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Bacteriological characterization of three releases of the city of Biskra

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ABSTRACT

The problem of water pollution in Biskra (South-eastern Algeria) is a subject that remains unsolved despite several initiations undertaken to the current date. Our study focuses initially on the characterization and seasonal evolution of bacteriological pollution parameters of the three major releases of Biskra city named as follow: Chabat Roba (site1) Messdour (site2) and Oued Z'ommor (site3). According to our results, it appears that the pollution load in site 1 is about 9.30 x 10^6 ±6.66 x 10^6 germs / ml for total germs and 5.48 x 10^4 ±2.98 x 10^4 germs / ml for E. coli. Regarding site 2 the pollution load is represented by 10.79 x 10^6 ± 8.04 x 10^6 germs / ml of total germs and 6.07 x 10^4 ±3.31 x 10^4 germs / ml of E. coli. Concerning Site 3 the pollution load is 10.93 x 10^6 ±8.83 x 10^6 germs / ml for total germs and 4.98 x 10^4 ± 2.34 x 10^4 germs / ml for E. coli. In fact bacteriological monitoring carried out confirms the presence of fecal contamination (fecal coliforms, E. coli, faecal streptococci and sulphite-decreasing clostridia) and also pathogenic (presence of Shigella).

Key words: Pollution, Wastewaters, fecal contamination, E. coli, Shigella.

INTRODUCTION

In recent years, the potential harms of pollution to the ecological balance and public health are estimated with a rising of concern by the public authorities [1] particularly the developing countries are subject to one hand, a strong demographic and the other hand consequences of the rural exodus. These factors increase water consumption and management needs of sewage discharges. Demographic pressure allows less at least the elimination of excreta and sewage by individual techniques [2, 3]. The urban environment and natural receptors become increasingly fragile and require more important protection against pollution [4]. It is not effortless to account for the pollution through the world but we can monitor the water quality locally by an analysis that allows us to evaluate the importance of any physico-chemical microbiological pollution which is daily discharged into the natural environment, bacteriological analysis of sewage can be considered as an easy epidemiological monitoring of enteric infections [5]. As in the majority of cities in developing countries where the problem of water pollution is still rampant chronically and remains a cause of serious morbidity. Biskra (city South Eastern Algeria) experiencing a severe crisis of disease transmission water, and suffers the consequences of sewage of reuse in agriculture [6, 7]. This is added the absence of a treatment plant sewage in the region [8- 10]. Thus, discharges of municipal sewage effluents added to those from industries, and flowing directly and untreated into the natural environment generate physico-chemical pollution type and bacteriological one which increases considerably and risks to contaminate groundwater. To know effectively the degree of sewage pollution of the town of Biskra and its impact on the environment, we tried to characterize the seasonal evolution of bacterial indicators of sewage flowing into the three main sites; the rejection Chabat Roba **(Site** I**),** Messdour rejection of the Oued Biskra **(Site** II**)** and Oued Z'ommor **(Site** III**)**.

MATERIALS AND METHODS

Description of the site:

The city of Biskra is situated in the east of the country, its area is 21,671.20 km2, its population has been steadily increasing in recent years to reach 205,162 people. It is bordered to the North by the wilaya of Batna, North-West by the province of M'sila, South-East by the province of Djelfa, South by the wilaya of El Oued and North-East by the province of Khenchla [8]. Biskra region is located in a semi-arid to semi-desert area.

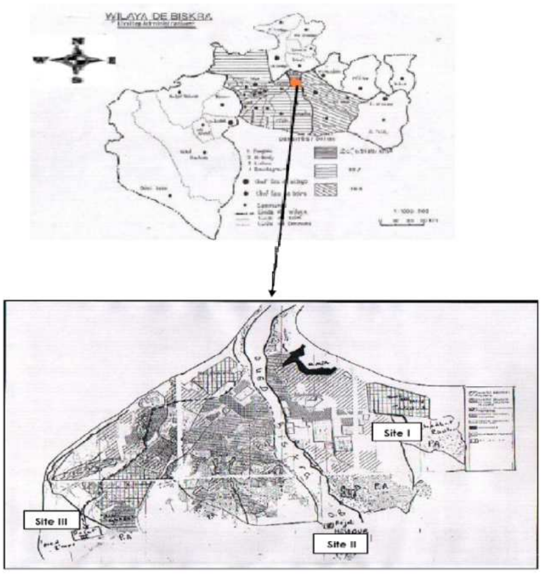

Fig. 1: Location of disposal sites

Sampling of wastewaters:

