"OPTIMIZATION OF ACTIVATED SLUDGE PROCESS THROUGH ENERGY SAVING"

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SUMMARY

The major drawback to using an "activated sludge" system in wastewater treatment is the expensive cost associated with the energy consumption required to meet the oxygen demand required to achieve the oxidation of organic matter, which represents about 50% of the energy consumption of the plant. We present our analysis and conclusions of the measurements of the physicochemical parameters obtained during the operation and maintenance of the SPA II plant located in San Juan del Río Querétaro, Mexico, where this process has been optimized, reducing operating costs.

1. - INTRODUCTION

It is well known the negative effect caused to humans and ecosystems when the wastewater is directly discharged into bodies of water, limiting their use, either as drinking water, irrigation water for agriculture, or restricting its use in industry.

Hence, since water is an indispensable element for life, making a responsible use and subsequent treatment is nowadays an obligatory activity, making the cost of treatment a very important issue.

2. - THEORETHICAL BACKGROUND

In the biological treatment of wastewater, different microbiological reactions are involved to eliminate or transform the different types of organic matter, nutrients, and other elements that compose it. These reactions can occur under different conditions: aerobic (presence of dissolved oxygen), anoxic (absence of OD, nitrates) or anaerobic (absence of OD and nitrates). The "Activated Sludge" process consist in reproduce in a confined and controlled space the mechanisms which nature uses to degrades organic matter through the supply of oxygen.

Its basic configuration consists in having a suspension of a microbial crop in a reactor, which is capable of assimilate organic matter present in the residual water with the oxygen supply, it requires an aeration and agitation system to avoid sedimentation of the flocks in the reactor, allowing homogenization of the activated sludge's. Once the organic matter has been rusted enough, the mixed liquor is sent to a tank of sedimentation where the biological mud is separated from the water. A part of the decanted biomass is recirculated to the reactor for keeping a proper concentration of microorganisms, while the rest of the mud is extracted of the system to avoid excessive accumulation of biomass and control the retention cell average time.

To grow and reproduce, the micro-organisms need:

- Power to support their metabolic functions and
- Carbon and nutrients (N, P, Ca, Mg, etc.) to generate new cell material.

All this it obtained of the matter in the effluent, from the environment, or from contributions of the treatment system.

In general, there are three types of microorganisms according to their breathing conditions:

- **Aerobic organisms:** they use dissolved oxygen for breathing. The carbon organic is oxidized getting CO2 and water:

  Heterotrophic aerobic bacteria: $C_6H_{12}O_6 + 6O_2 \dashrightarrow 6CO_2 + 6\ H_2O$

- **Facultative organisms:** they use dissolved oxygen when it is available, when there is no dissolved oxygen they use oxygen linked to nitrite (NO2-) or nitrate (NO3)-.

- **Organisms anaerobic:** they use endogenous reactions generating CO2 and CH4.

In a process of aerobic treatment, the metabolism of the microorganisms present in the system can be expresed in the following way:

$$\text{Organic Matter} + \text{Micro-organisms} + \text{Nutrients} + O_2 \longrightarrow \text{Final Products} + \text{New Microorganisms} + \text{Energy}$$

Specifically, during the removal or stabilization of organic matter contained in the wastewater, are three main phenomena's which consist of:

- ***Oxidation of organic matter***

  In this stage, it uses the oxygen dissolved in the water to generate from the biochemical reactions the energy required for the living processes:

$$C_xH_yO_2 + O_2 \xrightarrow{\text{microorganisms}} CO_2 + H_2O$$

  Organic matter is oxidized to produce CO2 and H2O (cellular respiration). CATABOLISM.

- ***Synthesis of cell mass***

  It uses the dissolved oxygen to generate the required energy for the synthesis of new cell mass:

$$(C_xH_yO_2) + NH_4^+ + PO_4^{3-} + O_2 \xrightarrow{\text{microorganisms}} \text{New Microorganisms} + CO_2 + H_2O$$

  Starting from the organic matter and using ammonium and phosphate as sources of nitrogen and phosphorus it generates new cell material (anabolic route) ANABOLISM.

- ***Oxidation of cell mass***

  Finally, the micro-organisms suffer an autooxidation progressive of its cell mass.

$$(\text{Microorganisms}) + O_2 \xrightarrow{\text{microorganisms}} CO_2 + H_2O + NH_4^+ + PO_4^{3-}$$

This process is known as "endogenous respiration" in which also dead microorganisms are serving for food to other microorganisms. This reaction has place when the organic matter available is limited so that the microorganisms of the system uses its own protoplasm to obtain energy for its maintenance.

When organic matter concentrations are high, even if they are composed of a complex nature, the rate of bacterial growth is also high and becomes independent of that concentration. As it performs the oxygen supply (period in that its aeration is made), the microorganisms come to use the organic compounds more easily to rust, to get the energy required in a fast way, until there only remain the complex compounds more difficult to remove, hence the bacterial growth rate starts to decrease, but despite this, the microorganisms still continue growing to a logarithmic rate since they have stored "reserves" of organic matter by what will continue to grow until exhaust its reserve, (time without aeration), when this happens it presents the fast decrease of cell mass in conjunction with an increase in the concentration of nitrogen (auto-oxidation).

