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"OPTIMIZATION OF ACTIVATED SLUDGE PROCESS THROUGH ENERGY SAVING"

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INTRODUCTION

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.

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.

INTRODUCTION

One of the processes with high remotion rate in wastewater treatment is called:

Activated sludge

This process consist in reproduce in a confined and controlled space, the mechanisms which nature uses to degrades organic matter through the supply of oxygen.

INTRODUCTION

However, the major drawback of this process, it’s the high cost of the necessary energy to satisfy the demand of oxygen required to achieve the oxidation of the organic matter.

In general, it represent approximately 50% of the energy consumption of a plant with activated sludge

INTRODUCTION

We present the analysis and conclusions of the measurements of the physical and chemical parameters obtained during the operation and maintenance carried out in the

Planta SPA II

Located in

San Juan del Río Querétaro, México

Where this process has been optimized reducing operation costs.

THEORETICAL BACKGROUND

In the biological treatment of wastewater involves different microbiological reactions to eliminate different types of organic matter, nutrients, and other contaminants.

THEORETICAL BACKGROUND

These reactions can be performed under different conditions:

- AEROBIC (presence of dissolved oxygen)
- ANOXIC (absence of OD, nitrates)
- ANAEROBIC (absence of OD and nitrates)

THEORETICAL BACKGROUND

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 sludges.

THEORETICAL BACKGROUND

Once the organic matter has been Oxidized 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.

THEORETICAL BACKGROUND

To grow and reproduce, the micro-organisms need:

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

THEORETICAL BACKGROUND

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

THEORETICAL BACKGROUND

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 : $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6\ H_2O$

THEORETICAL BACKGROUND

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 ($NO3$)-.

Anaerobic Organisms*:*

They use endogenous reactions generating $CO2$ and $CH4$.

THEORETICAL BACKGROUND

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

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

THEORETICAL BACKGROUND

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

THEORETICAL BACKGROUND

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.

THEORETICAL BACKGROUND

Synthesis of cell mass

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

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

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

ANABOLISM

(Microorganisms) + O_2 microorganisms CO_2 2 4 + 4 3-
(Microorganisms) + O_2 microorganisms CO_2 2 4 + 4 3-

THEORETICAL BACKGROUND

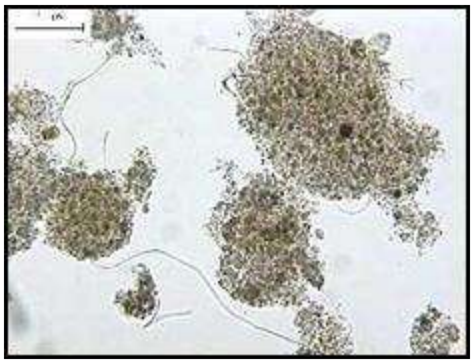
Oxidation of cell mass

Finally, the micro-organisms suffer a progressive auto - oxidation of its cell mass:

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

THEORETICAL BACKGROUND

This process is known as **"endogenous respiration"** in which also dead microorganisms are serving for food to other microorganisms.

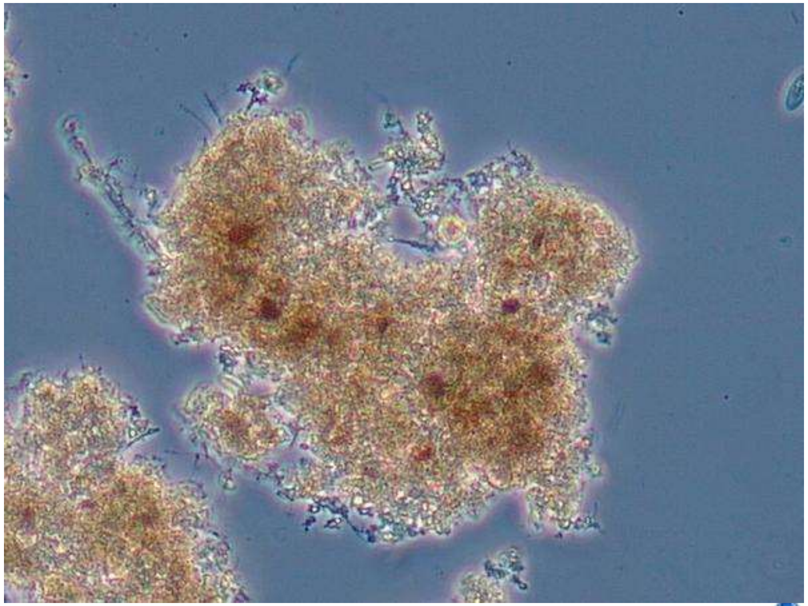


This reaction has place when the organic matter available is limited so that the microorganisms of the system uses its own protoplasm to obtain energy for it’s maintenance.

THEORETICAL BACKGROUND

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



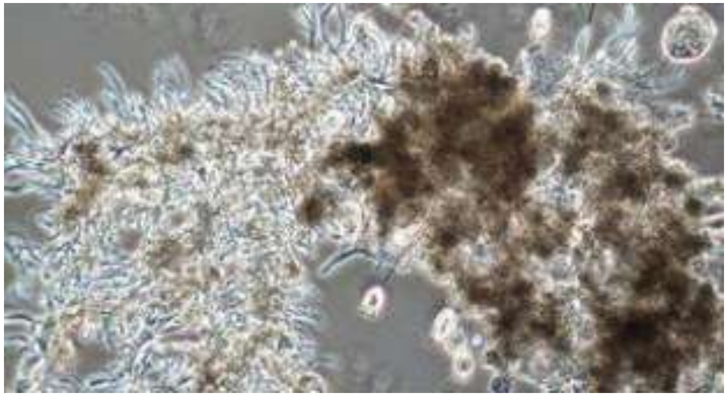
THEORETICAL BACKGROUND

After this, only remains 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).

THEORETICAL BACKGROUND

The consumption of oxygen of the system is proportional to:



- The activities of synthesis and conversion of organic matter in the microbial cells.

- The Endogenous respiration and use of biodegradable waste by living cells, discharged by dead cells.

