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EXAMINING PERFORMANCE OF STABILIZATION PONDS OF AHVAZ'S SLAUGHTERHOUSE

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ABSTRACT: A waste stabilization pond (WSP) is a hole in which household wastewater and other types of sewage are stored for long periods so that organic materials existing in them are deposited, decomposed and stabilized through exposure to light, heat, growth of algae and microorganisms. In this study, wastewater samples collected and treated by the treatment plant of a slaughterhouse in Ahvaz region of Iran and compared the relevant measured parameters with the standards, which set by the Environmental Protection Organization of Iran in order to determine the efficiency of WSPs in treating wastewater and making them usable for irrigation purposes. The results indicate that Turbidity, BOD5, PH, COD, TDS, and TSS values for the treated wastewater stood at >1000 NTU, 912 mg/l, 8.78, 1520 mg/l, 1052 mg/l, and 2180 mg/l respectively. A comparison of these values with the standard values set by the Environmental Protection Organization of Iran revealed a significant difference. This finding shows that the wastewater treatment plant under study had a poor productivity and performance. The wastewater treated by that facility should not be used for irrigation or discharge into surface water.

Key Words: *Environmental standards, Wastewater reuse, Waste stabilization pond*

İran'ın Ahvaz Bölgesinde Mezbahane Stabilizasyon Havuzu Arıtma Veriminin Araştırılması

ÖZ: Atık stabilizasyon havuzu (ASH), evsel atık su ve diğer kanalizasyon türlerinin uzun süre bekletildiği, içinde bulunan organik materyallerin ışığa, ısınmaya, alg ve mikroorganizmaların büyümesine ortam hazırlayarak çökelmesine, parçalanmasına ve stabilize edilmesini sağlayan bir kuyudur. Bu çalışmada; İran'ın Ahvaz bölgesinde bulunan bir mezbahane toplanan ve arıtma tesisinde arıtılmış atık sulardan numune alınarak ASH ile atık suyun arıtımındaki verimin saptanması ve sulama amaçlı kullanılabilmesi için İran Çevre Koruma Örgütü tarafından belirlenen standartlarla ilgili ölçülen parametrelerin karşılaştırılması yapılmıştır. Çalışma sonucunda, arıtılmış atık suyun Türbiditesi, BOİ$_5$, pH, KOİ, TÇKM ve TAKM değerleri sırasıyla > 1000 NTU, 912 mg/L, 8.78, 1520 mg/L, 1052 mg/L ve 2180 mg/L olarak elde edilmiştir. Bu değerlerin İran Çevre Koruma Örgütü tarafından belirlenen standart değerlerle karşılaştırılması sonucunda anlamlı bir farklılık gözlemlenmektedir. Bulgular sonucunda çalışmakta olan atık su arıtma tesisinin verimlilik ve performans açısından zayıf olduğu görülmektedir. Tesis tarafından arıtılan atık su, sulama için kullanılmamalı ve yüzeysel suya deşarj edilmemelidir.

Anahtar Kelimeler: *Çevre Standartları, Atık suların yineden kullanılması, Atık stabilizasyon havuzu*

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INTRODUCTION

The pollution caused by the activities of slaughterhouses units forms a huge part of the whole environmental pollutions and plays a very important role in creating environmental crises. Disorders caused by the wastewaters of these units change the status of aquatic ecosystems and have a negative effect on the variety of species (Nejati, 2006). This matter makes treatment of these sewages essential. Slaughterhouses are usually established far from the residential regions. Strategic management is not considered serious in wastewater treatment systems of slaughterhouses and does not have a proper efficiency. Therefore, slaughterhouses are considered as sources that pollute water and soil (Agha and Heshmati, 2007). If concentration of pollutants does not reduce to the standard limit, they can put the public health in danger by spreading pathogens and contamination of groundwater through wells absorbing sewage (as one of the common methods of disposal of slaughterhouses' sewage). It is obvious that applying proper management can provide such conditions to reduce the degree of wastewater pollution and make sewage reuse, particularly for irrigation uses, possible (Stoop, 1999).

Based on the theory of sustainable development, protecting environment is considered an unavoidable necessity for current and future generations and that is why the crisis of environmental pollutions has turned to a universal issue and challenge today (Darijani and David, 2007; Kupusovic *et al*., 2007). In this respect, being in compliance with the environment is considered as a precondition of activity in huge levels (Dehghanian and Farajnezhad, 2000) and measuring values of spread of environmental pollutants of productive and servicing units will have a special importance. Waste stabilization ponds (WSP) are a hole in which household wastewater and other types of sewage are stored for long periods of time so that organic materials existing in them are deposited, decomposed and stabilized through exposure to light and heat and growth of algae and microorganisms. In WSPs, deposition and stabilization processes take place simultaneously. Such features make WSPs suitable for treating industrial sewage such as wastewaters produced by slaughterhouses, dairy plants and canned food factories (Mara, 1999 ; Reed et al., 1995) .