The consumption of oxygen of the system is proportional to the activities of synthesis or conversion of matter organic in them cells microbial and the breathing endogenous or use from them cells living of them waste biodegradable, downloads by them cells dead.

It is precisely this concept which provides the basis for the optimization of energy consumption since we believe that it is possible to improve significantly the efficiency of the treatment process by introducing small changes in the operation of the plant, reducing the aeration times that will allow us to increase the utilization of the energy used, this system we call it "High stress".

The foundation theoretical of this system is based in the consumption of them reserves of energy that have them organisms present in the mud during the periods without aeration where is produces a reduction of the oxygen dissolved generating a phase of anoxia that cause a stress in them bacteria before this limiting, but that us allows the saving of energy; once enters air again the system, micro-organisms are a medium rich in organic matter and begin their degradation. The energy obtained of them routes catabolic is used first in create new reserves energy necessary for start it synthesis again material cell, which had been depleted in the phase of anoxia. Before biosynthesis routes to begin, the mixed liquor is again undergoing another phase of anoxia and reserves are again consumed without having been used in the cell of new material construction.

As a result of this system of operation of the plant, anabolic routes are minimized and encouraged the routes of degradation of organic matter and energy reserve in addition to reducing the production of sludge, with consequent energy saving.

2.- Practical approach:

In order to avoid contamination of the San Juan River, as part of the program comprehensive of sanitation of the area suburbs of San Juan del Rio, the second largest municipality in the State of Queretaro, built wastewater treatment plant "San Pedro Ahuacatlán II" (SPA II) with a flow rate of 300 lps design, and has been in operation since 2010.

The basic configuration of the treatment consists of:

- Pretreatment :
    - Screening
    - Pumping Cárcamo

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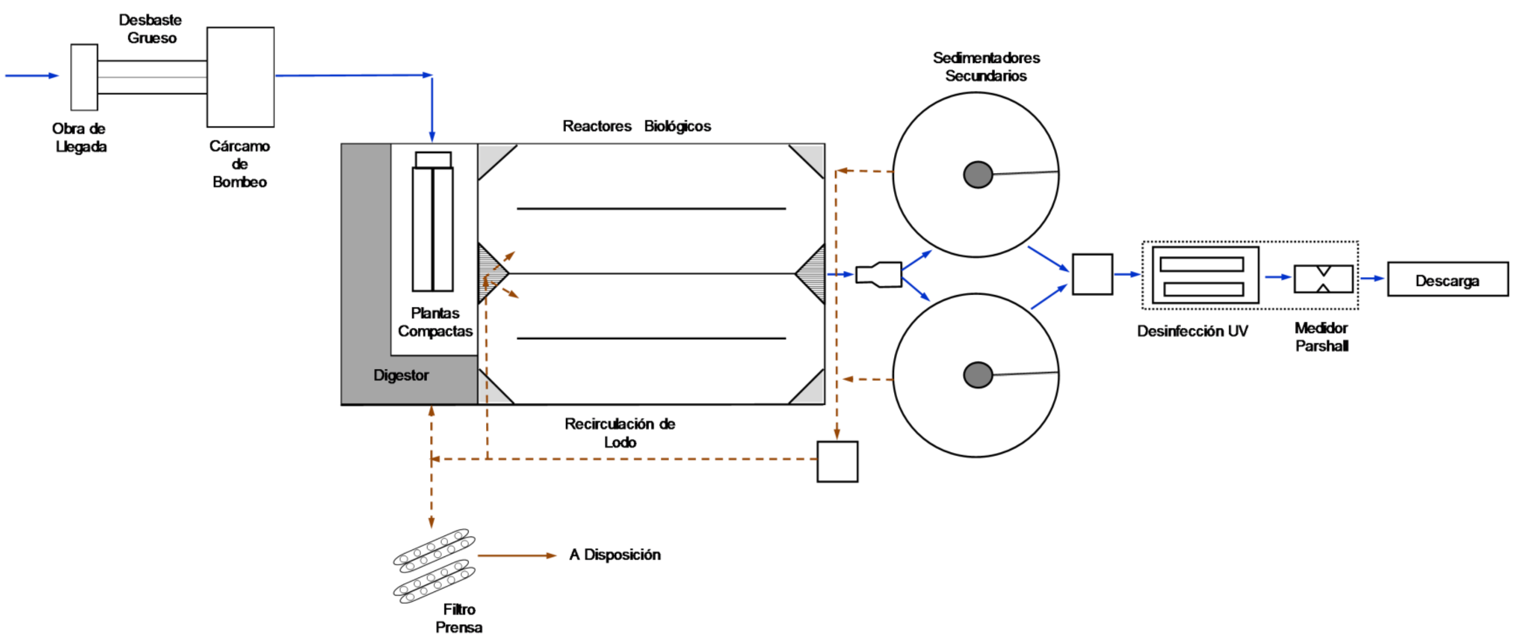
- Treatment system in two trains consisting of:
    - Compact plant (roughing, fine grit separator and degreasing)
    - Bioreactors (aeration by tubular horizontal flow mixers agitation and fine bubble diffusers)
    - Settler
    - Desinfection UV
    - Aerobic digester
    - Filter press

