

# The Bacterial Load of Hospital Discharges (Sidi Kacem, Morocco)

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## ABSTRACT

Fecal microorganisms, which are indicators or pathogens, have an optimum growth in the specific conditions of the internal environment animal or human. Therefore, when issued by a host, they result in sudden and drastic changes in the environment. This study aims at bacteriological characterization of the effluent from the provincial hospital in Sidi Kacem. And it shows that the effluent from the hospital contributing to non-regulatory standards ultimately reaches the environment (river wadi floor, animal, vegetable...). The results of bacteriological analyses (Total Coliforms, Fecal Coliforms) about sewage from the provincial hospital depending on the day of rest and work in the city of Sidi Kacem are presented with means respectively  $557 \times 10^4$  and  $328 \times 10^4$  in the rest and working days  $555 \times 10^4$ ,  $342 \times 10^4$  and the much higher maximum working days from the day of rest are  $64 \times 10^5$  and  $42 \times 10^5$ . The results obtained show that the rate of bacteria (CT-CF) exceeds standards recommended by CNS (1994) and WHO (1996, 1997). These results have adverse effects on human life, animal, environment and ecosystem in general.

**Keywords:** Bacteriology; Total Coliforms; Fecal Coliforms; Hospital, Sidi Kacem; Morocco

## 1. Introduction

It is known that the deterioration of the quality of water resources [1-4] due to human activities is as important as that related to quantitative imbalance caused by overexploitation of water resources threatens. Indeed, in addition to its scarcity, water is subject to increasing pressures and continuing needs of industrial development, the expansion of agriculture and the improvement of living conditions of the population of the hygiene and health. Like other countries in the world, Morocco does not escape the scourge of all forms of pollution of water resources [5], but the human activity is the main cause of the deterioration of their quality.

In recent years, the pace of development in the country has accelerated and various anthropogenic activities are located in several areas near large cities and also in the rural areas. This results in excessive production of wastewater that causes serious imbalances in aquatic ecosystems

including major rivers.

The water pollution caused by micro-organisms of fecal origin appeared very early as soon as the water has been used as a vehicle for waste disposal [6]. However, when the aquatic environment receives discharges of animal or human [7], the number and type of bacteria present are capable of making the water unfit for human use [8], especially at the hospital [9], and these diseases are most often transmitted by the faecal-oral contamination and the man, which are realized either by drinking water consumption, or by contaminated water food consumption, or even in a bathroom or contact with water for recreational.

## 2. Medium Material

### 2.1. Study Area

Province of Sidi Kacem is located in the region el Gharb-Chrarda-Beni-Hssen and borders the provinces of: Chefchaouan and Larache North, South Meknes, Kenitra and west by the province of Taounat east, covering an area of

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4060 km<sup>2</sup> (5.7% of the national area) and a population of 701,000 inhabitants, 68% of rural mileage density 173 inhabitants/km<sup>2</sup>. Its climate is continental invading the province of hot summers and cold winters. While spring and autumn are experiencing average temperatures on precipitation, rainfall is 400 to 800 mm/year on average.

The provincial hospital in Sidi Kacem, setting depending on the year 1989, occupies a total area of 4060 km<sup>2</sup> it serves a population of 701,000 inhabitants, city: 478,000 inhabitants and 223,000 rural inhabitants (projected on the basis of census 2010 population). Théorique 210 lits its bed capacity and functional capacity 202 functional beds between different medical departments (**Figure 1**).

### 2.2. Sampling

The sampling was conducted outlets one collector at the remediation provincial hospital in the town of Sidi Kacem network.

Our study is based on three variables are: time (8 h, 10 h, 12 h, 14 h, 16 h, 18 h) the monthly payment during twelve months spanning from March to December 2012 and 2 months (January, February) of 2013, according to the days of work and rest, six samples were taken during the same day, the analysis was performed on the bacteriological characteristics of wastewater from the provincial hospital in Sidi Kacem based variables.

For each month we made two samples: The 1<sup>er</sup> sampling: during working days: Monday, Tuesday, Wednesday, Thursday and Friday, 2 sampling: during rest days: Saturday, Sunday and vacation days.

The two samples are taken to determine the influence of hospital activity on the rate of bacterial pollution.

### 3. Test Methods

There are several methods for enumerating total coliforms (TC) and fecal coliform (FC), but the membrane filtration (MF) is currently the most widely used in Mo-



**Figure 1.** Map of the province of Sidi Kacem (Minister of Health).

rocco view (**Figure 2**) that outlines the steps for identifying CT, CF.