THEORETICAL BACKGROUND

It is precisely this concept which provides the basis for the optimization of energy consumption

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

THEORETICAL BACKGROUND

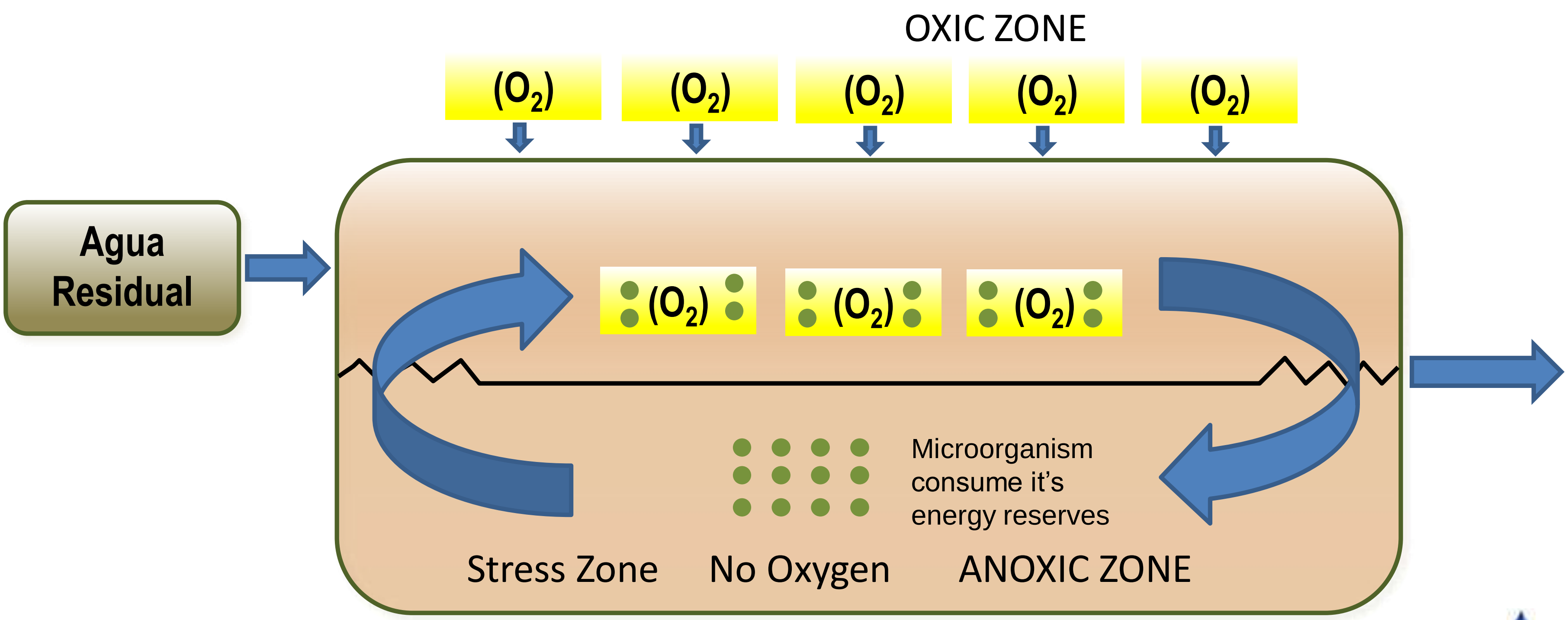
Reducing aeration times, allow us to increase the efficiency of the energy used.

We called this system:

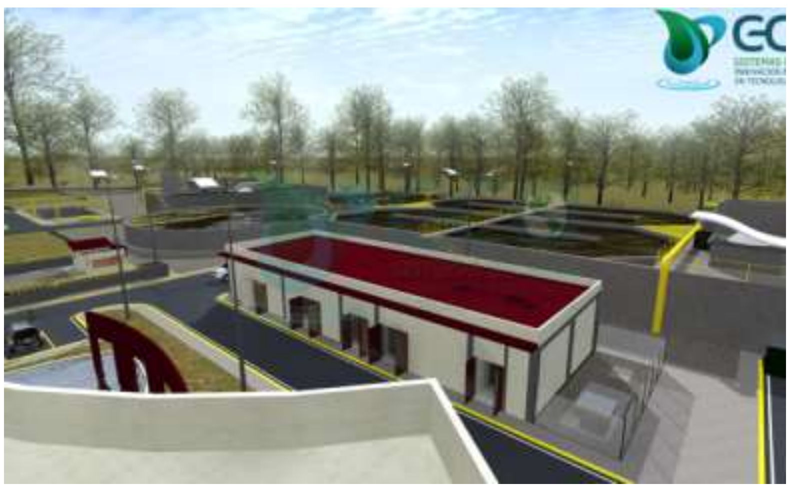
"High Stress".

PTAR Acámbaro Gto, México 160 LPS

THEORETICAL BACKGROUND



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.

PRACTICAL APPROACH

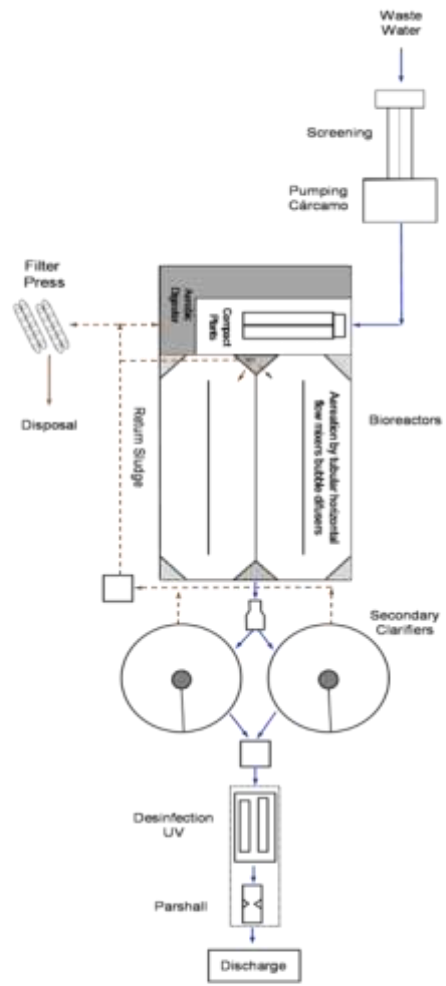
The basic configuration of the treatment consists of:

✓ Pretreatment :

