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Wastewater Physicochemical Characterization from the Thanatopraxy Room

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Abstract

Wastewater treatment consists of a series of physical, chemical and biological processes that aim to eliminate contaminants present in the effluent. In this research, a physical chemical treatment is carried out in a wastewater treatment plant from the thanatopraxy room of Lorduy Funeral Home. The waters coming from wastewater was characterized in terms of their levels of BOD_5, COD and fats, suspended and sedimentable solids, alkalinity, acidity, color. The physicochemical parameters were determined following the specifications of the Standard Methods for Examination of water and wastewater 22 ND Edition 2012. The results were analyzed by means of ANOVA (one way) in order to determine statistically significant differences ($p<0.05$) among the samples. Removal is achieved for BOD_5 of 98.3% and 98.8% for COD. The fat is removed almost 100%. The presence of metals in the treated wastewater is not detected. The treatment plant is efficient in the process of removal of contaminants.

Keywords: industrial effluents, pollutants, thanatology, water treatment, wastewater

1. Introduction

Wastewater is defined as material derived from domestic waste or industrial processes, which for reasons of public health and considerations of economic and aesthetic recreation, cannot be discarded by dumping them without treatment in lakes or conventional streams [1].

Wastewater treatment consists of a series of physical, chemical and biological processes that aim to eliminate physical, chemical and biological contaminants present in effluent water for human use [2].

The purpose of wastewater treatment is to produce clean water (or treated effluent) or reusable in the environment and a solid waste or mud suitable for disposal. It is very common to call it sewage treatment to distinguish it from the treatment of drinking water [3]. There are a great diversity of pollutants in industrial wastewater such as oils, fats, organic acids and metals, which means a great problem in the treatment and as a contaminant of aquatic ecosystems [4, 5, 6].

The wastewater generated in the tanatopraxia rooms of the funeral homes, when not receiving a treatment process, becomes an important source of contamination, this is why government institutions have established monitoring and control protocols that guarantee the non-generation of negative environmental impacts in the environment (IDEAM).

In today in the world it has focused on the search for biotechnological alternatives for the treatment of this type of waste and at the same time minimize or stop the effects mentioned. Biological treatment is one of the alternatives used, where the properties of living organisms are used to eliminate residues with high content of pollutants in the ecosystem [7,8].

The objective of this research was directed to the characterization of non-domestic wastewater coming from the thanatopraxy room of a funeral parlor when treating them conventionally, using a treatment plant for industrial wastewater.

2. Materials and methods

2.1. Samples.

In this research, was used as a study sample from residual water of the tanatopraxia room, located in the city of Cartagena de Indias, Colombia.

2.2. Collection of samples.

The collection of the residual effluent samples was directly carried out from the pipeline at the dumping site immediately after the preparation of the bodies and

subsequent washing of the thanotopraxy room**.**

2.3. Wastewater treatment.

The wastewater treatment from the thanotopraxy room was carried out in a conventional treatment plant with a capacity of 0.15 liters per second, constructed of polyester reinforced with fiberglass, resistant to bending and tension.

2.4. Physicochemical characterization of the effluent.

The physicochemical characterization of the residual water sample was carried out following the Standard Methods for Examination of water and wastewater 22 ND Edition 2012 and the guide for the monitoring of vertimientos and superficial waters of the Institute of environment (IDEAM- Colombia) [9].

2.5. Statistical analysis.

The results of the characterization of wastewater were analyzed by means of ANOVA (one way) in order to determine statistically significant differences ($p<0.05$) among the samples. The software SPSS (version 17.0 for Windows) was used. All test was done in triplicate.

3. Results and Discussion

3.1. Physico-chemical analysis.

Table 1 shows the physicochemical characterization of untreated wastewater.The values found for BOD_5 (2364.7 mg of O_2/L) and COD (6436 mg of O_2/L) are well above the reference values recommended by the regulations in force in Colombia for wastewater.

These results indicate the need to carry out a treatment to these waters before being discharged into the sewage system, otherwise, they can generate a negative environmental impact and therefore, damage to the ecosystem.