Since natural processes has a basic role in sewage treatment in ponds and by considering the fact that the speed of natural treatment processes is low, a long retention time is needed for sewage treatment that this retention time is variable between few days to few months depending on weather conditions. Stabilization ponds are among cheap methods of sewage treatment and they can easily be used for treating a wide spectrum of urban and industrial sewages in regions in which there is suitable weather conditions and sufficient cheap lands. Studies that have been done in some countries indicate that waste stabilization ponds can be used as a proper pattern for treating rich sewages such as slaughterhouse sewages (Eckenfelder, 1989). But comprehensive information of the performance of these units in the country is not available. According to the present study which sampled wastewaters collected and treated by the treatment plant of a slaughterhouse in Ahvaz and compared the relevant measured parameters with the standards set by the Environmental Protection Organization of Iran in order to determine the efficiency of WSPs in treating wastewaters and making them usable for irrigation purposes.

Among researches in this field that have been done before, feasibility of using effluents of wastewater treatment of industrial slaughterhouse for agricultural purposes in Qom which has been done by Alireza Najimi et al in which parameters pH, COD, BOD5, input and output sewage have been reviewed that all parameters are in the standard limitation of Environmental Protection Organization for agricultural purposes (Najimi, 2009). Among other researches, we can refer to the review of environmental pollutants of wastewater of slaughterhouse units that have been studies in the "Parandak Khazar" slaughterhouse of Som'e Sara, which was done by Ms Saeyin Daneshvar et al. in this research the parameters COD, TDS, BOD5, ammonium, coliform of digestive and fat and oil of wastewater treatment plants were higher than standard (Daneshvar, 2012). In a research which was done with the title of "review of efficacy of stabilization ponds in sewage treatment plans of Kermanshah's slaughterhouse" by Mr. Mehdi farzad Kia, the indexes of sewage treatment such as pH, TSS, BOD5, COD

all coliform bacteria and fecal coliform bacteria in exiting wastewater was tested and the obtained results showed that the exiting wastewater of this treatment plant with the available quality is not capable of being used in agricultural irrigation or disposal to surface waters and it has a significant statistical difference with the standards of Environmental Protection Organization of Iran (Farzad Kia, 2004). And in another research with the title of "review of efficiency of sewage treatment systems of Kerman's slaughterhouses" which was done by Ms. Leyla Javarani et al, 500 tests were done on the collected samples and the parameters pH, TSS, BOD5, COD were higher than the permitted limit by comparing them with standard values (Javarini *et al*., 2009). And ultimately, in a research entitles as qualitative and quantitative review of livestock and poultry slaughterhouses sewage in Lorestan province, which was done by Ms. Elham Borna et al, by measuring the factors Oil, pH, COD, BOD5 and comparing them with the results of standards of country's Environmental Protection Organization, it showed that exiting sewage of Lorestan's livestock slaughterhouses, except for industrial slaughterhouse of Khoram Abad, are more than the permitted limit and are not suitable for disposal to river and agricultural lands (Borna, 2002).

MATERIAL AND METHOD

Studied Region

Ahvaz's slaughterhouse with the daily slaughter capacity of 96 cows and Buffaloes, 1162 sheep and goats in a land with an approximate area of 8 hectares, and with an infrastructure of about 8 thousands square meters in 15th kilometer of Ahvaz – Khorram Shahr road is active in the area of comprehensive urban project. This slaughterhouse lacks blood sampling unit and blood entered in sewage and raw sewage approximately about 11000 cubic meters enters sewage treatment plants.

Type of pool treatment (Figure 1) is stabilization and it does not perform desirably and ultimately, the wastewater caused by treatment is disposed in Karoun River. In addition, this slaughterhouse lacks sewage treatment system and it only has a corpse-burning furnace for destructing the recorded corpses and other wastes caused by the slaughter are disposed to the slaughterhouse's surrounding area. Figure 1 show a view of stabilization ponds of Ahvaz's slaughterhouse.

Figure 1. A view of stabilization ponds of Ahvaz's slaughterhouse

Sampling

This research has been done on the input sewage and output wastewater of sewage treatment of Ahvaz's slaughterhouse. In order to review the efficiency of this treatment plant, something was arranged to remove the data from input and output sewage and it was set for the samples in cool conditions to be quickly transferred for the associated tests to the environment laboratory of the company "Ferdos Teb Shafa". In this research the parameters Turbidity, pH, BOD_5 (Biochemical Oxygen Demand), COD (Chemical Oxygen Demand), TDS (total dissolved substances) and TSS (total suspended solids) were reviewed in the samples and the feature of the method of the done tests are shown in Table 1.

