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State and evolution of the microbiological pollution of the lake of reghaïa

K. Delleci[1*], S. Sayoud[2], K. Louhab[1]

[1] Laboratory of Alimentary Technology, faculty of Engineering Sciences, University of Boumerdes, Boumerdes 35000, Algeria
[2] Laboratory of Microbiology EPH Bourdjmenaiel Boumerdes.

*Corresponding author: kamel-d@hotmail.com ; Tel.: +213 550 518 879; Fax: +21300 00 00

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ABSTRACT/RESUME

Abstract:*The lake of reghaïa is a fresh water tank, which represents a very vulnerable link for maintenance of the balance in the ecosystem, but currently it receives a very important volume of liquid-effluents generated by the industrial activities which disturbs the balance of the aquatic life opposite fauna and the flora, the micro-organisms represent a biological form of pollution conveyed by the industrial effluents (sewage), the objective of our study is the identification, the quantitative estimate and the follow-up of the seasonal dynamics of the various communities of the micro-organisms which develop in this tank, for this purpose 3 series of taking away were carried out between the month of December 2015 and July 2016, in order to follow the development and the proliferation of certain micro-organisms of the coliforms type fecal and streptococcus fecal which are, Escherichia coli (colon bacillus) (enterobactery) and the streptococcus ones of group D (enterococcus), where the enumeration was carried out by the method NP and the presence of the salmonella and vibrio-choleric.*
The results gave very high concentrations which exceeds $15*10^4$ for the coli bacilli and between 0-6 for the enterococcus ones, with absence of salmonella and choleric vibrio, which allows us to classify our water category 4 (water of bad quality), and the dynamics of the bacteria follows a seasonal cycle which varies according to the flow and the nature of the effluents rejected towards the lake (physico-chemical characteristics) of water.

I. Introduction

The excessive development of the bacterial communities in the fresh water (lake), represents a main danger for fauna and the flora and even for agriculture. bacterial reviviscence in the water of lake can lead to densities higher than the standards concerning fresh water, this displacement plays a big role in the deterioration of the quality of water of lake (1), the main aim of this study relates to the identification, the quantitative estimate and the follow-up of the seasonal dynamics of the micro-organisms of the fecal coliforms type and streptococcus fecal.

In the long term this study must allow to better know the conditions of development of the micro-organisms in the water of lake, and thus to help to define the means necessary to reduce their development.

The bacterial viruses are present where there is a bacterial life, in general in the hydrous mediums, in particular those polluted by the feces is large. They come from various ecological niches of which the digestive tract (2,3,4,5). Their concentration is lower than 10^5 particles by (G) in the saddles (6).

Significant amounts of waste water are rejected into the watery ecosystems which are generated by various activities (hearths, hospital, factories), in fact water convey pollutants in suspension or in solution of a microbiological nature (bacteria, parasites) which disturb the balance of the receiving mediums which causes problems of hygienic nature (7).

The lake of reghaïa is a receptacle temporary and permanent of the contamination of fecal origin, it is like a natural habitat of a certain number of bacteria.

largely higher concentrations, whereas the irrigation requires a quality lower or equal to quality 2.

II. Materials and methods

II.1. situation of the zone of study

The territory of the Natural reserve of the Lake Réghaïa is located at 30 km in the east of Algiers, with the north-eastern limit of the plain of Mitidja (longitude 3°19 - 3°21E; latitude 36°45 - 36°48N) and to 14 km of Boumerdes. It is bordered in north by the Mediterranean, in the south by the trunk road 24 connecting Algiers to Constantine, in the east by the town of Boudouaou and in the west by the town of Ain Taya. It is accessible to the west by the asphalt road from the range from El Kadous, to the south by the trunk road 24 connecting Ain-Taya to Boumerdes and to the east, by the road of Réghaïa range. This territory belongs to Wilaya of Algiers, administrative Unit of Rouiba, Communes of Reghaïa and Heraoua.

