaerobic and output during the period of the experiment.

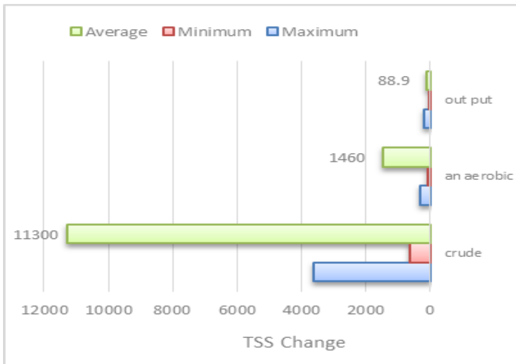

Figure 7. Average variance in TSS in different treatment stages during the operation

In order to evaluate the treatment process of the leachate at three of the five stations, the variance in TSS concentration was measured from year one to year four and annual averageswere compared to each other (Table 3). The results show that the concentration variance of the crude leachate and the final output did not differ significantly, but it decreased significantly in the third and fourth year compared to the first, which suggests that improvement of the treatment process of the plant in terms of the TSS parameter started gradually from year two onward. In Figure 8, the yellow bar that represents the fourth year (D) and the red bar that represents year three (C) of the operation are compared with the first year, with the best result being obtained in the third year. It should be noted, however, that the TSS concentration was lower in the third year compared with the first and the fourth year.

Table 3. Variance in TSS concentration at three of the stations in years one to four.

TSS variance	Crude	Anaerobic	Out put
First year	4406	315	169
Second year	2901	342	84
Third year	3054	291	76
Fourth year	4421	383	90

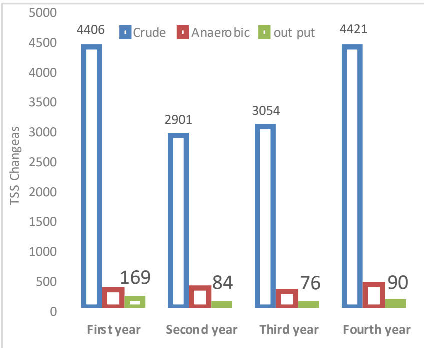

Figure 8. The graph of TSS concentration variance at three of the stations in different years.

-The average TSS = 3611 mg/l was recorded in the crude leachate unit, TSS = 89 mg/l in the final output leachate unit and TSS = 321 mg/l in the anaerobic reactor, which is shown in Figure 9. The acceptable efficiency and performance of 91% removal was observed in the anaerobic reactor and a 97.5% average removal efficiency in the whole system, which shows the high efficiency of the treatment plant.

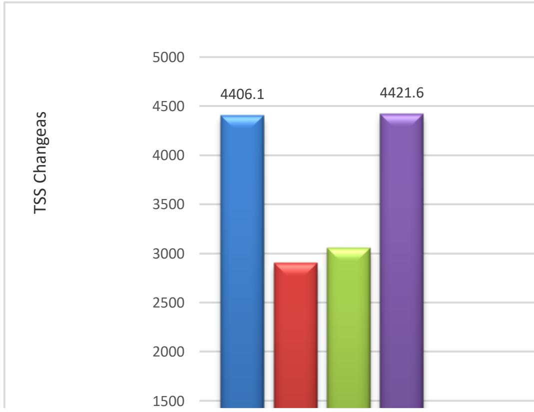

Figure 9. Average TSS variance at different stages of treatment during the period of operation.

According to Table 4, the maximum concentration of crude leachate (TSS = 11300 mg/l) was recorded in early autumn of 2017 and the minimum (TSS = 633.3 mg/l) in the first half of the autumn of 2017. Moreover, the average in the crude leachate unit was recorded to be TSS = 3611.4 mg/l, while in the final output leachate unit, the maximum (TSS = 200 mg/l) was recorded in late winter of 2017 and the minimum (TSS = 10 mg/l) in the first half of the summer of 2018 with the average of TSS = 89.8 mg/l. The lowest concentration (most optimum result) was obtained in the first half of the summer while the highest was recorded in late winter, which can relate to the ambient temperature and the population of the bacteria.