DIAGRAM OF FLOW WWTP SPA II



OPERATION OF THE PLANT OF TREATMENT

Systematic checking of the processing units and equipment fitted as well should be for the optimal operation of a WWTP and the reliability of the measurements obtained for study, as well as the chemical and biological monitoring the process it is necessary to specify a routine check and calibration of equipment and sampling and its periodicity.

Of way general the process of sludge activated managed of form efficient can obtain the following % of removal.

PARAMETER	% REMOVAL EFFICIENCY
BOD_5	90 95
SST	85 95
NITROGEN TOTAL	15-30
PHOSPHORUS	10 25
FECAL COLIFORMS	60-90

This study seeks to reduce the cost without lowering the efficiency of removal presented in the above table.

Are based on the premise that the preliminary processes such as roughing and systems of measurement of parameters on the PTAR are in good condition; for optimizing any process it is therefore of utmost importance develop a methodology that will allow the proper functioning of the installed equipment so both preventive and corrective maintenance of them is vital.

Within the actions performed to optimize the operation of biological reactors gave special care to pre-treatment systems cleaning since this helps the efficiency of process units subsequent to indirectly affecting the total consumption of oxygen required for the biological purification.

A wrong shredder may affect the proper functioning of the biological processes, because it increases the density of the mud hampering their separation walls and bottom reactors as well as pipes and pipelines or causing abrasion on mechanical components in movement.

Of equal form, an excess of fat can clog grids and this affects of form specific them processes biological, especially in a system of sludge activated hampering the correct aeration since decrease the coefficient of transfer in addition to favor the production of "bulking", affecting also them processes of digestion of sludge.

So as we can consider of way general that a good retention of solid suspended (SS) before the treatment biological can reduce the BOD since part of these are constituted by matter organic.

FACTORS AFFECTING THE BIOLOGICAL PROCESS:

Temperature: We know that an increase in temperature increases the rate of reaction but also reduces the stability of the micro-organisms. The biological treatment is developed appropriately between the ranges of temperature of 12 ° C - 38 ° C (mesophilic zone).

The temperature range reported in the period of study at certified laboratory analyses ranges from 16 ° C - 28 ° C, which is within specified by what not seen great influence of this parameter in our analysis, however to be an important factor is monitored constantly.

PH: Microorganisms are active around a particular pH and generally is not very different from pH = 7. This parameter is located within the range in the water to treat.

Both the temperature and pH have an important role in the survival and growth of the bacteria, although they can survive in a wide range, optimum growth occurs in a very restricted range.

Sludge age: Is defined as the time that remain them sludge in the interior of the system before be purged, controlling the age of them sludge is controls the speed specific of growth of the biomass in the system.

Recirculation: Is necessary to maintain sufficient sludge concentration in the system to achieve the degree of treatment required in addition, it is necessary to avoid loss of solids with the effluent and maintain the appropriate mud layer depth. For this purpose it is important to determine the optimal flow of recirculation.

Amount of runoff: The N and P in adequate amounts are necessary for the proper functioning of the system

Optimization of activated sludge system, we consider that the following aspects should be analyzed:

- Concentration of effluent *(BOD, TSS)*
- Amount of biomass in the reactor *(recirculation)*
- Excess sludge generated *(recirculation)*
- Amount of oxygen used *(time of aeration)*

The following considerations should be taken into account:

The majority of discharges of wastewater present flow and fluctuations of organic load due to the variation of water consumption by the population, which resolves with the basin of pumping that allows you to adjust these parameters.

Based on the experience of 16 years (2000 to 2016) in the design, construction and operation of treatment plants have found that it is possible to save up to 50% energy optimizing the operation of the bioreactor using optimum air supply applying systematically cleaning and maintenance of the equipment and the pretreatment.

3.- PRACTICAL EXPERIENCES:

In recent years some actions have been applied systematically in the operation of several treatment plants located in the city of San Juan of the Río Querétaro with the aim of reducing operating costs being the most representative plant of San Pedro Ahuacatlán II (SPA II), we present here the results obtained.

The quality of waste water generated by the city of San Juan of the river reaching SPA II plant was affected in the past by clandestine discharges from industries in the region, making it one of the priorities to achieve the reduction in energy consumption was homogenize the input to the plant influent controlling unwanted downloads , this was achieved thanks to the monitoring and tracking carried out by operating personnel of the plant and the support of the authorities, thus minimizing this problem.