Bimonthly samples were taken within one year (February 2003-February 2004) at three sites in releases Chabat Roba (site I), Messdour (Site II), and Oued Z'ommor (Site III). The waste water is collected at each site and stored in glass bottles with a capacity of 250 ml, then they are stored at low temperature 4 ° C and sent to the laboratory for bacteriological analysis [11].

Test Methods:

Table.1: Analytical methods used for the detection of bacteria

Germs sought	Description of the method	References
Total Germs	*Meduim PCA (standard agar with glucose) / incubation at 37 ° C.*	[12]
Fecal Coliforms ***E.coli***	*Presumptive medium: Lactose Broth proupre of bromocrésole double concentration with bell Durhan / Incubation at 37 ° C for 24 hours.* *Medium confirmatory: (test Mackenzie) Shubert-peptone water free of indole - Incubation at 44 ° C*	[12]
Fecal streptococci	*Presumptive medium: Rothe (D / C) - Rothe (S / C)*	[13]
Sulphite-reducing clostridia	*Meduim* : Liver Meat Additive: Sodium Sulfite-ferric ammonium citrate	[12]
Salmonella typhi and Shigella	*Enrichment medium* : sodium selenite broth *Isolation medium: S-S agar, Mac conkey,* Agar hectoen - Description of bacteria with Gram Stain- oxidase test-identification through classical biochemical gallery	[13]
cholera vibrio	*Enrichment medium: Milieu EPA* (peptone water hypersaline)*-Incubation at 37°C for 3 hours.*	[12]
staphylococci	*Isolation medium: Chapman - Medium Baird parker-incubation at 37 ° C - Catalase Test- coagulase test - Incubation at 37 ° C- Biochemical Identification.*	[12]

RESULTS

The research results of the cholera vibrio, staphylococci and salmonella are negative throughout follow-up. The results of the counting are clearly shown in figures (2) to (7).

Research and enumeration of total Germs (x10^6)

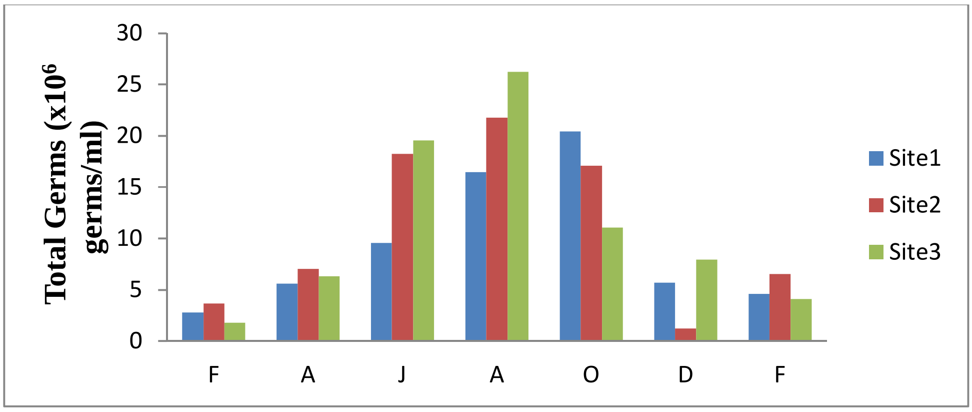

Fig. 2: The spatio-temporal distribution of total germs in the three disposal sites

Figure 2 demonstrates the spatio-temporal distribution of total germs in the three disposal sites. The distribution of total in the three disposal sites varies respectively from 2.8 to 20.4 germs / ml (9.30 ± 6.66 germs / ml) in site I from 1.23 to 18.2 germs / ml (10.79 ± 8.04 germs / ml) in site II, and from 1.8 to 26.2 germs / ml (10.93 ± 8.83 germs / ml) in the site III . The seasonal development of total germs fluctuates with maximum values in summer and minimum values in winter and autumn.

