EGSB'S PERFORMANCE FOR THE TREATMENT OF INDUSTRIAL EFFLUENT FROM A PAPER MILL IN GHARB-MOROCCO

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(Received on Date: 3rd July 2016 Date of Acceptance : 14th August 2016)

ABSTRACT

In 2013, CMCP-International Paper inaugurated the treatment plant anaerobic wastewater "WWTP". This treatment plant has a 6.000m3 processing capacity per day, allowing, thus, reducing water consumption and providing treatment before discharge into the environment. The present study aims to assess the efficiency of anaerobic digestion (methanation) of the WWTP. Furthermore, more than 450 samples were collected from each compartment (clarifier, dissolved air flotation unit and methanizer). The physicochemical parameters chosen in this study are pH, COD, BOD 5 and SM.
The results of this study show reductions that can reach 89.95% for BOD5, 59.09% for SM and 74.65% for COD. Alternatively, the other parameters did not show significant differences in the standards set by Veolia.

Keywords: waste water - purification - Methane - physicochemical - anaerobic.

No: of Tables: 7 **No: of References : 16**

INTRODUCTION

Nowadays, several regions in Morocco suffer from ever-increasing water needs, while resources are limited and unevenly distributed. The water deficit is now increasing with the growth of the industrial sector, which not only consumes large amounts of water, but also contributes to pollution and degradation of the quality of surface water and groundwater.

Thus, in an industrial, water has become a commodity like any other, and used in the vast majority of manufacturing processes. The resulting wastewater is discharged directly into the environment without any treatment. For this, the wastewater treatment has become today a priority; both to preserve human health and the environment, to produce water that could be used in agriculture, industry and other social activities.

Consequently, the Moroccan industries face tougher environmental regulations on effluent discharge standards. These standards will force companies to invest for the acquisition of wastewater treatment systems.

In 2013, CMCP-International Paper inaugurated the biological treatment plant with methanation of waste water (WWTP), operating in strict anaerobic. The principle of this treatment plant biology involves a type of "granular". It treats the carbon pollution and produces recoverable biogas. This WWTP has a 6.000m3 processing capacity per day. This allows the plant to reduce water consumption and therefore the flow of industrial waste and also provide a waste treatment prior to discharge into the river Sebou.

In order to bring objective responses on the operation of the wastewater treatment plant of CMCP in Kenitra, we studied the quality of wastewater discharged into the environment, through the measurement of the content of some physicochemical parameters.

Materials and Methods

Study station

Kenitra region located in the northwest of Morocco, between the meridians 30 ° 6 'and 6 ° 45' West and parallel 34 ° 15' and 34 ° 20', the climate is semi-arid to sub-humid, caused by the influence of the ocean, and presents fairly temperate and hot summers winters. The wastewater discharged by urban areas of this city, are discharged in the raw state in Wadi Sebou and Lake Fouarat through several urban collectors (El Guamri, 2007).The experimental site is located at the wastewater treatment plant (WWTP), longitude of 6°56' west and latitude of 34°27' north, in 2013 CMCP-International Paper inaugurated the treatment plant anaerobic wastewater, which has a 6.000m3 daily processing capacity, Through this project, management of the factory has two main purposes. First, reduce water consumption and thus the flow of industrial waste. And secondly provide treatment of these discharges prior to discharge into the river Sebou.This is an EGSB type digester. It involves a biological type "granular". This biologically treats the carbon pollution and produces biogas recoverable (power generation,

boiler used to heat the effluent ...) (Anonymous, 2012).

Sampling period and studied parameters

The sampling period spread from January 2013 to July 2014. The wastewater sampling (untreated industrial wastewater, pretreated wastewater and treated wastewater) has been performed with an average of five times per week for each parameter (water potential "pH" suspended matter "SM" chemical oxygen demand "COD" and biochemical oxygen demand "BOD 5). They are measured once a day (morning between 8 am and 10.30).

RESULTS

Hydric potential : The evolution of the pH in the three compartments (clarifier, flottatetur and Methaniser) depending on the month is shown in Figure 1. The results show that, the pH in the clarifier and the flotation unit evolves in the same direction. In fact the pH in the two compartments is, therefore, minimum during the warmer months and maximum in temperate and cold months. However the change in pH is almost stable in the methanizer and this is during the 12 months of the year.