Table 4. The highest and the lowest TSS concentration at measurement stations in different seasons.

Parameter	Maximum		Minimum		Average	
	Concentration	Season	Concentration	Season	Concentration	Season
Crude leachate unit	11300	Early autumn	633.3	Mid-autumn	3611	Summer
Anaerobic reactor	1460	Early spring	50	First half of autumn	322.2	Early and late winter/early summer
Output	200	Early winter	10	First half of autumn	898	Early spring and second half of autumn

-Figure 10 compares pH variance in crude leachate, anaerobic reactor, initial and secondary aeration and output in the specified period. As can be seen, the average pH in the anaerobic unit is very trivial compared to the input leachate, which suggests proper control over environmental conditions and, thus, proper planning during the period of the study, because sudden changes in the acidity of the wastewater can have significant effect on the decrease of bacterial activities and even their death (Rashidi et al. 2014). However, the final output, secondary aeration, crude leachate and initial aeration have the highest average variance in a descending order. Aerobic processes are less sensitive toward pH variance compared to anaerobic ones (Mohammadnezhad and Saleh, 2006). As can be seen, the average pH variance ranges from 6.8 for crude leachate to 9.17 for the final output (Figure 11 & 12). These variations are within the tolerance range of the bacteria (bacteria cannot tolerate acidic environments of pH < 4 and alkaline environments of pH > 9.5) (Rashidi et al. 2014).

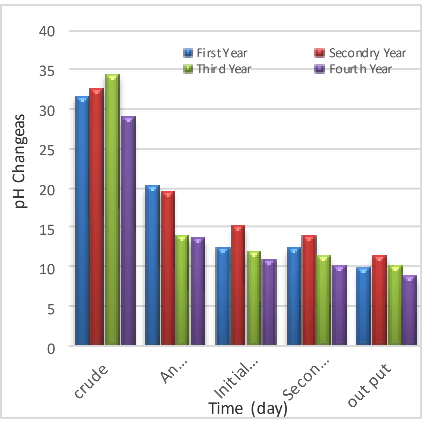

Figure 10. The gradient graph for pH variance at five stations during the time.

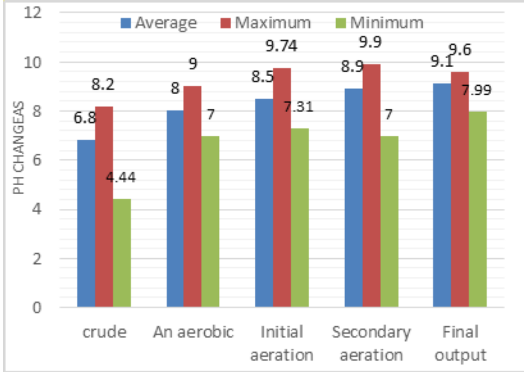

Figure 11. The highest and lowest pH variance at different stages of treatment during the period of operation.

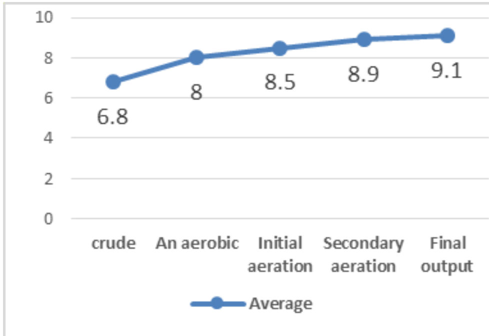

Figure 12. Average pH variance from crude leachate to the final output from 1389 to 1392.

In order to evaluate the treatment process of leachate at the five stations, the variance of pH concentration was measured from year one to year four at 135 occasions and the averages of each year were compared with each other (Table 5). The results show that despite the relative increase of pH from acidity to alkalinity in the crude leachate until the fourth year, pH results in the output unit fell into a fixed range in the third and fourth year and retained its stability. The best results, however, (pH = 8) were observed in the anaerobic reactor (Figure 13).