II.2. situation of the intake points

1. Shantytown of the locality "Ali Khoudja", commune Réghaia: flow of waste water on the asphalt road coming from the precarious habitats, flow directly in the marshy zone of the lake.

2. Purification plant "STEP" /Réghaia: according to the person in charge of the unit, the STEP daily ensures the treatment of approximately 80000 m3 of waste water of domestic and industrial origin; the observation made at the last stage of the treatment reveals a slightly transparent water with the irrigation and with the work maintenance of the station, remains to define the water quality poured in the lake.

3. Point of contacts between Oued El-Biar and the lake.

4. The center or medium of the lake.

5. The exit of lake, not of variously (dam of the lake): where there is a presence of a significant amount of foam of white color similar to the foam of detergent which is formed on the outlet side of the outfall of the dam and in addition, the deterioration of shrubs (prone scalded to the base) located on the banks of the driving channel at the range.

6. OuedRéghaia: observations made starting from the bridge: Appearance of an opaque and brownish color of waste water with release of bad smells, which flow directly in the lake.

7.OuedEl-Biar:WiththemouthoftheOued, stagnation of waste water, the existence of scattered discharges wild on the banks, the release of the nauseous odors. It is necessary to announce that the

waste water comes from the Industrial Park while forwarding by the agricultural land of the communes of Rouiba, Réghaia and Heuraoua and flows directly in the lake.

Figure 1.*Localization of the wetland of Réghaia*

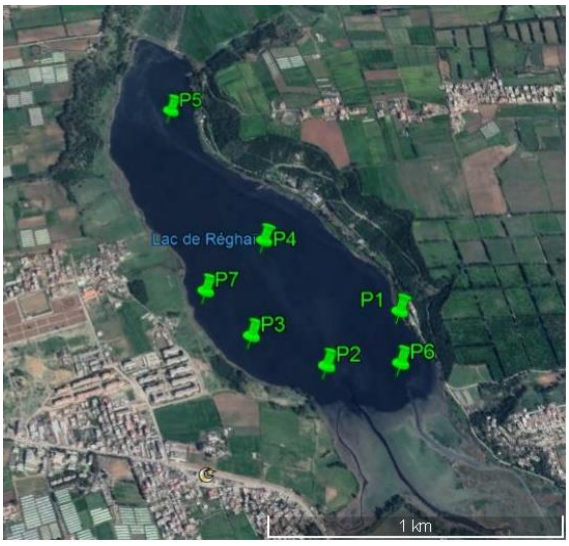

Figure 2. *intake points of the samples of the lake of reghaïa*

II.3. Physicochemical analysis of water

Parameters such as the temperature, the pH, Salinity and the rate of salts dissolved (RSD) of water was measured in situ using a bag multi - parameters, the measurement of (the chemical

demand for oxygen) CDO and (thebiological demand for oxygen) BDO are carried out According to (Rodier) (8).

II.4. microbiological analyzes

The bacteria Escherichia choli and streptococcus of group D were counted starting from taking away, carried out right under water surface, in sterile bottles. The water samples were analyzed according to the method described by Pochon and Tardieux. Each water sample underwent five successive decimal dilutions. Three tubes of each culture medium were sown for each dilution., the most probable number of micro-organisms was given by using the statistical tables of Mc- Crady.

III. Results and discussion

Table 1.*Results of enumeration of 28/12/2015*

sample/ analyzes	E.Coli	streptococcus D	Salmonelle	Vibrionchol
1	**>1400**	**0**	**Neg**	**Neg**
2	**>1400**	**0**	**Neg**	**Neg**
3	**>1400**	**0**	**Neg**	**Neg**
4	**>1400**	**0**	**Neg**	**Neg**
5		**0**	**Neg**	**Neg**
6	**>1400**	**0**	**Neg**	**Neg**
7	**>1400**		**Neg**	**Neg**