Table 1. Features of the method of testing the measured parameters

CONTAMINANTS (PHYSICAL,CHEMICAL,BIOLOGICAL)	UNIT	TEST METHOD
Turbidity	NTU	S.M2130 modeB
PH	-	S.M5210 modeB
BOD5 required oxygen for biochemical reactions	Mg/l	S.M5210 modeB
COD required oxygen for chemical reactions	Mg/l	S.M5220 modeB
TDS total dissolved substances	Mg/l	S.M2540 modeC
TSS total suspended substances	Mg/l	S.M2540 modeD

RESULT AND DISCUSSION

In order to review the efficiency this treatment plant, the parameters, which were tested in exiting wastewater , were compared with the environmental standards and criteria of Environmental Protection Organization of Iran (Table 4) for disposal in surface waters or reuse of wastewaters (Environmental Protection Organization of Iran, 1999). Results of analysis of input sewage of stabilization ponds are shown in Table 2 and results of analysis of output sewage of stabilization ponds are shown in Table 3.

Table 2. Results of analysis of input sewage of stabilization ponds

CONTAMINANTS (PHYSICAL,CHEMICAL,BIOLOGICAL)	UNIT	RESULTS
Turbidity	NTU	> 1000
PH	-	8.14
BOD_5 required oxygen for biochemical reactions	Mg/l	1440
COD required oxygen for chemical reactions	Mg/l	2400
TDS total dissolved substances	Mg/l	2600
TSS total suspended substances	Mg/l	2580

Table 3. Results of analysis of output sewage of stabilization ponds

CONTAMINANTS (PHYSICAL,CHEMICAL,BIOLOGICAL)	UNIT	RESULTS
Turbidity	NTU	> 1000
PH	-	8.08
BOD5 required oxygen for biochemical reactions	Mg/l	912
COD required oxygen for chemical reactions	Mg/l	1520
TDS total dissolved substances	Mg/l	1052
TSS total suspended substances	Mg/l	2810

Table 4. Standards of exiting wastewaters of sewage treatment plants (Environmental Protection Organization of Iran)

CONTAMINANTS (PHYSICAL,CHEMICAL,BIOLOGICAL)	DISPOSAL to SURFACE WATERS Mg/l	DISPOSAL TO WELLS Mg/l	AGRICULTURAL USES Mg/l
Turbidity	50	-	50
PH	6.5-8.5	5-9	6.5-8.5
BOD_5 required oxygen for biochemical reactions	50	50	100
COD required oxygen for chemical reactions	100	100	200
TSS total suspended substances	60	-	100

Analysis of the values of physiochemical contaminants of raw sewage of Ahvaz's slaughterhouse shows that the load of pollution of this raw wastewater of this treatment plant is high. Comparing the physiochemical parameters of the wastewater of Ahvaz's slaughterhouse with the environmental standards shows that the rate of TSS, COD, BOD_5 and Turbidity is higher than standard and it worrisome. High COD and BOD_5 show that dissolved oxygen of the exiting wastewater that enters surface waters is very low and this factor causes occurrence of the utriphication phenomenon; on the other hand, high rate of suspended and dissolved solid substances lead to too much and abnormal increase of the salts in water and soil in the region which will be problematic (Manesh and Afyooni, 2009).

Evaluation of Pond's Efficiency

According to the results written in valid references, the process of waste stabilization ponds has the capability to omit 70% to 80% of BOD_5 of samples that haven't been purified. And this capability shall also be increased in the purified samples up to 90%. Reduction rate of TSS in waste stabilization ponds is possible because of the presence of algae in exiting wastewater in rates less than BOD_5; nevertheless, this process can easily reduce the number of bacteria up to 99.9999%, number of viruses up to 99.99% and protozoa cysts and parasites up to 100% (World Health Organization, 2006).
Comparing means of percentage of omission of contaminants in waste stabilization ponds of Ahvaz's slaughterhouse based on the results written in Table 5. With the acceptable values of contaminants in this process indicates that efficiencies of the available ponds are low.

Table 5. Omission rate of tested contaminants in stabilization ponds (percentage)

CONTAMINANTS (PHYSICAL,CHEMICAL,BIOLOGICAL)	OMISSION RATE PERCENTAGE OF CONTAMINANTS
BOD_5 required oxygen for biochemical reactions	36.66
COD required oxygen for chemical reactions	36.66
TDS total dissolved substances	59.53
TSS total suspended substances	15.50

Usability of Wastewater in Irrigation

Figure 2 show comparing the rate of contaminants in exiting wastewater and standards of Protection Organization of Iran associated with using wastewater in agricultural irrigation shows that in most cases the rates of remained contaminants in wastewater is multiple times more than the permitted limit. According to this, using this wastewater for irrigation is in conflict with the standards of Protection Organization of Iran.