Below is the historical some input data where you can clearly see the difference in the concentrations of water to plant:

PARAMETERS INPUT TO THE WWTP SPA II AVERAGE						
PARAMETER	**UNITS**	**2010**	**2011**	**2012**	**2015**	**2016**
BOD	mg/lt	662.7	576.7	724	1145.6	498.7
SST	mg/lt	208.1	257.9	375	2788.1	327.5
NT	mg/lt				42	36.8
PT	mg/lt				6.166	13.5

Energy consumption being the item that represents the highest percentage of participation in the cost and at the same time, system of aeration equipment that consumes energy, we have focused to investigate and propose different ways of operation that will allow us to reduce operating costs through practical study of the aeration time.

It is important to highlight some behaviors defined during the study period:

More homogeneous flow gets first thing in the morning (6:00 am) being the organic load of a low value, to be increased gradually both flow and load to the passing of the hours, and from 12 and up to 19 hrs. there are tips of influent flow with the respective increase of organic to stabilize again from 19:00 hrs. and up to the first morning hours where the influent flow rate decreases and maintaining homogeneously.

The hydraulic residence time in the bioreactor was maintained between 8-11 hours, over a system of conventional active sludge, but without reaching the conditions of prolonged aeration.

Oxygenation was established around 1.5 - 2.0 mg / lt.

It proceeded to carry out systematic and controlled reduction in the aeration time and the measurement of the pollutant load both the input and the output through the parameters of BOD and TSS for the years 2015-2016. Determined the efficiency of treatment, maintaining the concentration of dissolved oxygen within the established parameters to analyze and compare against measurements of previous years.

4.- STATISTICAL ANALYSIS:

EVOLUTION HISTORICAL OF THE CONSUMPTION OF ENERGY FOR THE WWTP SPA II

The plant of SPA II is designed for 300 LPS average, starting operations in 2010 making until the last 2016 it greater catchment of waters residual urban for its treatment.

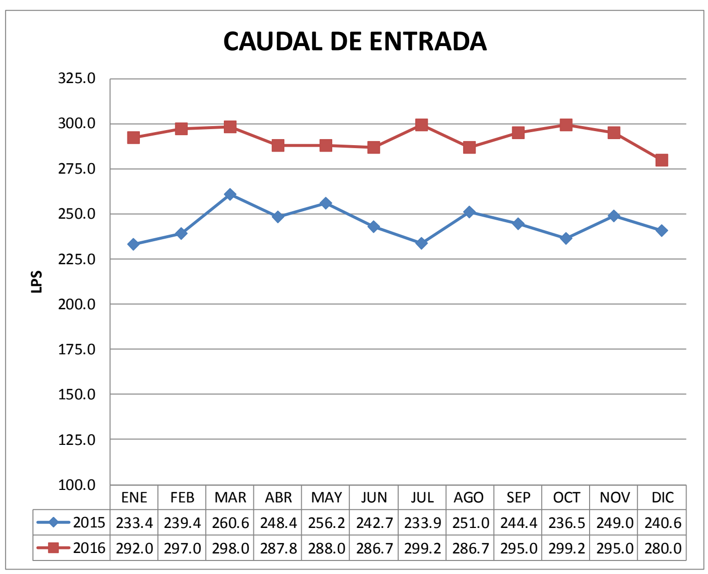
VARIABILITY IN THE VOLUME AVERAGE OF INPUT
WWTP SPA II
LPS

YEAR	2010	2011	2012	2015	2016
AVERAGE FLOW	196.4	218.6	241	245.7	292
% OF ANNUAL INCREMENT		11.3	10.3	1.9	19
% INCREASE2010-2016					48.7

The following graph shows the increase in the volume processed in the SPA II plant during the years 2015 and 2016

VARIABILIDAD EN EL CAUDAL PROMEDIO DE ENTRADA
PTAR SPA II
LPS

	2015	2016	% INCREMENTO
ENE	233.4	292.0	---
FEB	239.4	297.0	24.1
MAR	260.6	298.0	14.3
ABR	248.4	287.8	15.9
MAY	256.2	288.0	12.4
JUN	242.7	286.7	18.1
JUL	233.9	299.2	27.9
AGO	251.0	286.7	14.2
SEP	244.4	295.0	20.7
OCT	236.5	299.2	26.5
NOV	249.0	295.0	18.5
DIC	240.6	280.0	16.4
PROMEDIO		292.0	19.0



Is sought homogenize them parameters of input, controlling them downloads clandestine to the sewer of them industries of the region achieving in 2016 homogenize the load contaminant with respect to the 2015, regulating so them peaks so marked of them months of January, April, May and July 2015.

