

urban sewage wastewater treatment by the activated sludge method under arid climate at Touggourt (South-East Algeria).

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Abstract— The treatment of urban wastewater in an activated sludge treatment plant under the climatic conditions of the city Touggourt leads to an effluent of physicochemical quality and satisfactory organic materials. A reduction of all parameters characterizing the organic load:

COD and BOD₅ with average annual percentages of 89.7% and 90.1% respectively are achieved. This reduction is made in parallel with a reduction of more than 94.3% for the MES, with a residence time of 18 hour.

Key-Words— : Wastewater, activated sludge, arid zone, seasonal variation, Touggourt

1. INTRODUCTION

The choice of a wastewater treatment system in developing countries is subject to several criteria, the most important of which is the purification performance of the system. Does the activated sludge treatment plant in the town of Touggourt meet this criterion? Aerobic bacteria in the aerated lagoon aeration consume dissolved oxygen in the medium for oxidation of organic matter from the wastewater. This system is widely used in the treatment of wastewater from agri-food industries such as wastewater from sweets and dairies. It has allowed to obtain strong reduction of all the parameters characterize the organic load: DBO₅, COD and initial MES for stays of 2 hours to 1.5 days. Alongside this satisfactory reduction of pollutant organic matter and pathogens, the system

produces water for irrigation. We present in this work, the study of the activated sludge treatment plant of Touggourt (Algeria). The physicochemical quality of the effluent produced has been characterized.

2. Materials and methods

2.1 Description of the site:

The activated sludge treatment plant is located north east and 07 km from the town of Touggourt. It was commissioned in November 1993 and rehabilitated in 2003 covers an area of 5 ha. It has a unitary sanitation network, it aims to treat a domestic wastewater effluent with a nominal flow of 9360 m³/d, corresponds to 240000 Eq / ha, but the average current flow is 8017 m³ / d (Fig.1). Climate of the region is hyper-arid type, with an average annual temperature of 26.37 °C, the monthly average varies from 22.10 ° C in January and to 30.45 ° C in July, in the last 10 years (2003-2013).

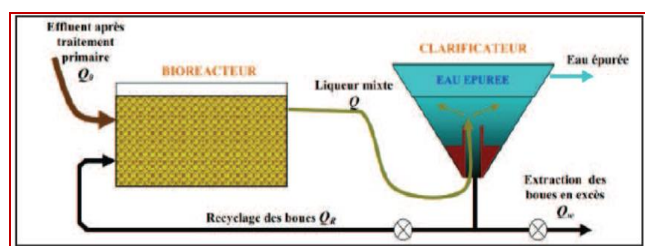


Figure 1: Schematic diagram of the activated sludge treatment process

2.2 Sampling methodology:

The wastewater samples were collected in accordance with the general guide for the conservation and handling of ISO 5667/3 samples. The experiments were conducted during the year 2016, the analyzes were carried out at the level of the laboratory of Water and Environment Engineering in the Saharan environment and the laboratory of the STEP Touggourt.

2.3 Parameters and analytical methods:

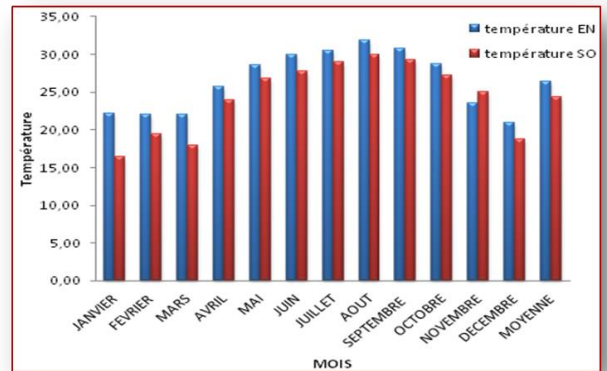
The dosing methods used are as follows: The pH and temperature (T) and conductivity are measured respectively by a digital pH meter, EUTECH Instruments 510 pH / mV / 0C / mS / cm; The BOD5 was determined using an OxiTop Model WTW pressure gauge in a thermostatically controlled chamber at 20 ° C. According to the AFNOR T 90 105 standard, the MESs were filtered using a Whatman GF / C filter. The COD at the level of the raw and purified waters of the WWTP are carried out by photometry using a Spectrophotometer of the WTW Photolab spectral type. The purification yields were calculated by the following formula:

$$R (\%) = ((C_0 - C_f) / C_0) \times 100$$

With: R: treatment efficiency (in %); C₀: concentration of the chemical element at the entrance to the WWTP; See chemical concentration of the chemical element at the output of the WWTP