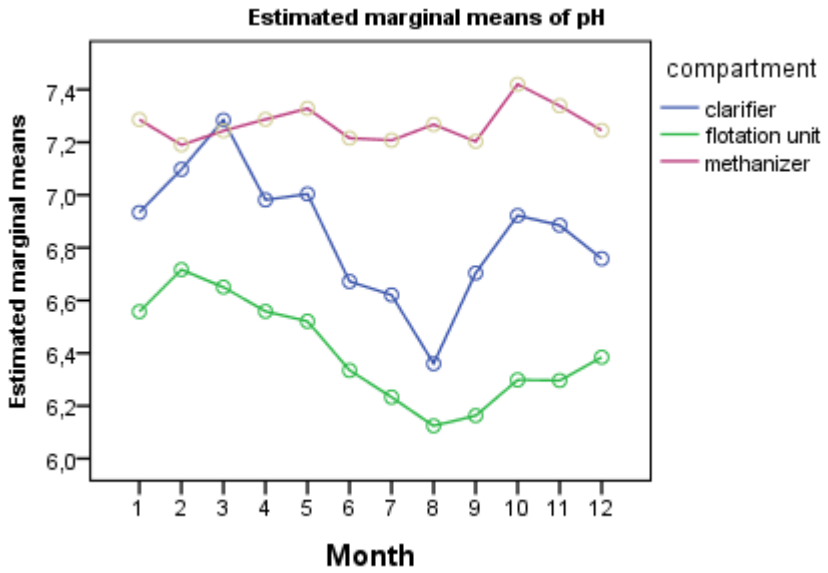

Figure 1: Monthly Evolution of pH in the three compartments (clarifier, flotation unit and methanizer)

Suspended matter : Analysis of the monthly evolution of the suspended matter in the three compartments (Figure 2) shows a great dispersion in the clarifier and the methanizer. This distribution is minimal and stable in the flotation unit; it does not exceed 100 mg / l. However except month 4 wherein the suspended matter (SM) is maximum at the clarifier (400mg / l), the values of the SM for the remainder of the month fluctuate between 100mg / l and 270mg / l. These values are substantially lower than the standard set by Veolia in the flotation (<150mg / l), the clarifier (<700mg / l) and the methanizer (<400mg / l).

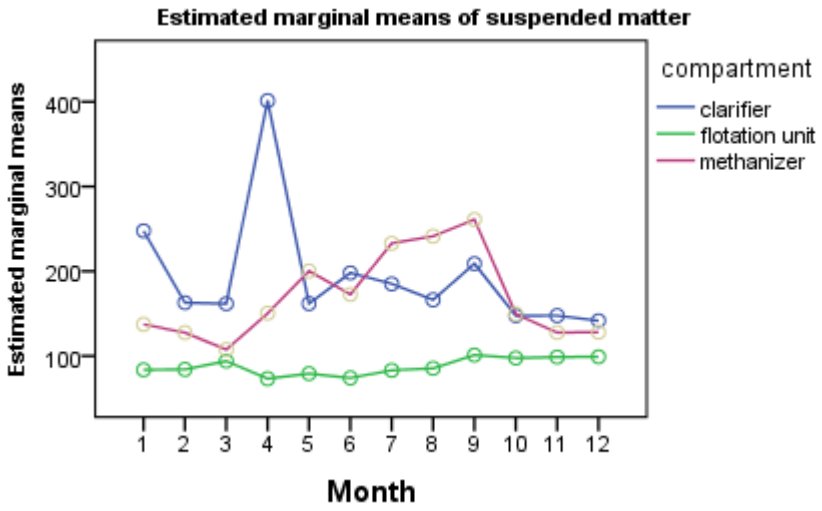

Figure 2: Monthly evolution of the Suspended Matter in the three compartments (clarifier, flotation unit and methanizer)

In order to assess the performance of the treatment plant we compared the purification rate of this parameter at the entrance (clarifier) and the exit (methanizer) of the WWTP. The estimated treatment rate between the clarifier and the flotation unit is 58.38% for 2013 and 44.56% in 2014 (Figure 3). The treatment rate between the clarifier and the methanizer is 3.12% and 5.95% respectively in 2013 and 2014. This purification rate is too low; this is attributed on one hand to treatment products added during purification at the methanizeron the other hand, to the resuspension of sludge.