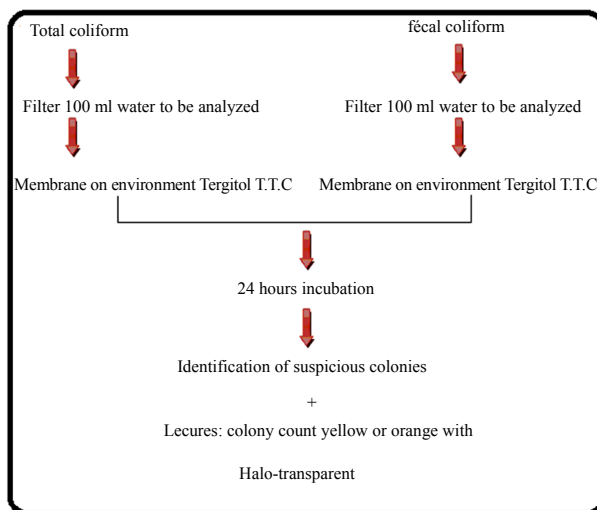
The results are processed by an Excel (2007) software.

### 3.1. Results and Discussion

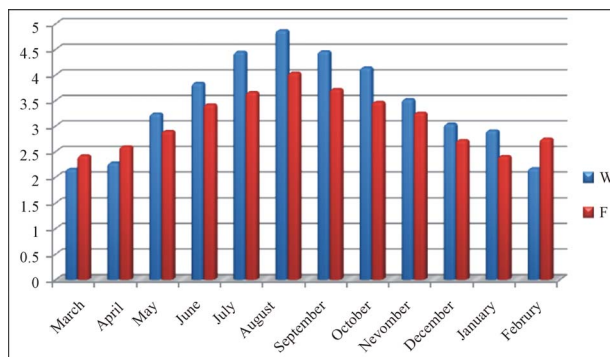
We conducted bacteriological analyzes of wastewater from the provincial hospital of Sidi Kacem to determine the bacterial load. That assessed by counting the number of total and fecal coliforms at the hospital.

Total coliforms are indicator organisms of fecal contamination; the count can detect a level of human or animal pollution.

The spatial study of fecal coliform highlights significant variation during the whole year, there is a significant degree of contamination in the months June, July, August and September (**Figure 3**) with an average ( $6.57 \times 10^6 \pm 0.22 \times 10^6$ ) CFU/100 ml for working days, and ( $6.03 \times 10^6 \pm 0.76 \times 10^6$ ) CFU/100 ml for rest days, which makes hospital wastewater during this dangerous period, especially during the summer or the concentration is maxi-



**Figure 2.** Schematic protocols identification total and fecal coliform.



**Figure 3.** Temporal variation of CT in the wastewater of HPSK/10<sup>6</sup>.

num and water demand is important, this contamination is due to the increase of the number of hospital visits passions by bacterial infections.

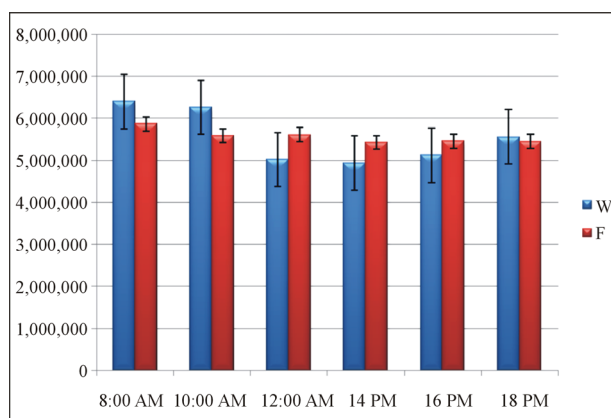
This graph gives us the total coliform bacteria counted annually (2012-2013) as a function of time studied; we find that there is a total coliform contamination of wastewater Provincial Hospital of Sidi Kacem with a crisp, clear variation. This counts as a function of working days and days off allowed us to say that the rate of total coliforms (**Figure 4**) has a greater contamination during working days as holidays with an average  $555 \times 10^4$  CFU/100 ml.

During the two periods (8 am et 18 pm) or the concentration of fecal coliform is high ( $6.4 \times 10^6$ ,  $5.56 \times 10^6$ ) CFU/100 ml for working days, and ( $5.8710^6$ ,  $5.45 \times 10^6$ ) CFU/100 ml for rest days. The strong growth of total bacteria recorded during these two periods is due to household cleaning (kitchen) and an enrichment of organic matter due to the decrease of water flow operating rooms and medical tools then both periods.

In addition, both (12 am and 14 pm) periods have values falling especially for working days ( $50.2 \times 10^5$  and  $49.4 \times 10^5$  CFU/100 ml) probably resulting from increased water flows down the drain during this period, without neglecting the hospital is in full activity at this time, then there is a strong use of hydrocarbons, toxic and inhibitory antibiotics these microorganisms.

This enrichment reflects the total fecal coliform load rejection hospital discharges resulting mainly valves, kitchen, operating rooms and garbage dumps.