With respect to the amounts of suspended solids (5820 mg/L), sedimentable solids (40 mg/L) and fats (5820 mg/L) found in the untreated wastewater, they present values that are higher than those required for this type of water (Table 1). It is also important to highlight the non-presence of metals, with the exception of phosphorus, for which a value of 13.8 mg of P/L is reported (See table 2).

In Table 3, the values of the parameters for the treated wastewater in the treatment plant are reported. In general terms, it can be affirmed that a great decrease is achieved in all quantities of the parameters evaluated.

Table 1. Physicochemical characteristics of the effluent from the tanatopaxy room of the "LORDUY FUNERAL".

Residual effluent without physicochemical treatment							
Parameter	***Analytical technique***	***Unit***	***Analytical method***	***LDM***	***LCM***	***Experimental value***	***Ref value.***
pH	PTA-FQ007	Units de pH	SM4500HB	0.01	0.01	5.62	5-9
Temperature	PTA-FQ067	°C	SM2550B	0.10	0.10	31.7	40.0
BOD_5	PTA-FQ002	mg de O_2/L	SM5210B	2.90	3.24	2364.7	375
COD	PTA-FQ001	mg de O_2/L	SM5220D	30.0	45.0	6436	900
Total acidity	S.C	mg de $CaCO_3$/L	SM5520D	N.R	8.00	178.9/8.30	Reported
Total alkalinity	PTA-FQ008	mg de $CaCO_3$/L	SM2340C	2.10	3.10	187.4	Reported
Calcic hardness	PTA-FQ008	mg de $CaCO_3$/L	SM2340C	2.10	3.20	59.9	Reported
Total hardness	PTA-FQ007	mg de $CaCO_3$/L	SM2340C	2.10	3.10	112	Reported
Colour	S.C	M-1	ISO7887-2011. MB	N.A	N.A	0.86	Reported
Total suspended solids	PTA-FQ004	mg/L	SM2540D	1.60	4.50	11468	100
Sedimentable solids	PTA-FQ066	mg/L	SM2540F	0.10	0.10	40	1.5
Fat	PTA-FQ003	mg/L	SM5520D	11.0	13.7	5820	30
Phenols	PTA-FQ076	Mg de Phenol/L	SM5530B,C	0.016	0.025	No detectable	0.200
Formaldehyde	N.E	Ug/L	ASTM-D 630398	N.E	N.E	640	Reported
Total Nitrogen	PTA-FQ080	mg/L	SM4500 Norg C	0.13	0.69	103.4	Reported

S.C: sub-contracted. N.E: not especified. LDM: Limit Detection Method. LCM: limit cuantificatión mrthod. Ref value: reference value Res 0631/2015 art 14 (Min of Environment). N.A: Not apply

Table 2. *Metal concentration values in wastewater, from the tanatopaxy room of the "LORDUY FUNERAL"*

Residual effluent without physicochemical treatment							
Metal	***Analytical technique***	***Unit***	***Analytical method***	***LDM***	***LCM***	***Experimental value***	***Ref value.***
Cadmium	PTA-FQ 093	mg de Cd/L	SM 3111B	0.016	0.054	N. detectable	0.05
Chromium	PTA-FQ 093	mg de Cr/L	SM3030 E	0.023	0.076	N. detectable	0.50
Mercury	Sub-.contracted	mg de Hg/L	SM3014B	NA	NA	N. detectable	0.01
Lead	PTA-FQ 093	mg de pH/L	SM3111B	0.029	0.094	N. detectable	0.10
Phosphorus Total	PTA-FQ 075	mg de P/L	SM4500-PB,E	0.030	0.094	13.8	Reported.