HISTORICAL CHARACTERIZATION OF THE WATERS OF ENTRY TO THE WWTP

DBO INFLUENT (mg/lt)

	2010	2011	2012	2015	2016
JAN		496.0	751.8	4,473.0	
FEB		601.9	822.3	735.5	313.9
MAR		436.0	524.6	540.5	474.6
APR		687.0	723.4	1,057.0	472.6
MAY		733.0	823.4	1,247.3	334.5
JUN		535.8	780.4	453.0	694.5
JUL		559.1	642.3	3,148.3	488.7
AUG		538.4		354.9	407.2
SEP		571.1		278.0	656.5
OCT		534.8		608.4	748.9
NOV	600.5	620.2		460.3	652.6
DIC	724.9	607.4		390.9	242.1
AVERAGE	**662.7**	**576.7**	**724.0**	**1,145.6**	**498.7**

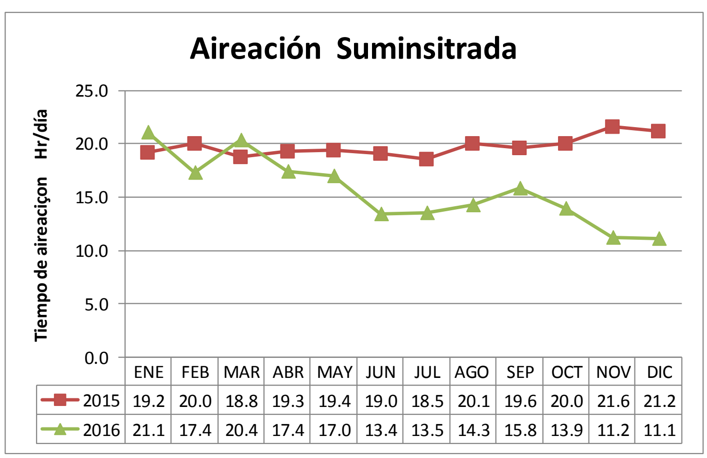
APPLIED AERATION TIME

Are they modified the aeration times and controlled the amount of dissolved oxygen in the reactors.

TIEMPOS DE AIREACION

HR /DIA

	2015	2016
ENE	19.2	21.1
FEB	20.0	17.4
MAR	18.8	20.4
ABR	19.3	17.4
MAY	19.4	17.0
JUN	19.0	13.4
JUL	18.5	13.5
AGO	20.1	14.3
SEP	19.6	15.8
OCT	20.0	13.9
NOV	21.6	11.2
DIC	21.2	11.1
PROMEDIO	19.7	15.5



The removal results shown below:

CHARACTERIZATION OF WATERS

DATA OBTAINED

MES	CAUDAL DE ENTRADA M3/MES	2015					
		DBO (mg/lt)			SST (mg/lt)		
		ENTRADA	SALIDA	% REMOCION	ENTRADA	SALIDA	% REMOCION
ENE	625,078.0	4,473.0	25.6	99.4	4,600.0	19.0	99.6
FEB	579,066.0	735.5	23.8	96.8	440.0	6.0	98.6
MAR	698,053.0	540.5	21.8	96.0	470.0	10.0	97.9
ABR	643,890.0	1,057.0	25.8	97.6	10,020.0	13.0	99.9
MAY	686,178.0	1,247.3	20.2	98.4	1,670.0	10.0	99.4
JUN	629,191.0	453.0	12.9	97.2	680.0	10.0	98.5
JUL	626,423.0	3,148.3	20.6	99.3	13,540.0	20.0	99.9
AGO	672,347.0	354.9	26.5	92.5	242.9	8.0	96.7
SEP	633,550.0	278.0	21.4	92.3	344.0	14.0	95.9
OCT	633,463.0	608.4	20.3	96.7	838.0	18.0	97.9
NOV	645,289.0	460.3	19.5	95.8	237.1	14.0	94.1
DIC	644,435.0	390.9	12.4	96.8	375.0	8.0	97.9
PROMEDIO	**643,080.3**	**1,145.6**	**20.9**	**96.6**	**2,788.1**	**12.5**	**98.0**

