International Journal of Innovation and Applied Studies
ISSN 2028-9324 Vol. 7 No. 4 Aug. 2014, pp. 1458-1464

http://www.ijias.issr-journals.org/

CONTRIBUTION TO THE TEMPORAL ASSESSMENT OF RELEASES PROVINCIAL HOSPITAL (SIDI KACEM, MOROCCO)

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ABSTRACT: Environmental concerns require a certain dynamic to basic safeguarding ecosystems against any type of pollution. Studies can guide practice and the development towards better environmental management. This study has considered making a physicochemical characterization of samples collected during one year (11.01.2012 to 7.1 . 2013) at 8h, 10h, ,12h , 14h, 16h and 18h from the collection of effluent hospital revealed the following results:
The temperature varies between 15.75 °C and 20.21 °C, the acid pH. The electrical conductivity of the samples studied is between in 4444 and 7135µS/cm, BOD5 is between 74mg/ld O_2 and 688mg/ld O_2 (BOD_5 is blocked by antibiotics), suspended matter is 233 mg/l, COD between (112 and 622 ppm), MES is between 163 and 257 mg / l, dissolved Oxygen is between (1.7 and 3.14 mg / l), chlorine is between (0.07 and 0.11 mg /l). Analyses show a variation of at least some important parameter. In general, the values obtained are higher than the discharge standards recommended by WHO (1989) and CNS (1994) for urban wastewater. At the end of this research, it was found that wastewater from the provincial hospital in Sidi Kacem are of very poor quality.

KEYWORDS: Physico-chemical; wastewater; pollution; hospital; Sidi Kacem; Morocco.

1 INTRODUCTION

Wastewater from the hospital represent a small fraction of the volume of water used in morocco but their quality, more or less poor, requires treatment before discharging them at crude state in the receiving environment. Depending on the nature and concentration of its constituents, hospital's wastewater can cause a number of diseases and other effects on the hydrosystem , There is no clear correlation between the consumption of specific hospital and size hospital ([1]; [2]; [3]; [4];[5]; [6]; [7]; [8]; [9]. Guidelines of Regione Emilia Romagna, Italy, 2009; [10]In presenting the physico- chemical characteristics of raw provincial hospital of Sidi Kacem wastewater. The use of characterization parameters of urban effluents is a good way to give the quality degree of theses urban wastewater, this research aims to inform us about the degree of physico-chemical raw sewage pollution of Sidi kacem provincial hospital.

The purpose of this study and make physicochemical analyzes is to assess the risk of hospital waste to human health.

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2 METHODOLOGY

MIDDLE OF STUDY

Sidi Kacem is a medium-sized city of northwestern Morocco and capital of the province of the same name. Its inhabitants are the number of 74,062 (RGP, 2010). On axes of Meknes (45km), Tangier (210km), Fez (85km) and Rabat (120km) (Fig.1), it is located where

R'dom's river leaves the heights of Meknes tableland plateau of to engage in large and fertile plain of Gharb. Its climate is continental with hot summers and cold winters that invade the province.

The provincial hospital in Sidi Kacem has a theoretical capacity of 210 beds. Its technical platform consists of an operation which contains three central blocks and 2 blocks, maternity rooms, rooms with standard radiology and imaging table and a digestive mobile device. Hemodialysis contains 5 generators, the number of patients reached 104/day.

The wastewater collection was selected to cover almost all the sanitation hospital network before discharge into the sewage of the city of Sidi Kacem networks during the 6 sampling periods (8h -10h - 12h- 14h-16h -18h). Samples are taken monthly 2 times for a period of one year (from 01/11/2012 to 7-1 - 2013) and 12 consecutive samples during the working days where activity is high (Monday - Tuesday- Wednesday - Thursday- Friday) and 12 samples during the holidays with less activity (Saturdays, Sundays and holidays). We try identifying the different sources of pollution for each sampling period.

Figure 1: Map locating the hospital in Sidi Kacem (Morocco)

METHODS OF STUDY

Measurements of temperature, pH and electrical conductivity were carried out in situ. The temperature of the water analyzed is measured with a thermometer. The pH determination was performed using a pHmeter model HANNA. The conductivity was measured by a conductivimeter cond312i. Matter suspended solids (MSS) and biological oxygen demand for 5 days (BOD_5) was analyzed in the Laboratory of Environment in Faculty of Kénitra. BOD_5 per Oxitop BODmeter and the suspended material is determined by filtering a volume of water on cellulosic filter 0.45 µm. COD, dissolved O_2 and chlorine carried out using a multi-parameter bench photometer.