- Screening
- Pumping Cárcamo

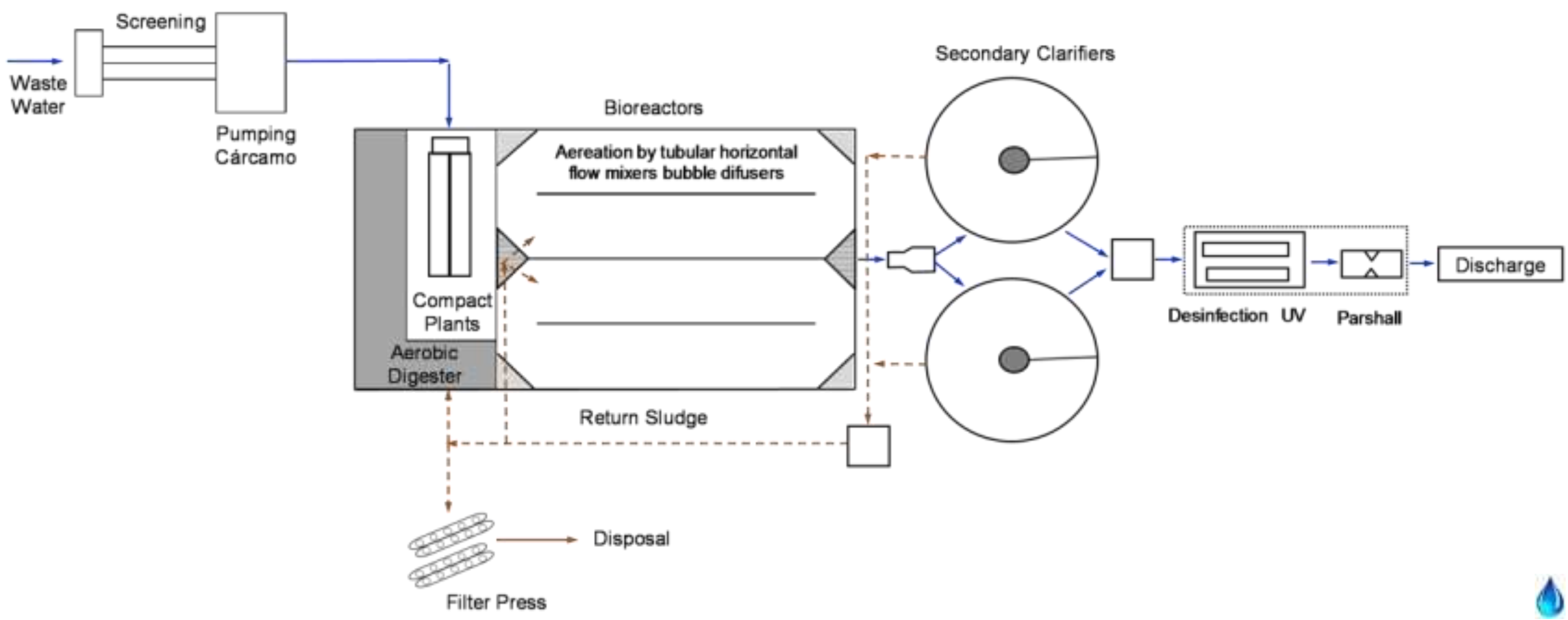
✓ Treatment system in two trains consisting of:

- 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



PRACTICAL APPROACH

DIAGRAM OF FLOW WWTP SPA II



PRACTICAL APPROACH

OPERATION OF THE TREATMENT PLANT

For the optimum operation and the reliability of the measurements obtained for its study, we performed:

- Chemical and biological monitoring of the process (sampling)
- The routine of checking equipment and calibration

PRACTICAL APPROACH

OPERATION OF THE TREATMENT PLANT

We seek to reduce costs without reducing the removal efficiency presented in the following table.

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

PRACTICAL APPROACH

It is based on the following premises:

- Preliminary processes such as screenings and parameter measurement systems located in the PTAR are in good condition.

- The preventive and corrective maintenance of the process units and the equipment installed has been carried out in a proper way to ensure good function.

PRACTICAL APPROACH

- Actions taken to optimize the performance of biological reactors:

Cleaning of pretreatment systems, this helps the efficiency of subsequent process units indirectly affecting the total oxygen consumption required for biological purification.

PRACTICAL APPROACH

FACTORS AFFECTING THE BIOLOGICAL PROCESS:

- ✓ *TEMPERATURE*
- ✓ *PH*
- ✓ *SLUDGE AGE*
- ✓ *RECIRCULATION*
- ✓ *QUANTITY OF NUTRIENTS*

PRACTICAL APPROACH

For the optimization of an activated sludge system we consider the following aspects:

- ✓ Effluent concentration (BOD, SST)
- ✓ Amount of biomass in the reactor (Recirculation)
- ✓ Excess of generated sludge (Recirculation)
- ✓ Amount of oxygen used (Aeration time)

PRACTICAL EXPERIENCES

In recent years, some actions have been systematically implemented in the operation of several treatment plants located in the city of San Juan del Rio, Queretaro, with the goal of reducing operation costs, the most representative being the San Pedro Ahuacatlán II plant (SPA II), and we present the results obtained here.

PRACTICAL EXPERIENCES

The following is the data history where the difference in the concentrations of incoming water to the plant is clearly seen:

AVERAGE ENTRY PARAMETERS TO THE PTAR SPA II						
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

PRACTICAL APPROACH

OTHER PREMISES AND OBSERVATIONS

- ✓ Energy consumption represents the largest part of cost and, at the same time, the aeration system is the equipment that consumes the most energy, which is why we have focused on investigating and proposing different forms of operation that allow us to reduce operating costs through a practical study of aeration time.

PRACTICAL EXPERIENCES

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

- ✓ The most homogeneous flow is generally obtained first thing in the morning (6:00 am), the organic load being rather of a low value, to gradually increase both the flow and the load in the following hours, and from 12:00 pm to 7:00 pm, influent spikes are produced with the respective increase in organic load to stabilize again past 7 p.m. until the first hours of the morning where the influent flow decreases and remains homogeneous.

PRACTICAL EXPERIENCES

- ✓ The hydraulic residence time in the biological reactor was maintained between 8-11 hours, above a conventional active sludge system, but without reaching the prolonged aeration conditions.