The average value of total coliforms is  $5.55 \times 10^6$  CFU/100 ml So if one refers to the grid quality of surface waters of Morocco (CNS 1994), we can say that the wastewater from the provincial hospital sidi kacem are of poor quality. And they go far beyond the standards of the WHO guidelines [10,11] on the water for an unrestricted irrigation, the problem is that wastewater from the hospital are paid directly into Oued R'dom which leads to a strong water pollution.



**Figure 4.** Change in total coliforms based on time sampling.

### 3.2. Equations Results and Discussing any CF

The microbiological analysis of fecal coliform from (**Figure 5**) during a year of study shows that there is a significant fecal contamination during the four months of July, August, September and October; it is average for the months May, June, November and December an lower in January, February, March and April (Always with a high rate of this organism pollution indicator of working days compared to days off).

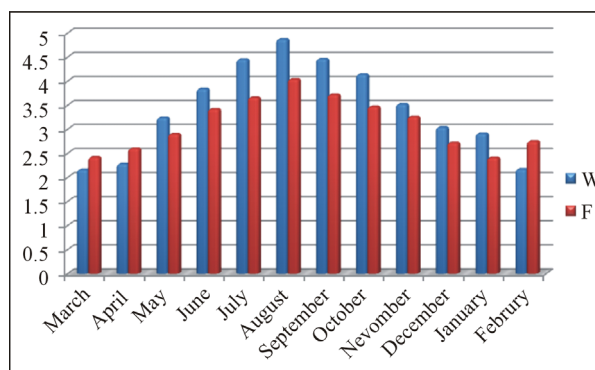
The results of the monthly fecal coliform sewage Provincial Hospital of Sidi Kacem analyzes reveal the presence of indicators of fecal contamination and some pathogens. An increase in bacterial contamination (fecal coliforms) analyzed waters are observed during June, July, August, September and October, there is also a peak in the month of August, it is up to  $4.87 \times 10^6$  CFU/100 ml for working days and  $4.04 \times 10^6$  CFU/100 ml rest days, there is also a decrease in bacterial load in the other months of the year, this difference is due to the influence of temperature on the bacterial multiplication and the number of bacterial contamination.

The analysis of the results in **Figure 6**, which shows the variation of fecal coliforms during sampling periods 8 am, 10 am, 12 am, 14 pm, 16 pm, 18 pm indicate a significant change in the number fecal coliforms with a maximum average value of  $4.16 \times 10^6$  CFU/100 ml observed at 8 am and a minimum average value of  $2.67 \times 10^6$  CFU/100 ml recorded at 12 am.

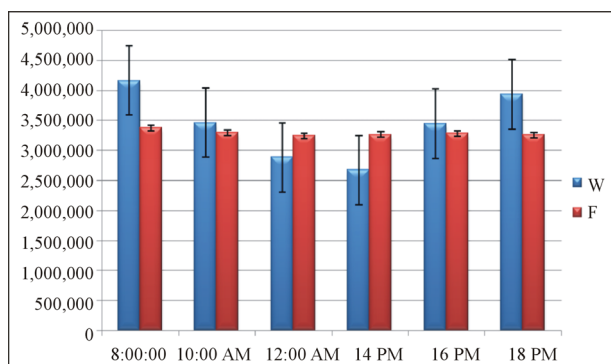
By comparing the values obtained with those of the grid surface water (CNS), we deduce that the wastewater from the provincial hospital of Sidi Kacem waters is heavily loaded with fecal contamination.

Indeed, the monthly evolution of this organism follows the same shape and the same trend as that of total coliforms.

Fecal coliforms are of particular importance, they reflect the sanitary quality of water or food [12], their count to estimate the importance of fecal contamination in water waste from the hospital by human or animal feces.



**Figure 5.** Temporal variation of CF/10<sup>6</sup> in wastewater Hospital of Sidi Kacem.



**Figure 6. Variation of fecal coliforms in different hourly sampling.**

#### 4. Conclusions

It was found that the microbiological analysis of fecal and total coliform sewage from the Provincial Hospital Sidi Kacem during a year of study showed that there was a significant fecal contamination with high levels of total coliforms from the fecal coliform, and the same rate of two seeds is very high during summer and between 8 am and 18 pm during working days from the day of rest. We see a clear decrease during 12 am and 14 pm for day work.

Fecal microorganisms, which are indicators or pathogens, have an optimum growth in the specific conditions of the internal environment or human animal (abundance of nutrients, temperature, humidity...). Therefore, when issued by a host, they result in sudden and drastic changes in the environment. On the one hand, this pollution has very serious risk to humans whatsoever skin or mucous [13] amplified by irritation of the skin and mucous membranes based on the seriousness spreads crops [13], when the irrigation water polluted soil [14], animal and environment.

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