Research and enumeration of Total Coliforms (x10^5)

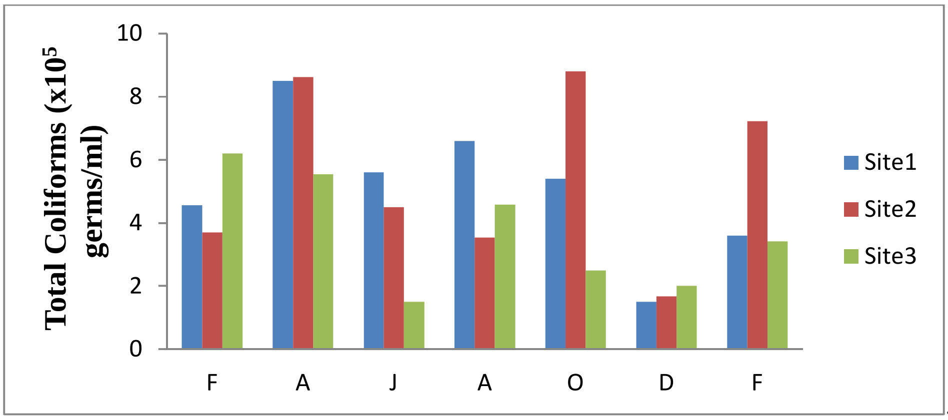

Fig. 3: The spatio-temporal distribution of total coliforms in the three disposal sites

Figure 3 shows the spatio-temporal distribution of total coliforms in the three disposal sites. Enumeration of total coliforms fluctuated between 1.5 and 8.5 germs / ml (5.10 ± 2.22 germs / ml) in site I, between 1.67 and 8.62 germs / ml (5.43 ± 2.77 germs / ml) in site II and between 1.5 and 6.2 germs / ml (3.67 ± 1.81 germs / ml) in the site III. The distribution of total coliforms revealed within the follow a diminution of germs in December and an increase in April in parallel in all three sites.

Research and enumeration of Escherichia coli (x10^4)

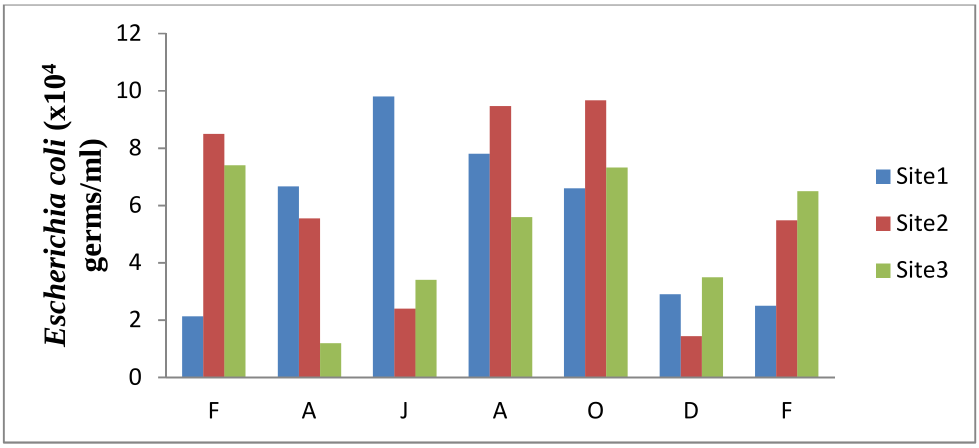

Fig. 4: The spatio-temporal distribution of Escherichia coli in the three disposal sites

Figure 4 represents enumeration of E. Coli. These ranged from 2.13 to 9.8 germs / ml (5.48 ± 2.98 germs / ml) at site I, of from 1.45 to 9.46 germs / ml (6.07 ± 3, 31 germs / ml) at site II and 1.2 to 7.4 germs / ml (4.98 ± 2.34 germs / ml) at site III. seasonal distribution of E. coli is subject to growth of the germ from spring to summer in site III, and the gradual decay of the seed from summer to winter in site I, while it overlaps between increase and decrease between seasons concerning site II.