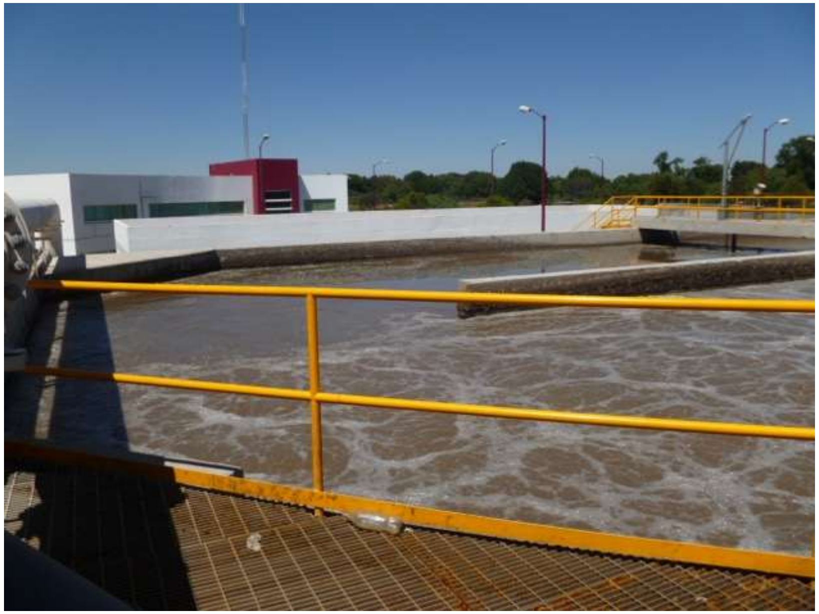
- ✓ Oxygenation was established around 1.5 - 2.0 mg / lt.

PRACTICAL EXPERIENCES

- ✓ The reduction in the aeration time and the measurement of the pollutant load were carried out in a systematic and controlled way both at the entrance and at the exit through the parameters of BOD and SST during the years 2015-2016.

PRACTICAL EXPERIENCES

- ✓ The treatment efficiency was determined by keeping the dissolved oxygen concentration within the established parameters and then analyzing and comparing it against measurements from previous years.



STATISTICAL ANALYSIS

The SPA II plant is designed for 300 average LPS, starting operations in 2010, achieving until the last 2016 the highest urban wastewater collection for treatment.

STATISTICAL ANALYSIS

The following graph shows the increase in the flow rate treated in the SPA II plant during the years 2015 and 2016

VARIABILITY IN THE AVERAGE OF INPUT VOLUME PTAR SPA II LPS					
YEAR	**2010**	**2011**	**2012**	**2015**	**2016**
AVERAGE FLOW	196.4	218.6	241.0	245.7	292.0
% ANUAL INCREMENT		11.3	10.3	1.9	19.0
% INCREMENT 2010-2016			22,7	25.1	48.7

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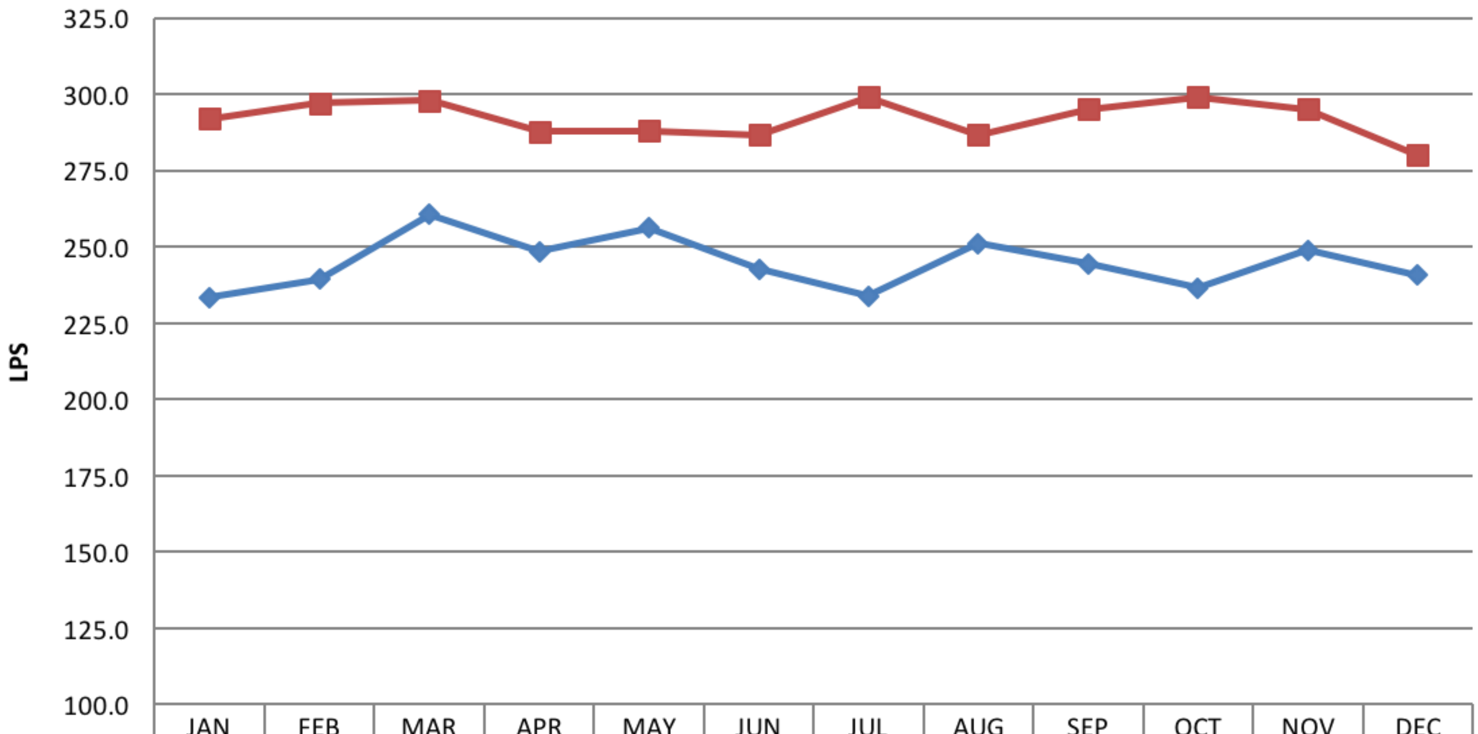
STATISTICAL ANALYSIS