LDM: Limit Detection Method. LCM: limit cuantificatión mrthod. Ref value: reference value Res 0631/2015 art 14 (Min of Environment). N.A: Not apply

Table 3. Physicochemical characteristics of the residual effluent after treatment

Residual effluent after receiving treatment							
Parameter	***Analytical technique***	***Unit***	***Analytical method***	***LDM***	***LCM***	***Experimental value***	***Ref value.***
pH	PTA-FQ007	Unidades de pH	SM4500HB	0.01	0.01	6.54-6.63	5-9
Temperature	PTA-FQ067	°C	SM2550B	0.10	0.10	32.90	40.0
BOD_5	PTA-FQ002	mg de O_2/L	SM5210B	2.90	3.24	40.00	375
COD	PTA-FQ001	mg de O_2/L	SM5220D	30.0	45.0	78.52	900
Total acidity	S.C	mg de $CaCO_3$/L	SM5520D	N.R	8.00	<8.00	Reported
Total alkalinity	PTA-FQ008	mg de $CaCO_3$/L	SM2340C	2.10	3.10	92	Reported
Calcic harness	PTA-FQ008	mg de $CaCO_3$/L	SM2340C	2.10	3.20	46.10	Reported
Total hardness	PTA-FQ007	mg de $CaCO_3$/L	SM2340C	2.10	3.10	68.30	Reported
Colour	S.C.	M-1	ISO7887-2011. MB	N.A	N.A	0.22	Reported
Total suspended solids	PTA-FQ004	mg/L	SM2540D	1.60	4.50	N. detectable	100
Sedimentable solids (SS)	PTA-FQ066	mg/L	SM2540F	0.10	0.10	<0.100	1.5
Fat	PTA-FQ003	mg/L	SM5520D	11.0	13.7	N. detectable	30
Phenols	PTA-FQ076	Mg de Fenol/L	SM5530B,C	0.016	0.025	N. detectable	0.200
Formaldehyde	N.E	mg/L	ASTM-D 630398	N.E	N.E	N. detectable	Reported
Total Nitrogen	PTA-FQ080	mg/L	SM4500 Norg C	0.13	0.69	14.055	Reported

S.C: sub-contracted. N.E: not especified. LDM: Limit Detection Method. LCM: limit cuantificatión mrthod. Ref value: reference value Res 0631/2015 art 14 (Min of Environment). N.A: Not apply

Table 4. *Concentration values of the metals in the residual water after receiving treatment.*

Residual effluent after receiving treatment							
Metal	***Analytical technique***	***Unit***	***Analytical method***	***LDM***	***LCM***	***Experimental value***	***Ref value.***
Cadmium	PTA-FQ 093	mg de Cd/L	SM 3111B	0.016	0.054	*<0.0048*	*0.05*
Chromium	PTA-FQ 093	mg de Cr/L	SM3030 E	0.023	0.076	*LDM<0.0036 <LCM*	*0.50*
Mercury	Sub-.contracted	mg de Hg/L	SM3014B	NA	NA	*<0.0006*	*0.01*
Lead	PTA-FQ 093	mg de Pb/L	SM3111B	0.029	0.094	*No detectable*	*0.10*
Phosphorus total	PTA-FQ 075	mg de P/L	SM4500-PB,E	0.030	0.094	*6,26*	*Reported*

LDM: Limit Detection Method. LCM: limit cuantificatión mrthod. Ref value: reference value Res 0631/2015 art 14 (Min of Environment). N.A: Not apply

The removal of BOD_5 and COD was 98.30% and 98.77%, respectively. These percentages of removal represent amounts that are well below the values required by the current regulations for wastewater in the funeral sector, these results correspond to those reported in the literature [3].

A total removal of the fat was achieved, which translates into the high lipolytic capacity of the microorganism used for the biodegradation of the effluent. The other parameters evaluated, such as sedimentable and suspended solids, were within the values required by Colombian regulations [6, 7, 10].

In the treated residual effluent, metas as lead not was found; The concentrations of metals such as cadmium, chromium, mercury and phosphorus were below the allowable limits that are required for wastewater according to the Colombian legislation.

4. Conclusion

The physicochemical treatment of wastewater from the thanatopraxy room turns out to be very efficient in terms of the removal of contaminants. The plant used allows to remove high percentages of BOD and COD, as well as the grease present in the effluent. The treated wastewater can be discharged into the sewer system with the assurance of not causing any negative environmental impact on the ecosystem.

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