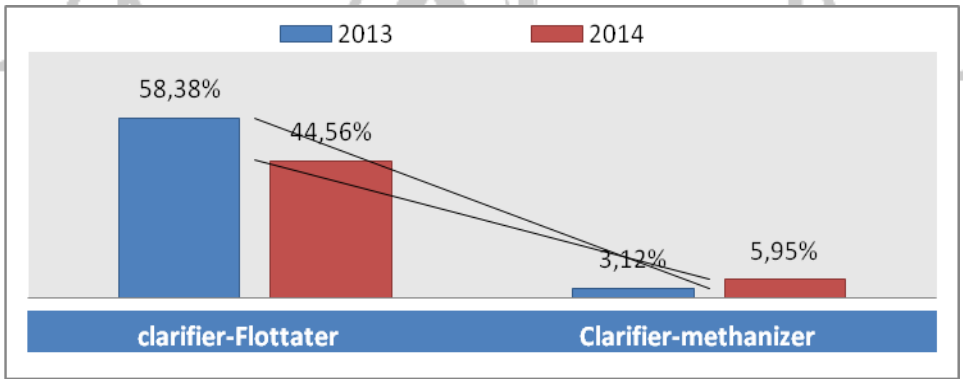

Figure 3: Comparative Evolution of the reduction of the suspended matter between 2013 and 2014 in the three compartments

Chemical oxygen demand

The analysis of the monthly evolution of the chemical oxygen demand in the three compartments (Figure 4) shows a great dispersion in the clarifier and the flotation unit. This distribution is minimal and stable in the methanizer, it does not exceed 900 mg O2 / l. The values of COD during the 12 months of the year fluctuate between 100 mg O2 / l and 270 mg O2 / l. These values are sufficiently below the standard set by Veolia in the flotation (<2360 mg O2 / l), the clarifier

(<2758 mg O2 / l) and the methanizer (<900 mg O2 / l).

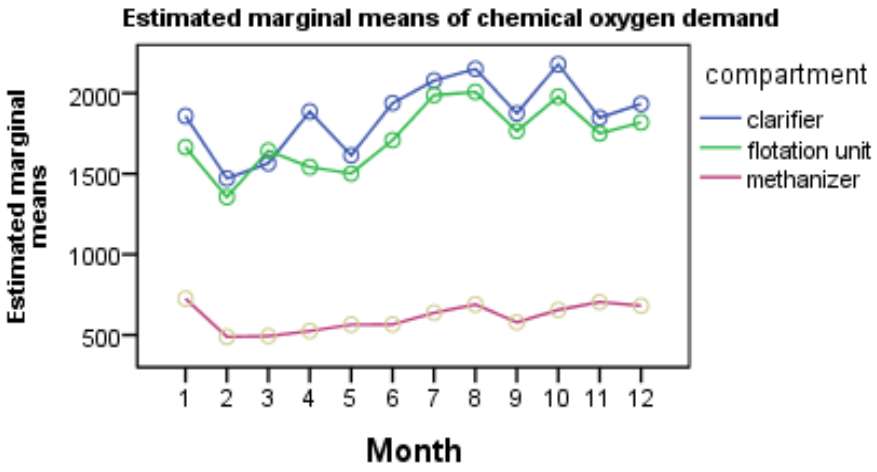

Figure 4: Monthly evolution of COD in the three compartments (clarifier, flotation unit and methanizer)

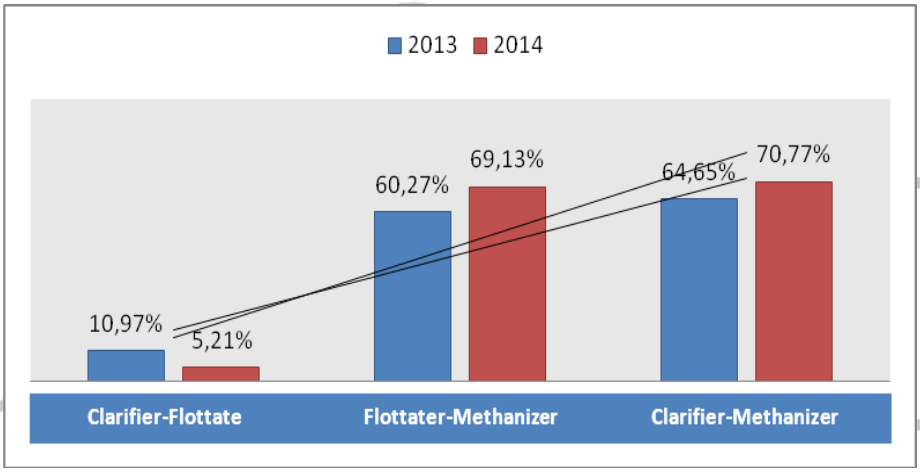

Figure 5: Comparative evolution of the reduction in COD between 2013 and 2014 in the three compartments