Table 5. Variance in pH concentration at five stations from year one to year four.

	Crude	Anaerobic	Initial aeration	Secondary aeration	Final output
First year	6.6	7.9	8.1	7.7	9

Second year	6.9	7.9	9	9	9
Third year	6.8	7.9	8.8	8.8	9.2
Fourth year	7.2	8.3	8.8	9.3	9.2

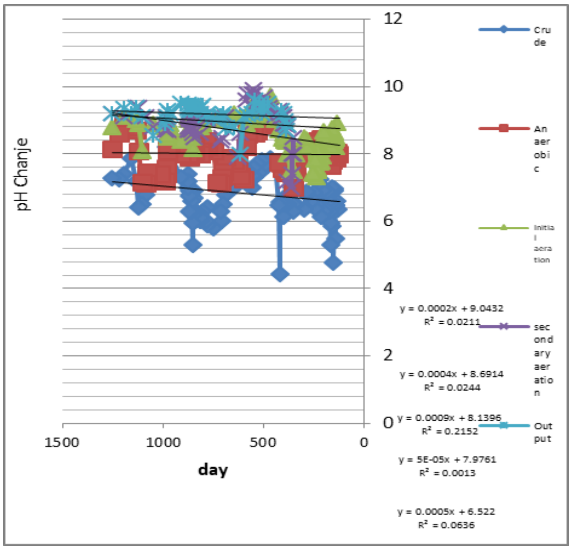

Figure 13. The graph of pH concentration variance at the five stations in different years.

Table 6 shows the results of the pH concentration variance in different seasons of the year for different units of the plant, which is in close correlation to the ambient temperature and the quality of the leachate produced in each season. The pH concentration of the leachate was at its peak in winter and at its lowest value was observed in late summer, which can be attributed to the abundance of fruit and vegetables in the people's diet in summer. The pH concentration of the leachate of the anaerobic unit was at its highest in late summer with the increase in temperature and at its lowest in winter and the pH concentration in the initial aeration unit was at its lowest in mid-autumn probably due to the population of the bacteria and the ambient temperature shock. To compensate this, with the increased bacteria population in winter in the anaerobic unit and by using one-month-old animal and compost fertilizer, a pH of around 8 was obtained, which improved the treatment process and consequently the efficiency of the plant in the cold season. In the final output unit, the pH concentration reached its lowest in the first half of spring (pH = 7.99) which was the best result (in terms of decreasing the alkalinity) for the output leachate.

Table 6. The highest and lowest pH concentration at sampling stations in different seasons of the year

Parameter	Maximum		Minimum		Average	
	Concentration	Season	Concentration	Season	Concentration	Season
Crude leachate unit	**8.2**	Mid-winter	4.76	Late summer	6.8	Early spring, early and mid-summer
Anaerobic reactor	**9**	Late summer and early autumn	7	Late summer	7.97	Early spring, late autumn and summer
Initial aeration unit	**9**	Early summer	7	Mid-autumn	7.976	Late summer, mid- and late winter and spring
Secondary aeration unit	**9.9**	Second half of autumn	7	Early summer and late winter	9.16	Late spring, early summer and mid-autumn
Output	**9.6**	Second half of summer	7.99	First half of spring	9.16	Early spring, summer and early winter

4. discussion

A. COD concentration variance at five measurement stations from year one to year four:

●In the first year, the lowest average concentration (COD = 52972 mg/l) was recorded in the crude leachate unit, while the average COD = 494 mg/l was recorded for the output leachate.

●In the second year, despite the 18-percent increase in the concentration of our crude leachate (COD = 65288 mg/l), decrease in concentration was observed at initial and secondary aeration and output units (COD = 477 mg/l).