INPUT FLOW



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2015	233.4	239.4	260.6	248.4	256.2	242.7	233.9	251.0	244.4	236.5	249.0	240.6
2016	292.0	297.0	298.0	287.8	288.0	286.7	299.2	286.7	295.0	299.2	295.0	280.0

STATISTICAL ANALYSIS

We looked to homogenize the input parameters, controlling the clandestine discharges to the sewerage from industries of the region, achieving in 2016 to homogenize the pollutant load with respect to 2015, regulating the peaks of the months of January, April, May and July 2015

STATISTICAL ANALYSIS

HISTORICAL CHARACTERIZATION OF THE WATERS OF ENTRY TO THE WWTP					
BOD INFLUENT (mg/lt)					
YEAR / MONTH	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
DEC	724.9	607.4		390.9	242.1
AVERAGE	662.7	576.7	724.0	1,145.6	498.7

STATISTICAL ANALYSIS

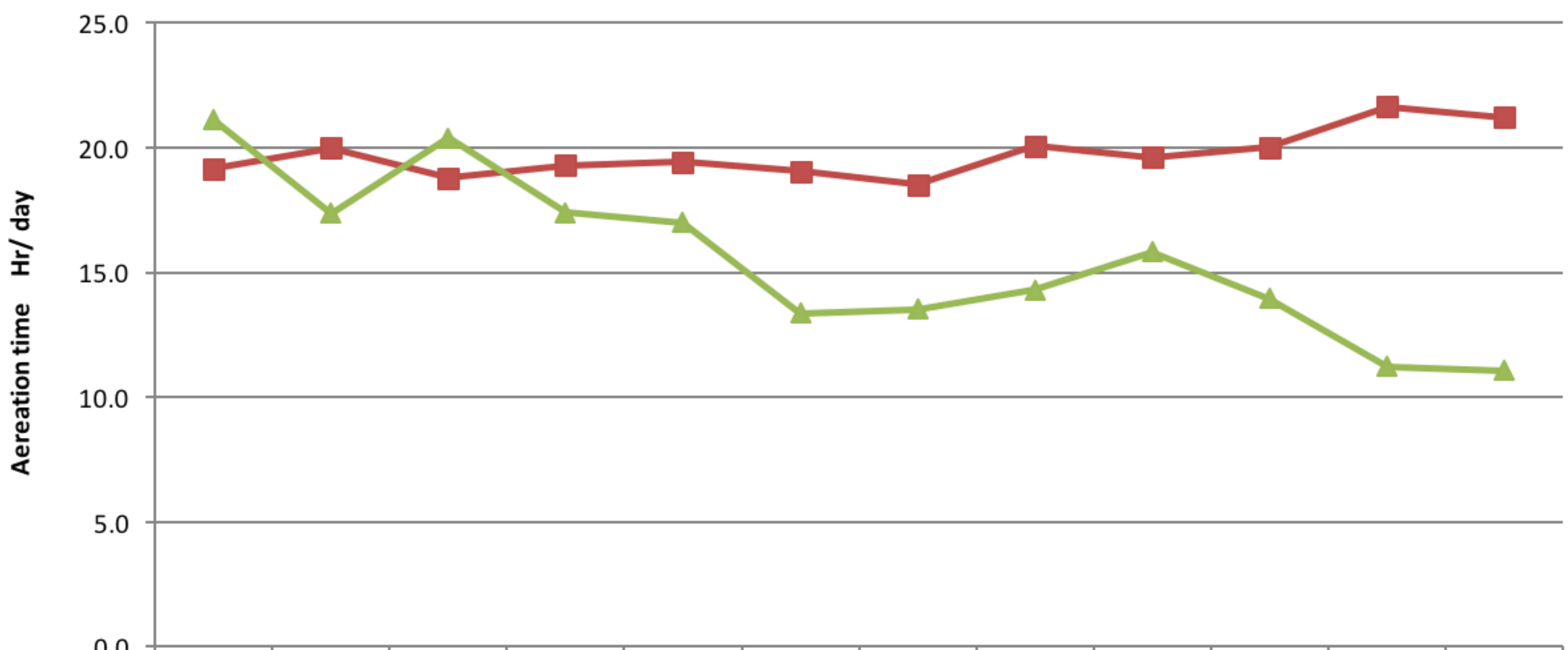
APPLIED AERATION TIME

The aeration times were modified and the amount of oxygen dissolved in the reactors was monitored.

AEREATION TIME		
HR / DAY		
YEAR / MONTH	2015	2016
JAN	19.2	21.2
FEB	20	17.4
MAR	18.8	20.4
APR	19.3	17.4
MAY	19.4	27.0
JUN	19.0	13.4
JUL	18.5	13.5
AUG	20.1	14.3
SEP	19.6	15.8
OCT	20.0	13.9
NOV	21.6	11.2
DEC	21.2	11.1
AVERAGE	**19.7**	**15.5**

STATISTICAL ANALYSIS

APPLIED AERATION TIME



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2015	19.2	20.0	18.8	19.3	19.4	19.0	18.5	20.1	19.6	20.0	21.6	21.2
2016	21.1	17.4	20.4	17.4	17.0	13.4	13.5	14.3	15.8	13.9	11.2	11.1

STATISTICAL ANALYSIS

The removal results shown below:

CHARACTERIZATION OF WATERS DATA OBTAINED

MONTH	INLET FLOW M3 / MONTH	2015					
		BOD (mg / lt)			SST (mg / lt)		
		INLET	EXIT	% REMOVAL	INLET	EXIT	%REMOVAL
JAN	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
APR	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
AUG	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
DEC	644,435.0	390.9	12.4	96.8	375.0	8.0	97.9
AVERAGE	**643,080.3**	**1,145.6**	**20.9**	**96.6**	**2,788.1**	**12.5**	**98.0**

STATISTICAL ANALYSIS

The removal results shown below:

CHARACTERIZATION OF WATERS DATA OBTAINED

MONTH	INLET FLOW M3 / MONTH	2016					
		BOD (mg / lt)			SST (mg / lt)		
		INLET	EXIT	% REMOVAL	INLET	EXIT	%REMOVAL
JAN							
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
APR	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
AUG	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
DEC	749,952.0	242.1	12.1	95.0	106.7	3.2	97.0
AVERAGE	**768,402.3**	**498.7**	**14.0**	**96.9**	**327.5**	**9.3**	**97.1**

STATISTICAL ANALYSIS

Let's look at it another way:

In this graph, the decrease in the pollutant load can be better appreciated, the values of the output concentration are lower in 2016 with respect to 2015 even though the numerical value of the% removal is lower.