3 RESULTS AND DISCUSSION

The physico-chemical characteristics of raw sewage of provincial hospital of Sidi Kacem are showed by Figures 2 to 9.

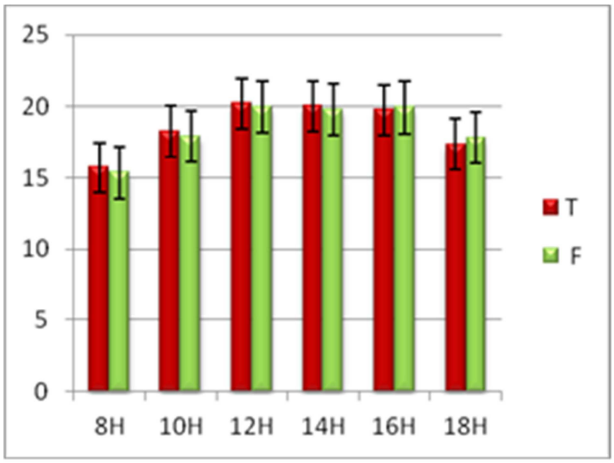

Figure 2: Temporal variation of temperature of hospital wastewater

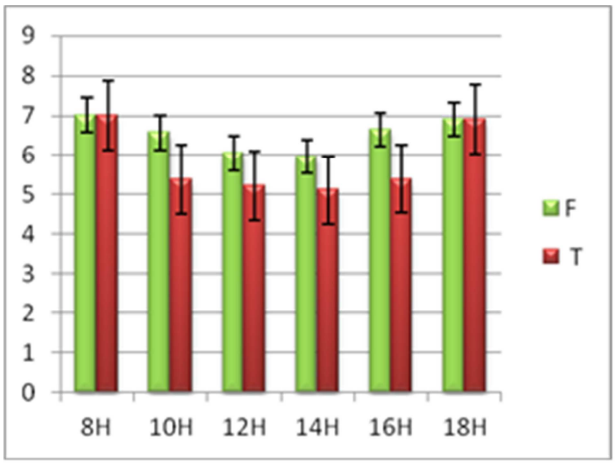

Figure 3: Temporal Variation of pH of wastewater

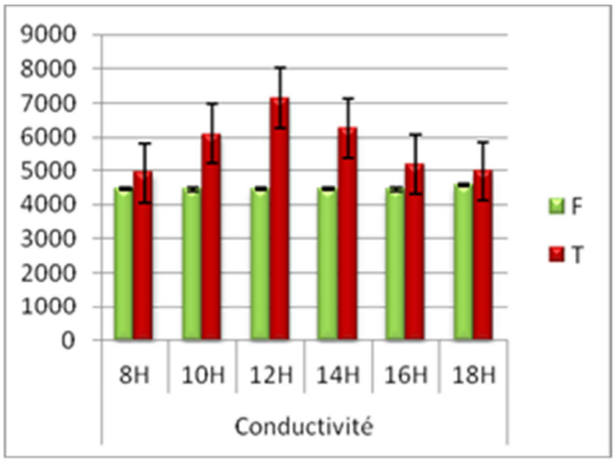

Figure 4: Temporal variation of EC of wastewater

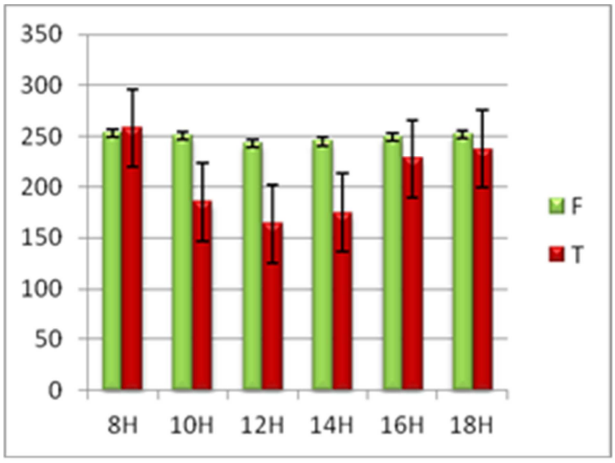

Figure 5: Temporal Variation of hospital wastewater

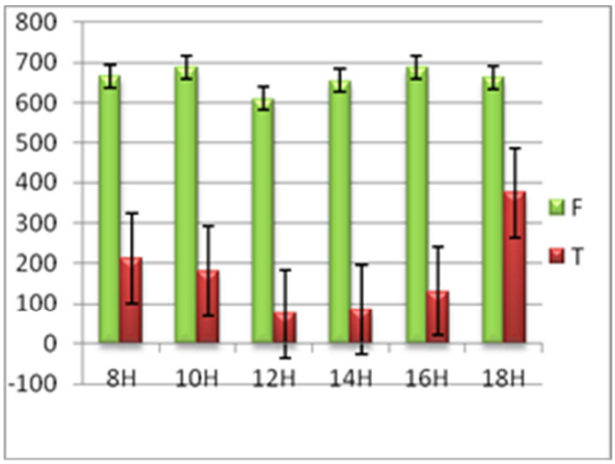

Figure 6: Temporal variation of BOD_5 wastewater

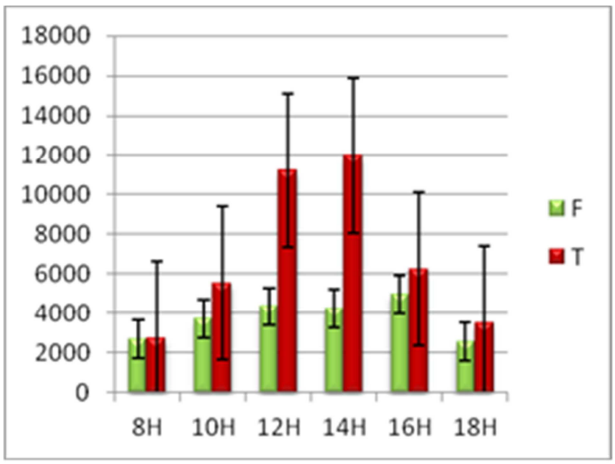

Figure 7: Temporal variation of COD wastewater