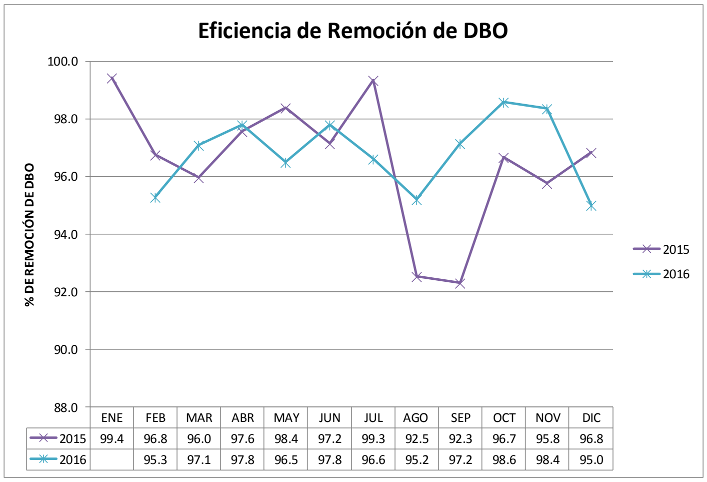
MES	CAUDAL DE ENTRADA M3/MES	2016					
		DBO (mg/lt)			SST (mg/lt)		
		ENTRADA	SALIDA	% REMOCION	ENTRADA	SALIDA	% REMOCION
ENE							
FEB	744,163.2	313.9	14.8	95.3	613.3	16.6	97.3
MAR	798,163.2	474.6	13.8	97.1	350.0	10.2	97.1
ABR	746,064.0	472.6	10.4	97.8	380.0	12.5	96.7
MAY	771,379.2	334.5	11.7	96.5	268.0	9.4	96.5
JUN	743,040.0	694.5	15.3	97.8	300.0	9.6	96.8
JUL	801,288.0	488.7	16.6	96.6	168.0	7.1	95.8
AGO	767,808.0	407.2	19.5	95.2	260.0	7.5	97.1
SEP	764,640.0	656.5	18.7	97.2	466.0	15.3	96.7
OCT	801,288.0	748.9	10.7	98.6	394.0	5.6	98.6
NOV	764,640.0	652.6	10.7	98.4	296.0	4.9	98.4
DIC	749,952.0	242.1	12.1	95.0	106.7	3.2	97.0
PROMEDIO	**768,402.3**	**498.7**	**14.0**	**96.9**	**327.5**	**9.3**	**97.1**

EFFICIENCY OF BOD REMOVAL

EFICIENCIA DE REMOCION DBO

% REMOCION

	2015	2016
ENE	99.4	
FEB	96.8	95.3
MAR	96.0	97.1
ABR	97.6	97.8
MAY	98.4	96.5
JUN	97.2	97.8
JUL	99.3	96.6
AGO	92.5	95.2
SEP	92.3	97.2
OCT	96.7	98.6
NOV	95.8	98.4
DIC	96.8	95.0
PROMEDIO	**96.6**	**96.9**

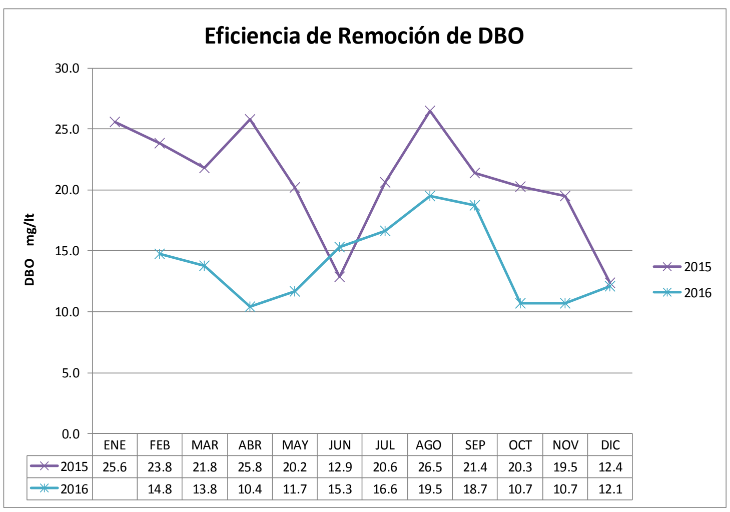


Look at it another way, in this graphic the pollutant load reduction, can appreciate better the output concentration values are lower in 2016 with respect to 2015 even if the numerical value of the % of removal is less.

EFICIENCIA DE REMOCION DBO

DBO mg/lt

	2015	2016
ENE	25.6	
FEB	23.8	14.8
MAR	21.8	13.8
ABR	25.8	10.4
MAY	20.2	11.7
JUN	12.9	15.3
JUL	20.6	16.6
AGO	26.5	19.5
SEP	21.4	18.7
OCT	20.3	10.7
NOV	19.5	10.7
DIC	12.4	12.1
PROMEDIO	**20.9**	**14.0**