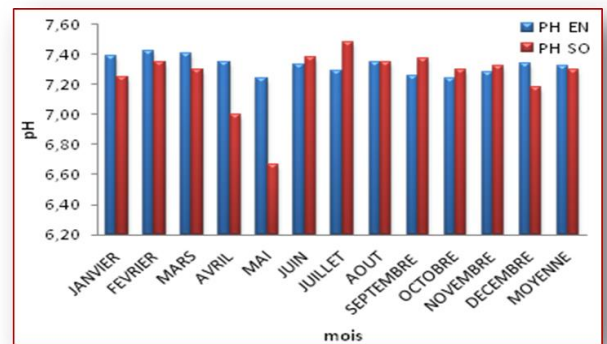
3. Results and discussion:

The results are presented in such a way that they are easily used to determine the residual pollution of the Touggourt activated sludge treatment plant. Considering the flow rates at the entrance of the WWTP average 8017.13 m³ / d, with a residence time of 18 hours. The table (below) gives the average values of the pollution factors of the effluent before and after the purification during the four diurnal cycles.



3.1 Physicochemical variations:

The temporal evolution of the temperature of the different samples are very close. They stand at 26.7 at the inlet and for treated water at 23.8 ° C during the study period, they are close to ambient temperatures. These values are based on sampling time, flow rates and weather conditions.



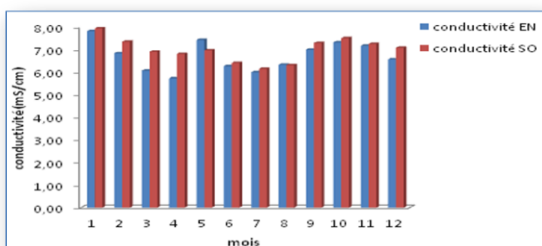
The water has a basic pH throughout the year 2016, the average value is 7.32 for raw water and 8.23 for treated water. As a result, with the exception of a few values, the recorded pH values are in line with Algerian reuse standards in irrigation, and are almost invariable regardless of the season.

Table 1: Average effluent pollution criteria parameters before and after Purification in hot and cold season

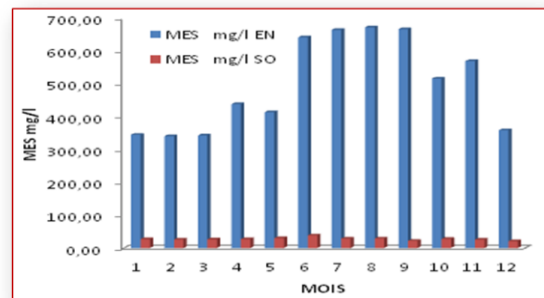
Paramètre	Unit	Entrance		Exit		Yield	
		P. Cold	P. Hot	P. Cold	P. Hot	P. Cold	P. Hot
COD	mg/l	411.6	358.2	39.8	88.9	90.3	90.6
BOD5	mg/l	325.8	283.1	27.7	30.6	90.2	94.3
SS	mg/l	529.3	466.6	24.8	29.9	94.7	94.3
Cond	S/cm	6.30	7.11	7.39	7.42	/	/
pH	/	7.3	7.3	7.2	7.3	/	/
T	°C	23	24	22.7	25.9	/	/

NB / Hot period; spring - summer, cold period; autumn winter

This increase can be explained by an intense bacterial activity in the activation lagoon, hence a high oxygen consumption and therefore a CO₂ release. These results agree with those reported in the literature. According to Sevri R et al, the alkaline pH and the moderate temperature are ideal environmental conditions for the proliferation of microorganisms that establish a perfect biological balance, allowing the degradation of the organic matter which leads to the decontamination of the water.