For the purpose of estimating the performance of the treatment plant we compared the purification rate of this parameter during the treatment process WWTP. The purification rate estimated between the clarifier and the flotation unit is 10.97% for 2013 and 5.21% in 2014. The wastewater treatment rate between the flotation unit and the methanizer is 60.27% and 69 and 13% respectively in 2013 and 2014. Regarding the treatment rate estimated between the clarifier and the methanizer is 64.65% for 2013 and 70.77% in 2014. There is, then, a continuous increase purification rate after each treatment, this indicates the effectiveness of the purification.

Biochemical Oxygen Demand

Figure 6 shows the analysis of the evolution of biochemical oxygen demand in the clarifier and the methanizer. This analysis shows a great dispersion in the two compartments. This

distribution undergoes a sharp drop from the clarifier (≈1050 mg O2 / l) to the methanizer (≈ 220 mg O2 / l). The values of BOD5 are more or less below the standard set by Veolia at the clarifier (<1515 mg O2 / l) and the methanizer (<200 mg O2 / l).

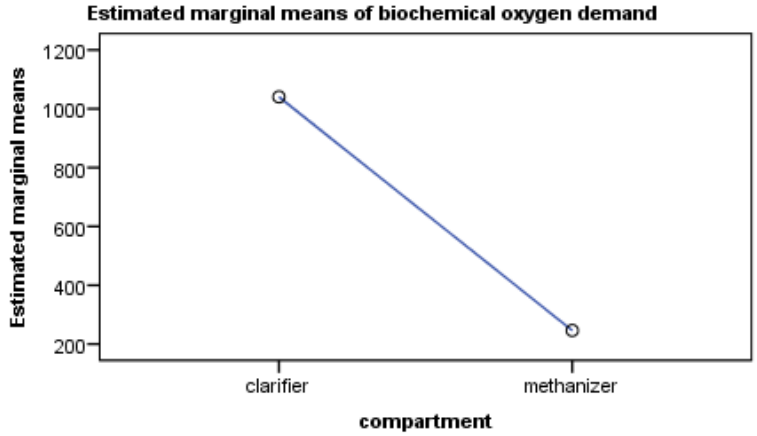

Figure 6: Monthly evolution of BOD5 in both compartments (clarifier and methanizer)

To assess the performance of the treatment plant we compared the purification rate of BOD5 at the entrance (clarifier) and at the exit (methanizer) of the WWTP. The estimated treatment rate between the clarifier and the methanizer is 75.16% for 2013 and 74.52% in 2014. There was a slight decline in the purification rate between 2013 and 2014.

The analysis of industrial wastewater undergoing treatment with the aéroflottateur and the methanizer show effective results, generally meeting the Moroccan standards of water quality for irrigation and within the range limits of direct discharges, standards Moroccan indirect discharge and Veolia standards.

In light of these results, we can already confirm the efficiency of the anaerobic digestion system (reduction of 70% of the organic pollution). Furthermore, the value of the report volatile fatty acids / total alkalinity (VFA / TA) calculated has proved always less than 0.4, this indicates that the alkaline reserve of the digester is sufficient to absorb the variations in the content of VFA, subsequently it indicates good functioning WWTP.

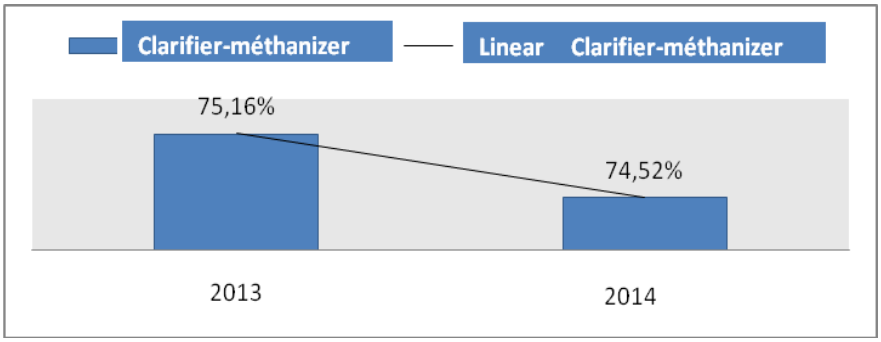

Figure 7: Comparative evolution of the reduction of BOD5 between 2013 and 2014, and between clarifier methanizer