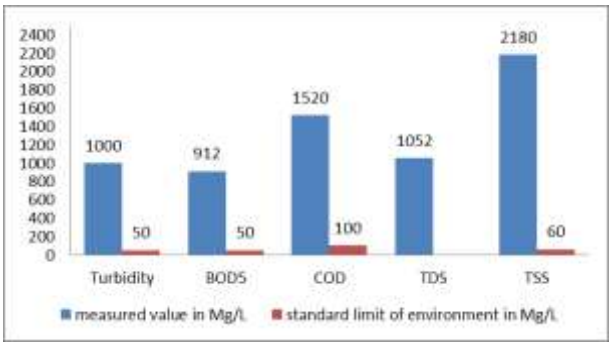

Figure 2. Comparison of parameters of contaminants of exiting wastewater with the standards of Environmental Protection Organization of Iran for irrigation purposes

Ability of Disposing Wastewater in Surface Waters

Figure 3 show Comparing the rate of contaminants in the exiting wastewater with standards of disposing wastewater in surface waters of Environmental Protection Organization of Iran shows that in most cases the rate of remained contaminants in the wastewater is multiple times more than the permitted limit. According to this, disposal of exiting wastewater with this compound in river is in conflict with the principles of country's Environmental protection and leads to pollution of river's water.

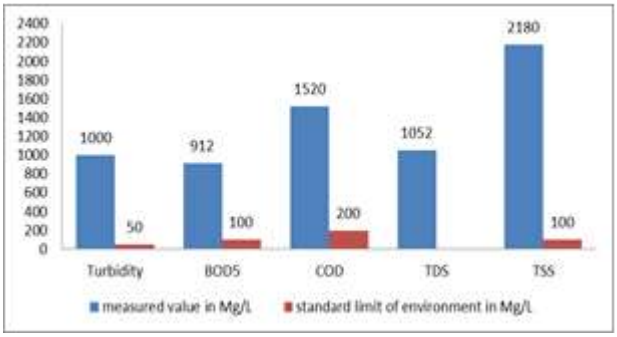

Figure 3. Comparison of parameters of contaminants of exiting wastewater with the standards of Environmental Protection Organization of Iran for disposal in surface waters

CONCLUSION

Given the reviews that have been done, Ahvaz's slaughterhouse has not considered the environmental actions and this slaughterhouse's exiting wastewater makes the load of environmental pollution twice more. Low efficiency and increase of the volume of the exiting wastewater are the most important problems of this treatment plant. In most of the slaughterhouses of Iran, due to lack of use of proper technology, preliminary separation of blood for producing side products such as blood powder does not take place; therefore, blood enters the sewage system and increase the organic load and degree of sewage pollution which will consequently increase the side costs (environmental effects and costs of water treatment). Since establishing efficient systems of sewage treatment is an unavoidable necessity and needs a considerable investment, regulatory organizations can make establishment of industrial units a priority by considering the national and regional conditions and in the form of development programming model and obligate contaminant units to comply with the environmental standards. Also developing and implementing proper encouraging and punishing policies, development of industrial units, privatization and changing the role of government from outsourcer to policy maker and supervisor, will be of crucial help to the improvement of environmental situation of the region. The significant point is that of the necessity and value of environmental issues became clear for industry owners, they will certainly become guardians of the ecosystems and we could hope that the policy of "sustainable development" replaces development with each cost and method.

The provided treatment system shall response to environmental standards and requirements and shall be suitable for the capacity of slaughterhouse, climatic conditions, personnel's skill and implementation costs. One of the most suitable methods for treating slaughterhouses' sewage is simultaneous use of physical and biological treatment.

Given the studies which have been done, the most important program of controlling and reducing wastewater contaminants of slaughterhouses is announced as follows:

- Using chlorination method by intelligent systems instead of manual method for reducing microbial load.
- Using anaerobic sequencing batch reactor (ASBR) in treating slaughterhouse' wastewater.
- Using new chemical treatment systems.
- Reconstructing dirt stuck systems, secondary treatment, fat retention and filtration of the slaughterhouse.
- Using nanotechnologies in treating sewage of poultry Industry.
- Using ozone in order to reduce the microbial load of corpses and increase the durability of the produced products.
- Using sewage treatment systems of activated sludge in the slaughterhouse and using the resulting water for agricultural uses.

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