EFFICIENCY OF BOD REMOVAL

EFFICIENCY OF BOD REMOVAL % REMOVAL		
MONTH	2015	2016
JAN	99.4	
FEB	96.8	95.3
MAR	96.0	97.1
APR	97.6	97.8
MAY	98.4	96.5
JUN	97.2	97.8
JUL	99.3	96.6
AUG	92.5	95.2
SEP	92.3	97.2
OCT	96.7	98.6
NOV	95.8	98.4
DIC	96.8	95.0
AVERAGE	**96.6**	**96.9**

STATISTICAL ANALYSIS

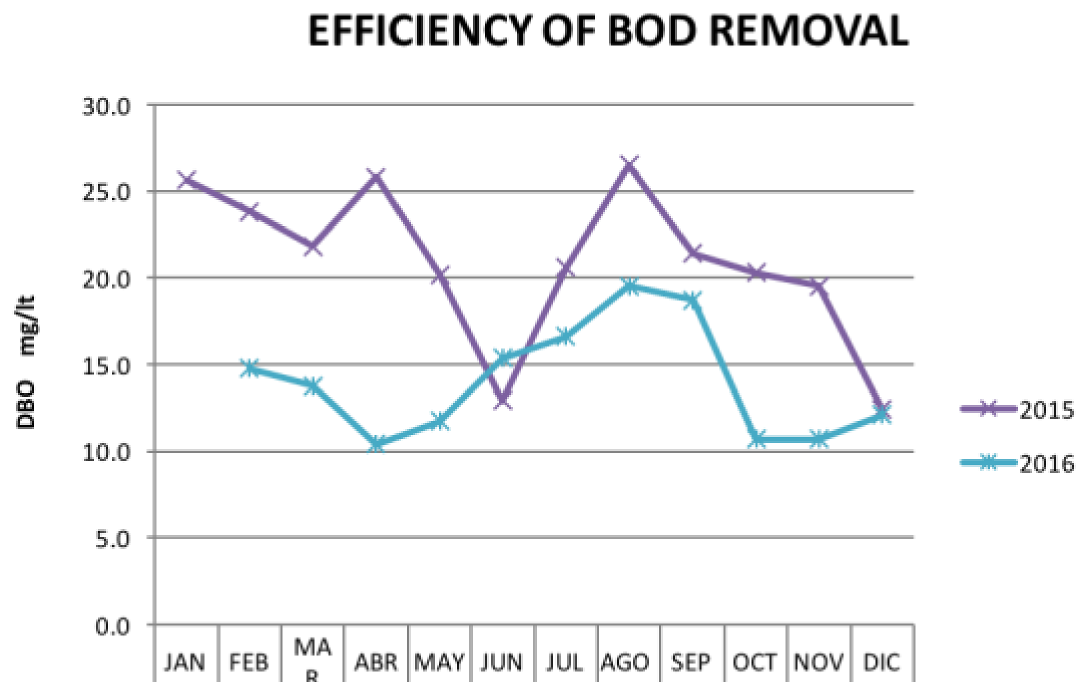
EFFICIENCY OF BOD REMOVAL

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

STATISTICAL ANALYSIS

EFFICIENCY OF BOD REMOVAL

EFFICIENCY OF BOD REMOVAL BOD mg/ lt		
MONTH /YEAR	2015	2016
JAN	25.6	
FEB	23.8	14.8
MAR	21.8	13.8
APR	25.8	10.4
MAY	20.2	11.7
JUN	12.9	15.3
JUL	20.6	16.6
AUG	26.5	19.5
SEP	21.4	18.7
OCT	20.3	10.7
NOV	19.5	10.7
DEC	12.4	12.1
AVERAGE	**20.9**	**14.0**

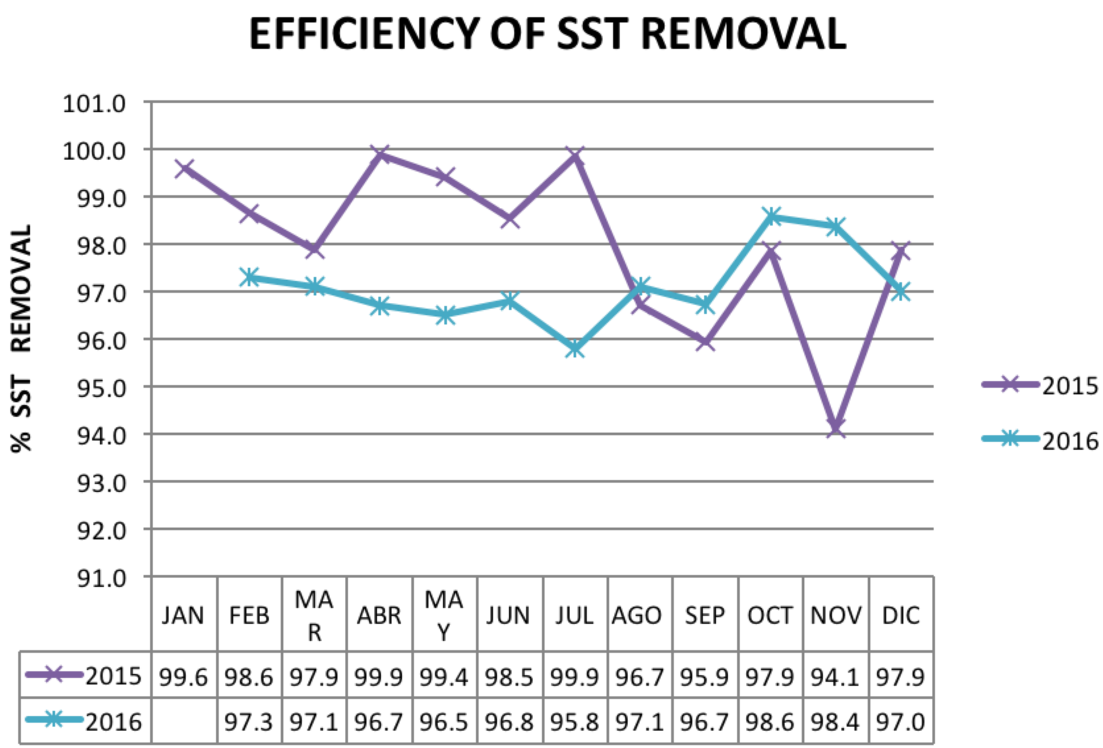


	JAN	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC
2015	25.6	23.8	21.8	25.8	20.2	12.9	20.6	26.5	21.4	20.3	19.5	12.4
2016		14.8	13.8	10.4	11.7	15.3	16.6	19.5	18.7	10.7	10.7	12.1