Table 2.*Results of enumeration of 10/03/2016*

sample/ analyzes	E.Coli	streptococcus D	Salmonelle	Vibrionchol
1	**>15000**	**2**	**Neg**	**Neg**
2	**>28000**	**2**	**Neg**	**Neg**
3	**>20000**	**0**	**Neg**	**Neg**
4	**>2000**	**0**	**Neg**	**Neg**
5	**>20000**	**2**	**Neg**	**Neg**
6	**>1500**	**0**	**Neg**	**Neg**
7	**>1500**	**2**	**Neg**	**Neg**

Table3. *Results of enumeration of 13/07/2016*

sample/ analyzes	E.Coli	streptococcus D	Salmonelle	Vibrionchol
1	**>1400**	**0**	**Neg**	**Neg**
2	**>150000**	**2**	**Neg**	**Neg**
3	**>93000**	**6**	**Neg**	**Neg**
4	**>93000**	**6**	**Neg**	**Neg**
5	**>1500**	**6**	**Neg**	**Neg**
6	**>2800**	**2**	**Neg**	**Neg**
7	**>3800**	**2**	**Neg**	**Neg**

All the bacteriological and physico-chemical data seem concordant to indicate that the water of lake probably offer a serious risk for the usersthus, we can think that the microbiological load which reaches the lake does not exceed these capacities of self-purification when water appears temporarily polluted in period of rising, the presence of a pathogenic species (9.10.11) seems essential to us to supervise the microbiological level in order to follow the evolution of these microbiological and physico-chemical data.

Toourknowledge, thisstudyisoneofthefirsthavingforgoalthequantificationofthebacterialcommunitieswhicharedeveloping in thecontaminatedandpollutedlakeofreghaïa (freshwater tank). Onenotes a very high bacterialabundance all alongthelake.

Bulkyquantitiesofindustrialanddomesticwastewater arerejectintothiswateryecosystem (lake).

These resultsrelatetothewholeofthelake. II existssometimesnonsignificanttinydifferencesbetweenthevariouspointsoftakeneachseason.

At theendofthisstudy, itappearsthatthedensities (number) bacterialrecorded in thevariousintakepointsareveryrandomandarehighert hanwhatisawaitedfor a freshwaterlake. These greatabundancesareprobablyrelatedtothecontaminat edrejectionsindustrialanddomesticandthevariousinte ractionsbetweenthem. Moreover, thebacterialdensities in wintry time (rising) seemtobesimilarmore in thesevenpointswith a valueorequalto 1400 germes/100ml bywhatthewateroflakeundergoes an importantdilutionwhichreturnstoconsiderablepluvio metry.

On theotherhandonenotes an increase in thebacterialcommunities in spring periodwhichreaches a valueof 28*103ger/100ml on thelevelof item 2, andtwovaluesidenticalof 20*103ger/100ml tothelevelofitems 2 and 5, thisevolutionofmanybacteriareturnstotheincrease in theconcentrationoftheorganic matter andthesuspended matter, thesepeakshas a relationshiptothemicrobiologicalqualityoftherejectio nsandeventhecompositionofreceiving medium, theevolutioncontinuous rate ornumberofthebacteriadoes not ceaseincreasing in summerperiodanditreachesvery high values, onerecords 150*103ger/100ml as in point 2 and 93*103ger/100ml as in points 3 and 4 thisincreaseisexplainedbyrichnessofreceiving medium out oforganic matter andthegreatdiversityofthesuspended matter bywhatthelakeofreghaïareceivestherejectionsofmore than 247 industrialactivitiesandthemajoritydoes not treattheirwaste, andalthoughnostudyhas, untilnow, beenabletoestablish a simple lawmodellingformallytheseparameters (12).