Discussion & Conclusion

The results of the analysis of physicochemical parameters show that the average pH in untreated wastewater collected from the clarifier during the years 2013 and 2014 is slightly alkaline (average pH of 6.871), it fluctuates between a minimum pH of 6.10 and a maximum pH of 7.8. These registered pH values conforms to the specific discharge standards applicable to discharges of paper pulp industries, paper and cardboard 5.5 <pH <8.5 and Veolia 6 <pH <8. Nevertheless, pH average registered at the exit of the flotation unit (6.43) and exit of the methanizer (7.26) are well below the limit value of Moroccan discharge Standards, Official Bulletin of Morocco. (2002). Values stored in the different compartments are similar to those of Boutayeb et al. (2012), Chaouki. (2013), El Halouani (1995), El Hamouri et al. (1993) and Maiga et al. (2006). In this study we have seen a drop in pH between the untreated wastewater (clarifier) and pretreated water (flotation unit), this could be mainly due to the addition of coagulant. However, a significant increase was noted between the pretreated wastewater (flotation unit) and treated wastewater (methanizer), it would probably be attributed to the addition of soda.

For the suspended matter (SM), a large monthly dispersion was reported at the entrance to the WWTP (clarifier), with an average of 205.79 mg / l. and a widespread ranging from 80 mg / l to 4832 mg/l. Compared with the standard general limit discharge of treated wastewater and our values well beyond the threshold of 50 mg / l. Moreover, a considerable decrease was observed between the average value of the SM at the exit of the flotation unit (84.42 mg / l) and the average value at the output of the clarifier (205.79 mg / l). These values are similar to those described by Chachoua. (2013) in Algeria and El Krati (2000) in Sidi Bennour, but lower than the results published by Raweh (2011) in Yemen. Nonetheless, the reductions in SM show variations of high amplitudes sometimes negative, reflecting an increase in the SM concentration at the outlet of the WWTP. The increase in MY at the exit of methanizer is probably due to the resuspension of sludge. This increase is associated with the addition of reactants and loss of sludge. The results confirm system performance of anaerobic digestion for the abatement of 70% of the organic pollution.

Concerning COD, concentrations identified at the entrance to the WWTP are much more varied; they range from 850 mg/l to 4396 mg/l with an average of 1844.94 mg/l of O2. These values are significantly lower than those found by Rassam et al. (2012), Raweh (2011) and Gerbati et al. (2002). At the exit of the methanizer, the average COD value reached 605.8 mg O2/l, it oscillates between 206 mg/l and 1175 mg/l. in addition, a remarkable decrease was illustrated between the clarifier and the methanizer. This large variation confirms the good abatement of the methanizer in regard to the organic pollution. These recorded values conform to the specific limit values for discharges of the pulp industry by Moroccan standard (1000 mg / l) of Morocco Official Bulletin No. 5448.

(2006) and are similar to those of the paper industrial unit (CDM) is Sidi Yahya El Gharb (Morocco) Fathallah et al. (2014). The abatement varies between 55.94 and 74.65%, with an average reduction of 67.10%. The developer has adopted an average discount of 60 to 70% at the exit of the methanizer for the design of the STEP CMCP.

The untreated wastewater at the entrance of the station reveals contents of BOD5 ranging between 340 and 1800 mgO2/l, with an average of 1009,01 mgO2/l. Furthermore, concentrations of BOD5 identified in collected wastewater from the methanizer fluctuate within a range of [58 mg O2/l -550 mg O2/l], with an average of 255.11 mg O2/l. despite this difference in concentrations, the average does not exceed the discharge standards of treated wastewater (<500 mg O2/l).

Consequently, the steps of the treatment process impact the reduction of BOD5 and enable significant reductions through different stages, these results are similar to those of El Hachemi (2012), but higher than those found by Raweh (2011) at wastewater Sanâa (Yemen) and Badawy et al. (2006); Chaouki et al. (2013) in Jordan. Subsequently CMCP-IP station provides satisfactory removal of organic matter.

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