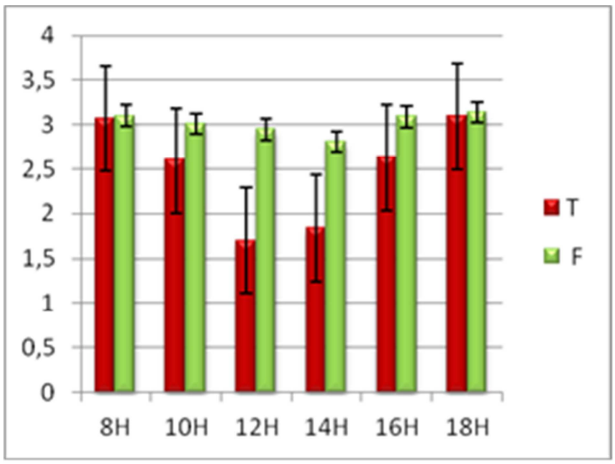

Figure 8: Temporal variation in O_2 wastewater

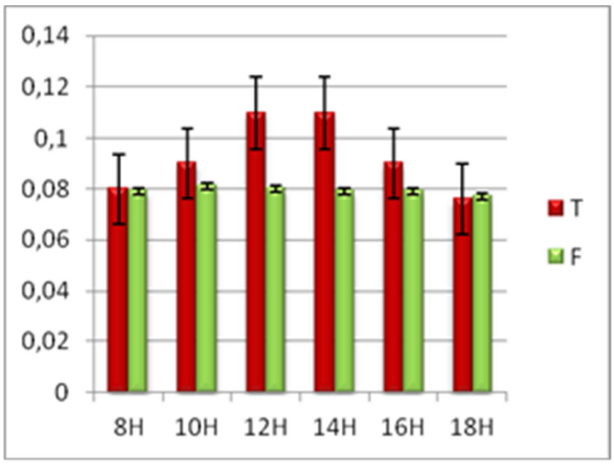

Figure 9: Temporal variation Cl.lib wastewater

The temperature measurement is required for each analysis of wastewater. The averages and extremes of wastewater temperature during periods vary between 15.75 °C and 20.21°C (Figure 1) with an average value of 18 °C for 55 working days and 18.47 °C for the holidays.-There is not much difference in temperature between workdays and holidays, they are below 30 °C which means that theses wastewaters are acceptable for irrigation and indirect discharges in the receiving environment. Our results are consistent with Elguamri et al,[11] in Kénitra.