The presence of the micro-organisms coliforms fecal and streptococcus fecal indicate that microbiological quality is reduced which can induce a more or less large health hazard. from where the recording of a very important values of the fecal coliforms (colon bacilli) standard E-Coli and which exceeds the quality standards for the fresh water which reaches value $15*10^4$/100ml.

whereas we have recorded weak values of streptococcus fecal (streptococcus type of group D) which varies between (0--6)/100ml with an absolute absence of the choleric salmonellas and vibrio on the

totality of the lake and during all the duration of study.

We have to mention that on the whole of the lac there is a significant difference between the various intake points especially on the last two taking

away.However, the bacteriological loads are stronger at the time of the rising.

The physico-chemical parameters of water of the lake take almost the same values on the level of the sites of taking awayIt is important to announce that measurements of the characters physicochemical of lake (Flow, pH, temperature, dissolved oxygen, oxygen saturation, conductivity) in the case of our study are complementary (10), nevertheless, we considered to be useful to bring extra informations which will probably be useful like references to other work.

Temperatures

The values of temperatures of water raised relates to only its surface layer and to the effect direct of the seasonal room temperatures (temperatures of the air), the duration of sunning, and the depth of the station;
The variation in temperature of water enter stations varies from 0,1 to 3,2 °C (January), from 0,4 to 1,3 °C (February) and, from 0,1 to 3,2 °C (Mars).

The minimal and maximum temperatures of the air raised remain seasonal. (between 14,8 and 25,5 °C)The variations in temperatures between the highest air and water is raised in January for Station 05 with 9,6°C.

Hydrogen potential Ph

The pH value measured on the six stations are included/understood between 7, 1 for weakest (January) and 8,1for Mars.
We note an increase in the time of the pH of water of the lake while keeping the character slightly Alcalinthe analysis of the monthly average pH of the Lake Réghaia indicates a temporal tendency evolutionary Alcaline.

Electric Conductivity
The measured monthly values fluctuate between 793 for weakest and 1740µS/cm for highest. But which remains in lower part of the limiting standardsIt is also noticed that for the S5 station: Upstream left bank "Wadi el biar" and S6: Upstream Right Bank "Réghaia river" are highest that we regard as normal sight that they are the two independent sources of the rejections.

Depth and Transparency

The temporal data recorded during theperiod from January to Mars relating to the depth show temporal variations wich are not very important with a maximum of dropped water level which did not exceed 60 cm during 03 months what qualifies this type of flow by the Slow.

We noticed a weak spatiotemporelle variation of the transparency which is about 01 to 12 cm (Month), and a maximum of 27 cm (Stations), it corresponds to the euphotic layer where the phytoplanktons receive sufficient light to carry out photosynthesis.

The calculation of the depths and recorded average transparencies led us on the one hand has schematically to recall the morphology of the lake according to a gradient of flow (South-North) of water of the Lake, which takes the shape of a basin bordered downstream by the dam, and on the other hand to estimate measurements of the two components layers the water column of the lake at knowing the euphotic layer and the dysphotic layer
.
The primary layer of productivity accounts for only 07% of the water column of the Lake Réghaia against 93% for the layer known as dysphotic.

Considered too weak, it reduces the photosynthetic activity considerably, and thus less production of oxygen; It acts also negatively on the development and the qualitative composition of the phytoplanctonic diversity of this medium

IV. Conclusion

Our study, although limited, can bring a certain number of objective elements allowing to appreciate the reality of a pathogenic risk related to the current position and the frequentation of the lake, the follow-up of the physicochemical parameters of water in the three series of taking away, indicates almost identical values,and according to the results obtained our fresh water one classifies them in Category 4, (water of poor quality): when the number of Escherichia coli tolerated is exceeded in at least a levy on three, the bathe is prohibited as soon as these poor results are observed. The actual position of lake must be the subject of immediate ormedium-term measurements, wich will make it possible definitively to improve the quality.

Each year, 4 to 6 million m^3 of water are pumped from the lake between Mars and November for the irrigation (about1200 ha of arable lands). Forthat,it is important to supervise and improve water quality of the lake in order to make it clean for the irrigation.

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