STATISTICAL ANALYSIS

EFFICIENCY OF SST REMOVAL

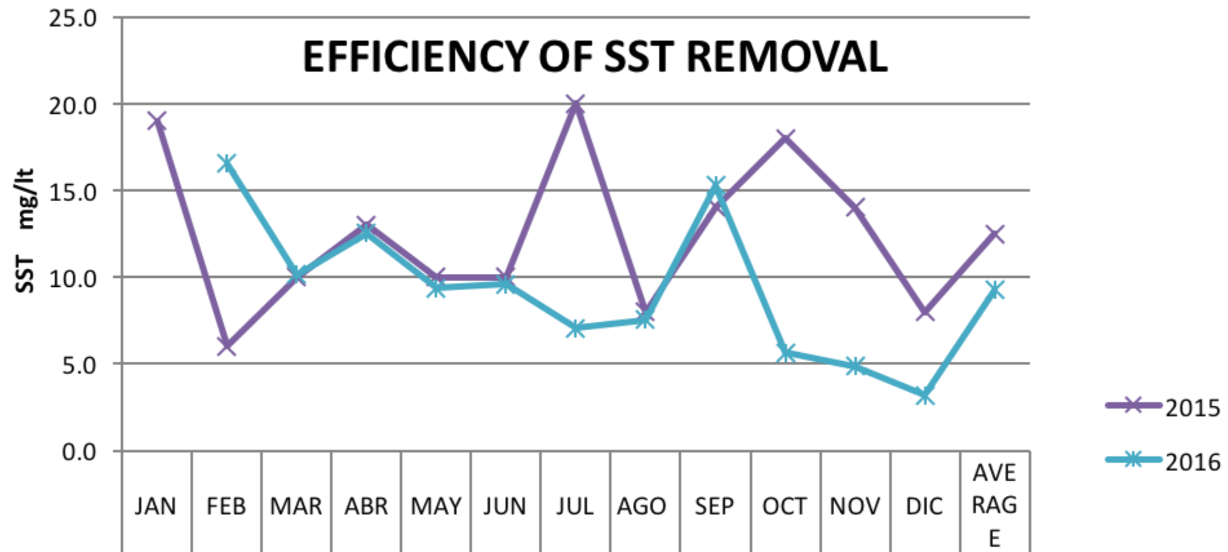
EFFICIENCY OF SST REMOVAL % SST REMOVAL		
MONTH /YEAR	2015	2016
JAN	99.6	
FEB	98.6	97.3
MAR	97.9	97.1
APR	99.9	96.7
MAY	99.4	96.5
JUN	98.5	96.8
JUL	99.9	95.8
AUG	96.7	97.1
SEP	95.9	96.7
OCT	97.9	98.6
NOV	94.1	98.4
DEC	97.9	97.0
AVERAGE	**98.0**	**97.1**



STATISTICAL ANALYSIS

EFFICIENCY OF SST REMOVAL

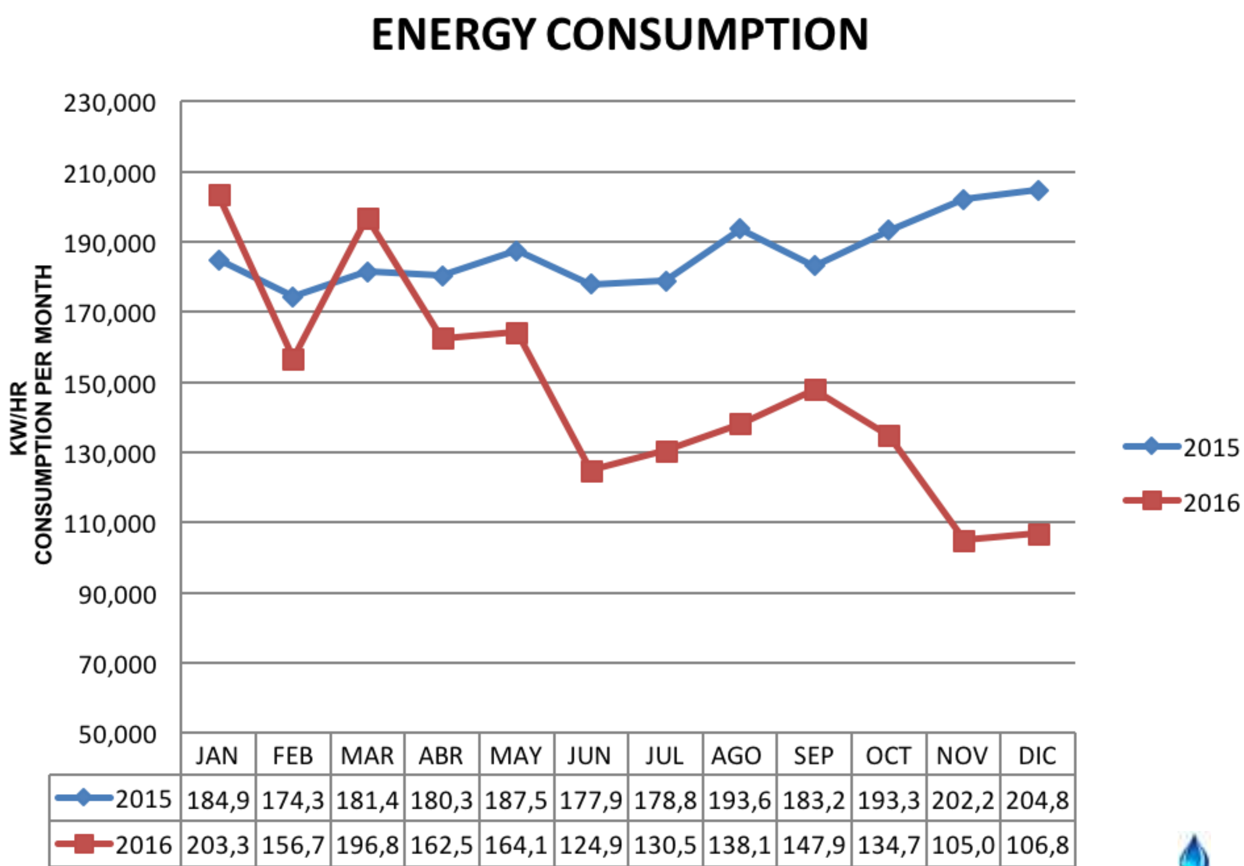
EFFICIENCY OF SST REMOVAL SST mg/ lt		
MONTH /YEAR	2015	2016
JAN	19.0	
FEB	6.0	16.6
MAR	10.0	10.2
APR	13.0	12.5
MAY	10.0	9.4
JUN	10.0	9.6
JUL	20.0	7.1
AUG	8.0	7.5
SEP	14.0	15.3
OCT	18.0	5.6
NOV	14.0	4.9
DEC	8.0	3.2
AVERAGE	**12.5**	**9.3**