Research and enumeration of fecal streptococci (x10^4)

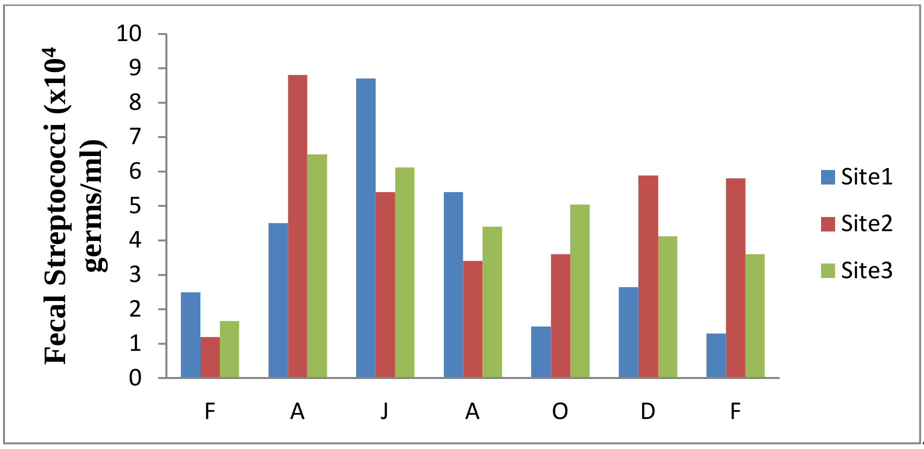

Fig. 5: The spatio-temporal distribution of fecal streptococci in the three disposal sites

Figure 5 shows the number of fecal streptococci. Thus, streptococci range from 1.3 to 8.7 germs / ml (3.79 ± 2.63 germs / ml) at site I from 1.2 to 8.8 germs / ml (4.86 ± 2.41 germs / ml) at site II and 1.66 to 6.5 germs / ml (4.49 ± 1.63 germs / ml) at site III. Seasonal evolution of faecal streptococci at sites II and III is almost similar in the 12 months of our experiment. At site I, the seasonal evolution of the germs is characterized by maximum growth in June.

Research and enumeration of sulfite-reducing Clostridium (x10^2)

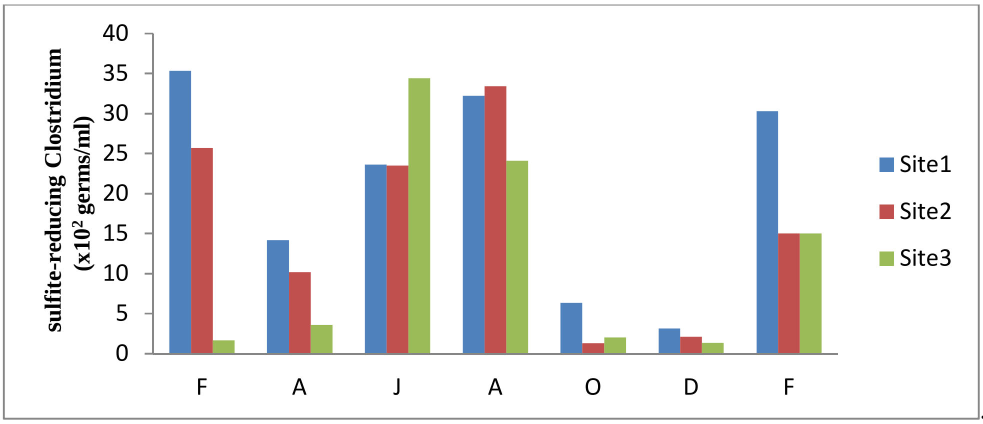

Fig. 6: The spatio-temporal distribution of sulfite-reducing Clostridium in the three disposal sites

Figure 6 demonstrates the enumeration of sulfite-reducing clostridia. They show that they oscillate between 6.33 and 35 33 germs / ml (20.72 ± 12.92 germs / ml) in site I, between 1.3 and 25.66 germs / ml (15, 88 ± 12.21 germs / ml) in site II and between 1.35 and 34.25 germs / ml (11.71 ± 13.17 germs / ml) in the site III. During our monitoring, distribution of sulphite-reducing clostridia is considerably high but with a decrease . The highest values which were recorded at sites II and III in the latter, the results are more or less scattered compared to the average.