The electrical conductivity of the raw wastewater is 6.70 mS / cm. And in purified water tends to increase (6.98 mS / cm) during its passage in the basins of the station. This increase is more pronounced in hot weather, from the month of Mais. These values are based on the natural mineralization of drinking water and that for domestic , is mainly controlled by the evaporation of water in the basins.



3.2 Abatement of particulate pollution:

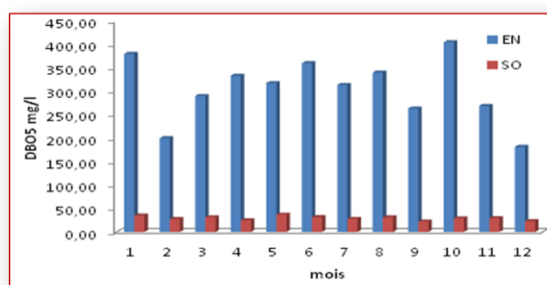
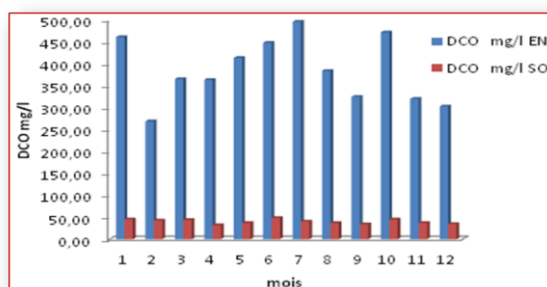
The values recorded during our study reveal a significant reduction of the SS between raw and treated water. They are an average of 506.8 mg / L for the raw water, these values are according to the nature of the rejection. Regarding treated water, the rate of SS with an average of 29.5 mg / L, comply with Algerian standards and international standards for irrigation reuse.

The Touggourt station ensures a good reduction of the MES. Nearly 50% are eliminated on average in the first basin. The total reduction achieved an average efficiency of 94.7% recorded during the cold period. The evolution curve of SS in the station often shows peaks, indicating a production of these. This phenomenon is more marked in hot weather, a reduction of 94.3% from late spring to early autumn.

3.3. Abatement of organic pollution:

It is noted that the COD values of the raw water are variable according to the weeks, they oscillate with an average of 382.5 mg/L. Concerning the treated effluent, are much lower than that of the raw water for an average of 40.2

mg / L. The average value of the BOD₅ on average of 304.4 mg / L, reported at the daily load reaches 2437Kg. However, it is found that the maximum of biodegradable organic pollution is eliminated by the station, the effluents treated with 30 mg / L. In addition, during the study period, the comparison of the contents of all the parameters characterizing the organic load in the Kouinine station with the Algerian norm. These pollutants are not very variable during the cycles followed, but change at the incoming organic load. The abatement efficiency of carbon pollution; their abatement therefore contributes to a better yield on the COD of 83.7% and the BOD₅ of 90.4%



According to Metcalf & Eddy. The biodegradability coefficients are calculated by the ratio COD / BOD₅, and depends on the nature and origin of wastewater that can be domestic or industrial, they are on average between 1.3 <3. This result confirms the absence industrial discharge connected to the domestic sewerage network. According to Bliefert and Perraud, the COD and BOD₅ values of treated water are typical of communal waters after biological purification.

4. Conclusion and recommendation:

The results presented show that the activated sludge process is effective in the treatment of wastewater under the climatic conditions of the city of Touggourt, considering the physicochemical amount of the treated effluent, the world of driving system treatment will usually depend on the season. Indeed, the elimination of the organic load and SS is important and has periods of good and bad operation concerning the accumulation of algae. It should be noted that the purified effluents are low in nutrients on all nitrogen (N-NO₃, N-NO₂). Finally, collaborate with epidemiologists to improve the purification performance of treatment plants, depending on the quality of the treated water and determine additional risks such as the accumulation of heavy metals in the soil and plant, the monitoring of parasites digestive tract (helminths and protozoa ...) can run farmers; following the use of wastewater in irrigation.

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