●In the third year, despite the 19-percent increase in the concentration of the crude leachate compared with the first year (COD = 66358 mg/l), the decreasing trend of concentration was observed at the anaerobic, initial aeration and output units (COD = 460 mg/l). (the application of an up-flow anaerobic sludge blanket (UASB) reactor followed by a self-aerated sponge (SAS) unit as a combined system for the treatment of hazardous landfill leachate (HLL) for 310 days. The removal efficiencies of the integrated UASB/SAS system were 34.5–59.2% for COD total, Issa Alabiad et al, 2017)

●In the fourth year, the concentration of the crude leachate increased by 18% (COD = 64705 mg/l), and the most optimal result was achieved at all of the station of the plant, in terms of concentration decrease and treatability, especially anaerobic reactor with the efficiency of 95% (COD = 3006 mg/l) and the final output unit with the efficiency of 99% (COD = 375 mg/l).

B. Variance in EC concentration at five measurement stations from year one to year four:

●In the first year, the average concentration EC = 31.5 ms/cm for the crude leachate unit decreased to EC = 20 ms/cm for the anaerobic reactor and EC = 9.7 ms/cm for the final output.

●In the second year, despite the 3-percent increase in the concentration of the crude leachate compared to the first year (EC = 32.6 ms/cm), the concentration decreased significantly in the anaerobic reactor (EC = 19.4 ms/cm). (The performance of the treatment system was found to be hydraulic retention time (HRT), salinity, and C/N ratio dependent Issa Alabiad et al,2017).

●The concentration of the output, however, increased to EC = 11.3 ms/cm.

●In the third year, despite the 8-percent increase in the concentration of the crude leachate compared to the first year (EC = 34.3 ms/cm), the decreasing trend continued at the anaerobic, initial and secondary aeration units, but an insignificant increase was observed in the final output unit (EC = 10 ms/cm).

●In the fourth year, despite the 7-percent increase in the concentration of the crude leachate compared to the first year (EC = 29 ms/cm), a significant decrease was observed at all of the stations, especially the output (EC = 8.7 ms/cm), which stands out as the most optimum result in terms of concentration decrease and treatability.

C. Variance in TSS concentration at three measurement stations from year one to year four:

●In the first year, the average concentration in the crude leachate (TSS = 4406 mg/l) decreased to TSS = 169 mg/l in the output unit.

●In the second year, along with the 34-percent decrease in the concentration of the crude leachate compared to the first year (TSS = 2901 mg/l), a decrease was observed in the output unit (TSS = 84.7 mg/l).

●In the third year, along with the 30-percent decrease in the concentration of the crude leachate compared to the first year (TSS = 3054 mg/l), the decreasing trend continued in the final output unit (TSS = 76.6 mg/l), which was significantly better than the first and the third years.

●In the fourth year, despite the 0.5-percent increase in the concentration of the crude leachate compared to the first year (TSS = 4421 mg/l), a significant decrease was observed at the output station (TSS = 90 mg/l), which stands out as the most optimum result in terms of concentration decrease and treatability.

D. Variance in pH concentration at five measurement stations from year one to year four:

●In the first year, the average concentration was pH = 6.631 in the crude leachate, pH = 7.97 in the anaerobic reactor and pH = 9 in the output unit.

●In the second year, along with the 5-percent increase in the crude leachate compared to the first year (pH = 6.95), the average concentration of the anaerobic reactor and the output unit remained the same (pH = 7.97 and pH = 9.09, respectively).

●In the third year, the average concentration was pH = 6.81 in the crude leachate (a 2.7-percent increase), pH = 7.98 in the anaerobic reactor and pH = 9.24 in the output unit.

●In the fourth year, the average concentration was pH = 7.21 in the crude leachate (a 8.7-percent increase), pH = 8.38 in the anaerobic reactor and pH = 9.29 in the output unit.

5. Conclusions

Waste leachate has a high pollution load, and its leakage and expansion with groundwater or porous environment causes the transfer of pollution parameters in the underground environment. Due to the different physicochemical and biological nature of waste, it is necessary to measure and analyze its important parameters and how it changes throughout the year to predict the performance and efficiency of the treatment plant.