Research and enumeration of Shigella (x10^4)

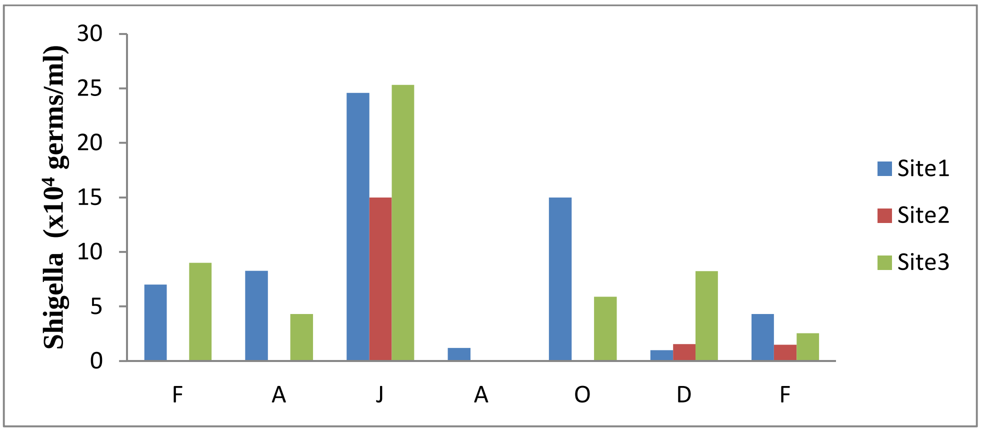

Fig. 7: The spatio-temporal distribution of shigella in the three disposal sites

Figure 7 shows the results of counting of Shigella. We note that the number of these organisms vary from 1.02 to 8.25 germs / ml (8.76 ± 8.45 germs / ml) in site I, 0 to 15 germs / ml (2.58 ± 5 52 germs / ml) in site II and from 0 to 25.26 germs / ml (7.89 ± 8.27 germs / ml) in the site III. Seasonal evolution of Shigella is marked by an increase of germs in June and a reduction in August.

DISCUSSION

Monitoring of bacterial contamination in the sewage of the three sites over time revealed a drop in the number of total germs in winter respectively recorded minimums vary between 1.23 and 2.8 x 10^6 germs / ml. This bacterial reduction can be explained by the dilution water by the rains this season [14]. Whereas, the maximum total bacteria was recorded in summer in the three sites. During this period, the average temperature determined in the water is 31 ° C, proliferation factor indicator bacteria pollution. Distribution of total coliforms is similar in site I and II respectively with averages of 5.10 x 10^5 germs / ml and 5.43 x 10^5 germs / ml. These values are higher than those obtained by [15] in Tunisia and lower than those found by [16, 17] in Rouen. The number of total coliforms in water site III is twice less than in the waters of sites I and II. Seasonal evolution of E. coli is approximately typical sewage discharges of the three sites However the average cost varies between 4.98 x 10^4 germs / ml to 6.07 x 10^4 germs / ml. These results are inferior to those found for [15]. The results of the enumeration of faecal streptococci are similar to those found by [17]. The seasonal evolution of the germ at three sites translated almost the same distribution. The presence of sulphite-reducing clostridia in sewage indicates a terrestrial contamination [18, 13], their proteolytic action is highlighted by the putrid smell emanating releases. The average distribution of this germ in site I is greater than twice the site III. Research pathogens only reveals the presence of Shigella in the three sites, however, we note a total absence during the month of August at sites II and III. This disparity of numbers is the result of chlorination of the environment by the hygiene of the town of Biskra services. However, throughout our study (1 year), we noted the presence of Shigella in Site I and, whatever the season.

CONCLUSION

The quality of discharged depends essentially on the amount of water consumed (daily staffing per capita), the percentage of that amount that is found in the sewer and depends on climatic conditions, the standard of living of the population connected to sanitation, social habits and habitat type network. Discharges of urban sewage (domestic and industrial) into the environment without treatment, can have a significant environmental impact especially when they are vectors of water-borne germs. Indeed bacteriological monitoring carried confirms fecal contamination (fecal coliforms, E. coli, faecal streptococci and sulphite-reducing clostridia) and also pathogenic (presence of Shigella). These wastewaters result in contamination of the receiving water bodies and consequently, cause significant harm to the urban population, users (irrigation) and wildlife resources.

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