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

STATISTICAL ANALYSIS

POWER CONSUMPTION PER TREATMENT WATER KW / HR		
MONTH /YEAR	2015	2016
JAN	184,982.0	203,367.0
FEB	174,370.0	156,797.0
MAR	181,440.0	196,812.0
APR	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
AUG	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
DEC	204,806.0	106,804.0
AVERAGE	**186,901.2**	**147,654.3**
% SAVING		**21.0**

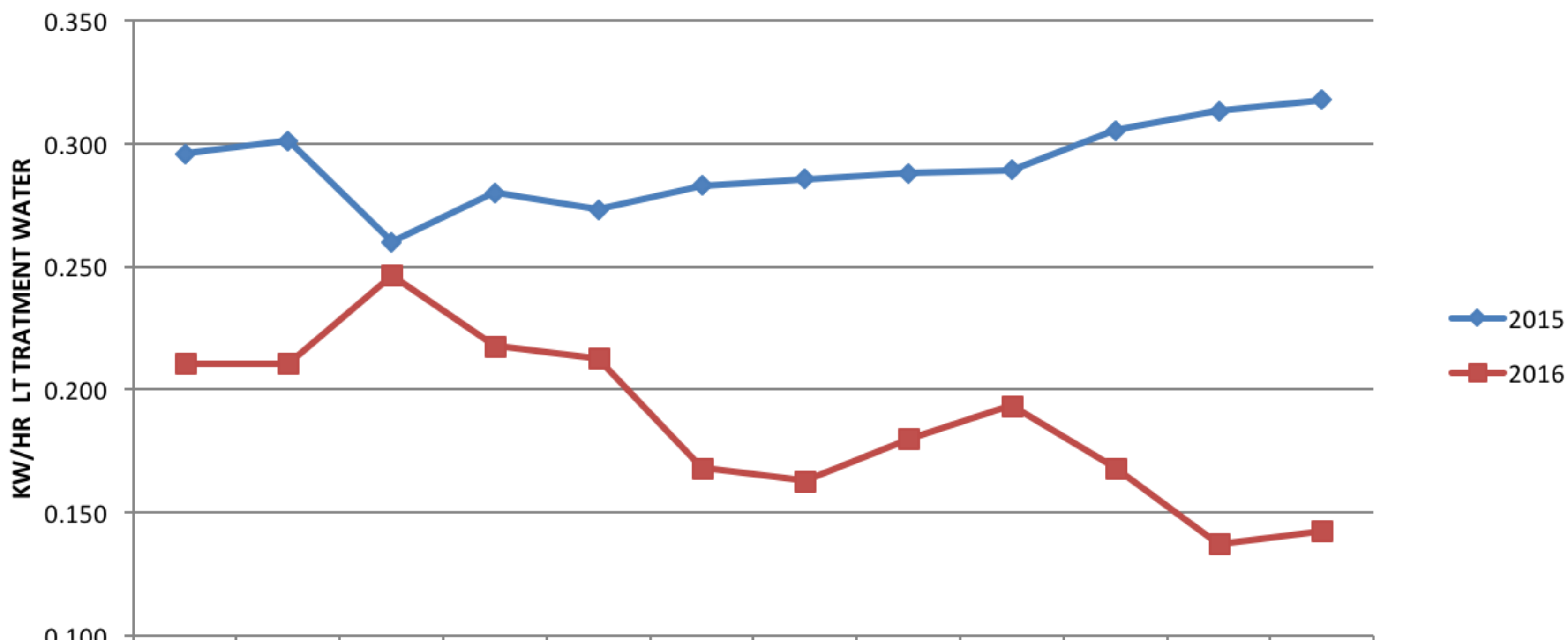


STATISTICAL ANALYSIS

POWER CONSUMPTION PER LT TREATMENT WATER KW / HR			
MONTH /YEAR	2015	2016	% DECREASING
JAN	0.296	0.211	---
FEB	0.301	0.211	**-30.0**
MAR	0.260	0.247	**-5.1**
APR	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**
AUG	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**
DEC	0.318	0.142	**-55.2**
AVERAGE	**0.291**	**0.185**	
% SAVING		**0.106**	**35,4**

STATISTICAL ANALYSIS

POWER CONSUMPTION PER LT TREATMENT WATER



	JAN	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC
2015	0.296	0.301	0.260	0.280	0.273	0.283	0.285	0.288	0.289	0.305	0.313	0.318
2016	0.211	0.211	0.247	0.218	0.213	0.168	0.163	0.180	0.193	0.168	0.137	0.142

STATISTICAL ANALYSIS

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**

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..

CONCLUSIONS

- 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.

CONCLUSIONS

- 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.

CONCLUSIONS

- 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.

CONCLUSIONS

- 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 “common” process 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%

CONCLUSIONS

- 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 an additional factor of pressure on the energy sector 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.