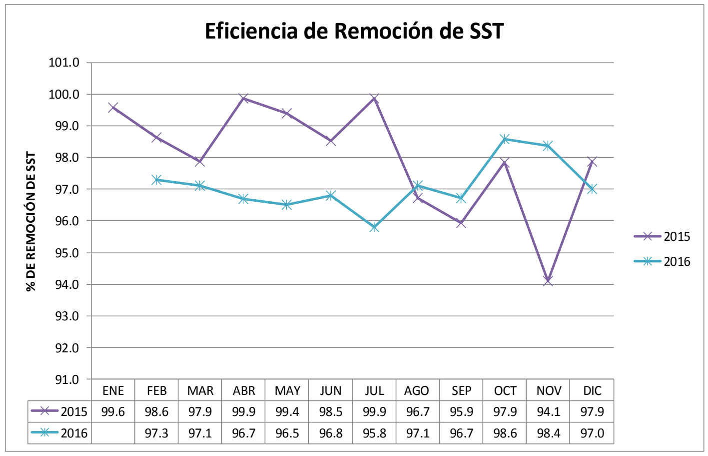


EFFICIENCY OF REMOVAL SST

EFICIENCIA DE REMOCION SST

% REMOCION

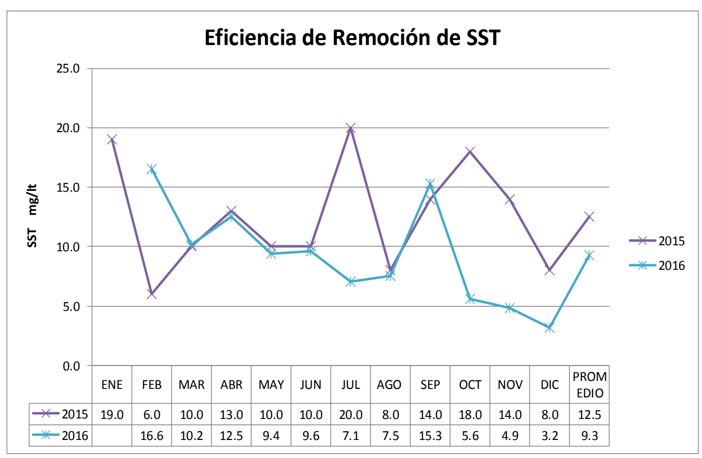
	2015	2016
ENE	99.6	
FEB	98.6	97.3
MAR	97.9	97.1
ABR	99.9	96.7
MAY	99.4	96.5
JUN	98.5	96.8
JUL	99.9	95.8
AGO	96.7	97.1
SEP	95.9	96.7
OCT	97.9	98.6
NOV	94.1	98.4
DIC	97.9	97.0
PROMEDIO	**98.0**	**97.1**



EFICIENCIA DE REMOCION SST

SST mg/lt

	2015	2016
ENE	19.0	
FEB	6.0	16.6
MAR	10.0	10.2
ABR	13.0	12.5
MAY	10.0	9.4
JUN	10.0	9.6
JUL	20.0	7.1
AGO	8.0	7.5
SEP	14.0	15.3
OCT	18.0	5.6
NOV	14.0	4.9
DIC	8.0	3.2
PROMEDIO	**12.5**	**9.3**

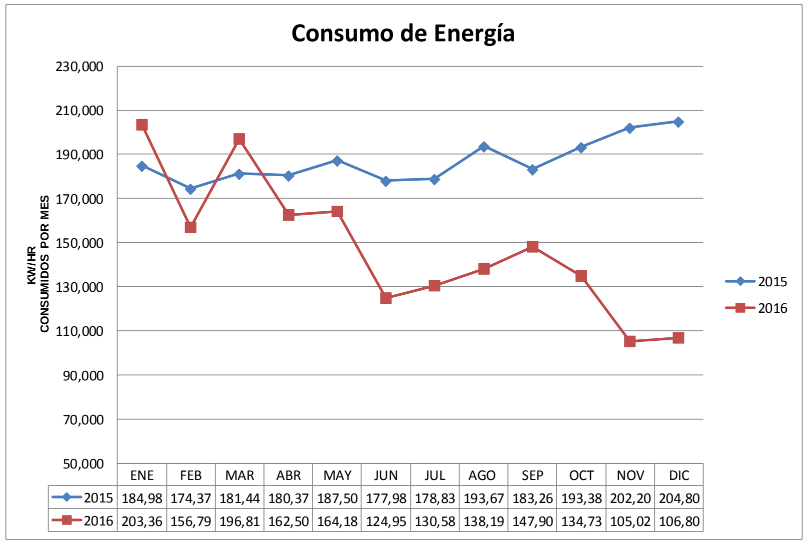


POWER CONSUMPTION PER LT WATER TREATED

CONSUMO DE ENERGIA

KW/HR CONSUMIDOS POR MES

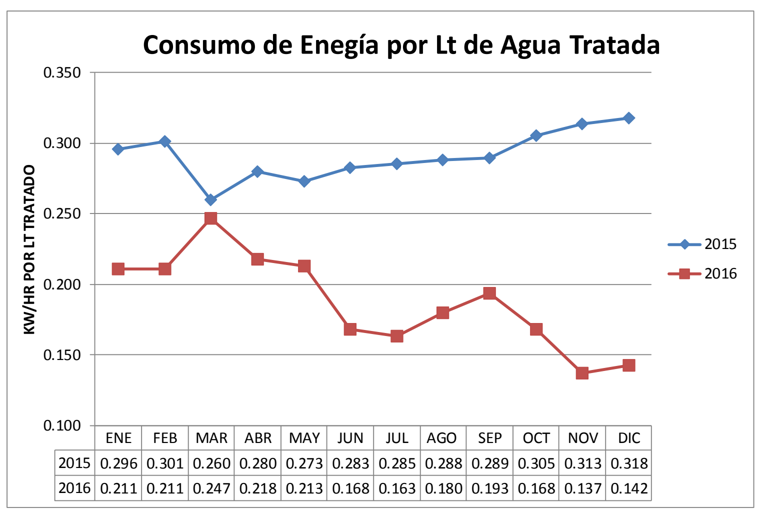
	2015	2016
ENE	184,982.0	203,367.0
FEB	174,370.0	156,797.0
MAR	181,440.0	196,812.0
ABR	180,376.0	162,500.0
MAY	187,502.0	164,185.0
JUN	177,982.0	124,958.0
JUL	178,836.0	130,580.0
AGO	193,676.0	138,194.0
SEP	183,260.0	147,902.0
OCT	193,382.0	134,733.0
NOV	202,202.0	105,020.0
DIC	204,806.0	106,804.0
PROMEDIO	**186,901.2**	**147,654.3**
% DE AHORRRO		**-21.0**