In this study, the results of a study of 4 important pollution parameters during 1258 days in 135 measurements showed that the highest average decrease for all tested parameters among the measuring stations was obtained in the anaerobic unit. flow Anaerobic Sludge Blanket (UASB) Reactor has been successfully implemented to treat wastewater in ourneighboringcountry, India for more than 20 years and its performance was found to be satisfactory (KUET, Khulna, 2020). The anaerobic reactor, primary and secondary aeration unit, represents the concentration changes in a favorable decreasing trend and shows the optimal performance of the aeration units along with the anaerobic reactor (UASB) in reducing and adjusting the concentration of the studied parameters the application of an up-flow anaerobic sludge blanket (UASB) reactor followed by a self-aerated sponge (SAS) unit as a combined system for the treatment of hazardous landfill leachate (HLL) for 310 days. The removal efficiencies of the integrated UASB/SAS system were 34.5–59.2% for COD total, Issa Alabiad et al,2017).

. The aeration units led the concentration changes to a slope reduction, and the results showed the efficiency of the treatment process over a period of 4 years.

The chart of changes in the COD parameter of raw leachate in anaerobic reactor, primary aeration, secondary aeration and output compared to raw leachate (input) has decreased, but this decrease was much less in primary and secondary aeration units. It seems that the bacterial population in the years after operation, has undergone an optimal process and environmental reactions such as temperature shock and various concentrations in terms of organic pollution load despite the increase in COD concentration in raw leachate, over time They have been less involved in refinery treatment activities. The best results were obtained in late autumn at the final output, which was related to the ambient temperature corresponding to the optimal operating temperature of the bacteria (temperature 18 to 25 ^{OC}).

Comparing the average COD in the raw leachate unit and the output leachate with the average yield yield was 99%. The average salinity changes during this period were reduced for 5 stations in the treatment plant treatment process, so that in the output unit a relative stability and relative stability of the untreated leachate was observed. Overall results in the 4-year period showed that despite the relative increase in concentration in raw leachate up to the third year, still the best desired result in all stations in the third year and especially in the fourth year, more favorable result in 4 treatment plants from anaerobic reactor to the final output was very noticeable.

The EC changes in raw and outlet leachate were accompanied by very large changes due to heavy precipitation during the rainy season. The average efficiency of the system salinity removal concentration was calculated to be 67.7%. The average concentration for leachate was the final output with the maximum concentration having the maximum, minimum in the middle of summer and the first half of spring, respectively, which was due to changes in ambient temperature and bacterial population. The anaerobic reactor was able to withstand environmental shocks and pollutant changes throughout the year and adapt over time.(In this treatment plant, anaerobic reactor unit showed the best performance and was able to adapt with high concentrations of TSS and EC)(Rashidi et al. 2014).

In monitoring TSS changes, raw leachate and output both showed a significant slope reduction chart, indicating an acceptable yield of 91% removal and optimal performance in anaerobic reactors and an average removal efficiency of 97.5% for the entire system. The lowest concentrations of TSS were obtained in the first half of summer and the highest concentrations in late winter, which are related to the bacterial population and the temperature inside the treatment plant. the lowest efficiency was achieved in Summer

and late winter, which was related to the temperature and bacterial population. (Rashidi et al. 2014).

The results of the study of pH changes showed that the average in the anaerobic unit compared to the inlet leachate is very small, which indicates the control of environmental conditions and consequently the correct guidance in this time period studied. The pH changes in different seasons of the year in the treatment plants were highly related to the ambient temperature and the quality of the leachate produced in each season. The raw pH of leachate seems to be the highest in winter and the lowest in late summer, which is related to the high consumption of fruits and vegetables in people's diets during the summer. The pH concentration of leachate in the anaerobic unit reached its maximum in late summer with peak heat and in winter to the lowest, and the pH concentration in the primary aeration unit reached its lowest level in mid-autumn, which could be related to bacterial population and ambient temperature shock. Be. Therefore, to compensate for this, by increasing the population of bacteria in the winter in the anaerobic unit and by feeding it with animal manure and compost, which is one month away from the process, improve the treatment process and consequently increase the efficiency of the treatment plant in the cold season, was obtained.

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