The pH is an indicator of the pollution by excellence; it varies following the nature of the acid or basic effluents. For four sampling times (10h, 12h, 14h, 16h) of the hospital wastewater is acidic, causing the acidity is due to the use of disinfectants and detergents, they use during activities of medical diagnosis and bacterial fermentation which tends to acidify the medium (Finance, 1985). These releases are slightly lower than the WHO standards that admit a pH range of 6.5 to 8.5. The average pH value of six periods is 4.53; it does not meet the standards of water quality for irrigation (CNS, 1994). Several authors ([12]; [13]; [14]; [15]; [16]) connect the wastewater pH variations with biological and biochemical activities, including photosynthesis. The pH is in the WHO standards, and meets the standards of water quality for irrigation ([17]).

The conductivity reflects the amount of ionizable salts dissolved, the content of the electrical conductivity of the waste water, is mainly the result of the presence of sodium chloride and calcium bicarbonate as reported by Torrens et al., 2010. The curve time variation of the electric conductivity shows that during workdays there is an increase in conductivity in comparison with the less active days. There is also a variation between periods of work, the most active are 10h, 12h, 14h and 16h and the least active are 8h and 18h. The maximum value of the electrical conductivity is 7052.08 µS/ cm recorded at 12h.

Suspended solids are all mineral and organic particles in the wastewater and vary between Working and rest days. There is a decrease during the most active periods 12h, 14h, 16h. It is due to high water use. But the period of 18h and 8h like rest days, usually the average value of the suspended matter is stronger because there is a high use of detergents for infections and for cleaning operating rooms.

The Biochemical Oxygen Demand (BOD_5) expresses the amount of oxygen required for the degradation of biodegradable organic matters through the development of micro-organisms, under given conditions (5 days at 20 °C, protected from light and air). The recorded values of BOD_5 during the study are very low for days of work; they are between 97.5 mg O_2/l and 275.85 mg O_2/ l (Fig.5), with an average value of 176.34 mg O_2/l for working days. This value beyond that assigned by Moroccan standards that set the rejected quantity of biodegradable organic matter to 100 mg O_2/l. The maximum value reached 658.56 ± 19.03, which exceeds the normal range of urban wastewater (200-400mg O_2/ l). This requires the treatment of the wastewater prior to discharge into the waters of the sanitation of the city. BOD5 hospital wastewater days of work are less than the holidays, this decrease is due to the wide variety of chemical compounds used in the hospital and especially in work days, these chemical compounds are antibiotics, cytostatics, disinfectants, contrast, other drugs (hormones, statins...).

Chemical Oxygen Demand (COD) is a measure of the amount of oxygen required to chemically oxidize the total organic matter in the water, COD measured in hospital effluents days of work is very high compared to holidays the average value of COD periodic work days is 6865.3 ppm, and holidays is 5752.2 ppm (Figure 6).The two values are generally much higher than those allowed by the French standards (150ppm), WHO (<80ppm) and Tunisian standards (<90ppm). There is a variation between 12h and 14h COD because there is a high organic load during this period which is the most active period and this shows that the decrease in values of BOD5 is due to blockage of bacteria by antibiotics.

The Dissolved oxygen is an important factor in the distribution, species composition and abundance of the biological community. Examination of the vertical profiles of dissolved oxygen (Figure 7) shows poor oxygenation of the water in the work days as well in non working days, with maximum levels of 2.75 mg /l observed in waters surface. The comparison of these values with the grid of wastewater discharge, they are poor than the minimum recommended $5<O_2<8$. We find that in both periods (12h and 14h) there is a significant decrease in dissolved oxygen levels indicating increasing pollution at this level due to the use of toxic products.

Chloride ions are negative chlorine anions, this element is very abundant in the environment, it is present in water, soil, rocks, and in many foods. In working days the amount of free chlorine remains variable during the most active periods and less active periods, the amount of free chlorine exchange between a minimum value of 0.076 mg/l and a maximum value of 0.11 mg/l. The maximum value is recorded at 12h and 14h of the two most active periods (Fig. 8), this increase is due to the high use of chlorine in cleaning products especially to sterilize everything that are hospitable tools. But none works days the amount of chlorine remains stable for all periods it the limit of direct discharges [17].

4 CONCLUSIONS

This study aims to evaluate the degree of Sidi Kacem Provincial Hospital wastewaters by the realization of physicochemical analyzes the course of a year. This can be concluded that the studied waters are very bad quality. This requires the treatment of the wastewater prior to discharge into the water network sanitation of Sidi Kacem city. We hope in the light of results from this study have led to a real awareness of the competent authorities on the need to develop in the region works for the treatment of wastewater.

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