CONSUMO DE ENERGIA POR LITRO

KW/HR LT

	2015	2016	% DECREMENTO
ENE	0.296	0.211	---
FEB	0.301	0.211	**-30.0**
MAR	0.260	0.247	**-5.1**
ABR	0.280	0.218	**-22.2**
MAY	0.273	0.213	**-22.1**
JUN	0.283	0.168	**-40.5**
JUL	0.285	0.163	**-42.9**
AGO	0.288	0.180	**-37.5**
SEP	0.289	0.193	**-33.1**
OCT	0.305	0.168	**-44.9**
NOV	0.313	0.137	**-56.2**
DIC	0.318	0.142	**-55.2**
PROMEDIO CONSUMO	**0.291**	**0.185**	
PROMEDIO AHORRO		**-0.106**	**-35.4**



This table summarizes the results

	2010	2011	2012	2015	2016	DIFFERENCE 2016 VS 2015
M^3 TREATED / MONTH	519,930.0	574,504.7	631,167.6	643,080.3	768,402.3	**125,322.0**
% BOD REMOVAL	97.6	95.8	96.1	96.6	96.9	**0.34**
BOD effluent mg/lt				20.9	14.0	**-6.90**
% TSS REMOVAL	95.1	91.1	93.7	98.0	97.1	**-0.92**
TSS effluent mg/lt				12.5	9.3	**-3.20**
AERATION (HR) TIME			19.0	19.7	15.5	**-4.2**
CONSUMPTION OF POWER KW/HR PER LT				0.291	0.185	**-0.106**

5. CONCLUSIONS

Undoubtedly the factor which influents the most in the process of wastewater treatment, is its composition, however, knowing the origins and variability of the waters that are received at the plant makes possible to carry out preventive measures for harmonizing the pollutant load before entering process and counteract peaks which may arise, as well as to define the parameters of operation achieving a greater stability in the process with high organic matter removal efficiencies.

Its operation is highly flexible, particularly in the acceptance of variable organic loads.

To obtain the desired ranges of removal should be considered that this depends not only on the design features of the process, but also of a number of factors that have an impact on the "work" of microorganisms such as the concentration of dissolved oxygen and the amount of available nutrients, temperature and pH as well as the intrinsic properties of the influent wastewater.

To achieve a high efficiency in the treatment we must monitor the parameters of the water's arrival, as well as variations in flow, reason why a buffer structure helps achieve the homogenization of the flow and load control.

The temperature directly affects the level of activity of bacteria in the system, we recommend as range 25 to 32 ° C.

To compensate the variation of the activity biological to different temperatures, must adjust is the concentration of solid suspended of the liquor mixed.

In extreme climates in the summer the bacterial activity increases and decreases the oxygen dissolved in the water, both phenomena can give as result a greater demand for oxygen. During the winter, the temperatures fall and occur those phenomena inverse, decreasing the demand of oxygen. However, it can be assumed that one mass of micro-organisms with lower during periods of low temperature oxidation rates performs the same removal of organic matter than one lower aerobic mass but with higher during periods of high temperature oxidation rates.

Determination of oxygen and its control requirements is essential in the operation of a treatment by activated sludge plant. If microorganisms are deprived of oxygen in amount and adequate supply, causes the use of other sources unless it involves a minor treatment capacity.

The routine development of appropriate measurements will allow us next to other experiences of follow-up and operational control, obtaining valuable information to be used by the operator to optimize and control the use of aeration systems impacting greatly on operating costs and the identification of operational problems.

He team of measurement should include instrumental of high reliability, which must be calibrated previously to the development of them experiences to ensure the quality of its results.

All the experiences that arise in the plant during the daily operation give important information to identify potential problems due to the presence of poisons in the wastewater and/or operation problems early.

Is estimated that in a process "common" of sludge activated the consumption of energy is located between 0.25-0.45 kWhr / m3 where the consumption of aeration occupies among the 50-70%

In Mexico, according to official data, the coverage of wastewater treatment levels reach 29% only. This means that the impact energy of these plants will be in increase as the coverage is expand and will mean a factor additional of pressure on the sector energy of our country to supply the growth of the demand.

Automatic controls and variable speed systems can help to minimize the time of operation of the equipment.

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