

NUTRITIONAL AND MICROBIAL ASSESSMENT OF THE ESTUARY OF AL-SIN RIVER–LATTAKIA-SYRIA

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

ALSin river is located in the southwestern of Lattakia, next to the border administrative of Tartous. The waters of the estuary AlSin River is(Brackish waters which water not salt and not fresh), its salinity and temperature is ranged between(0-39) (15.9-27.9)C° respectively. The nutrients is changed with the different seasons and according to the river's load of sewage water and which filtered by agricultural soils.

Nutrient is ranged between (7.17-18.25), (5.61-36.83)µmol/L for ammnioum and phosphate ions, and between (2.35-3.68) µmol/L for nitrite.

And Total Bacteria ranged between (5000-40000) cells/100ml, and Streptococcus bacteria count is ranged between (4560 -520) cells/100ml.

Keywords: ALSin river; nutrients; streptococcus; total bacteria; total coliform; fecal coliform bacteria; Syria.

1. INTRODUCTION

The sources of pollution are multiple [1], including natural ones resulting from human activities, algae, insects and climate changes [2], the human activities is agriculture, industry and others [3, 4]. Industrial discharges affected on our result [5], biological research is low in ALSin river, there is [6] which studied nutrients and behavior of dissolved nutrients in water along the salinity gradient. in region of Tigris river [7, 8] presented water quality in the downstream in Baghdad.

There are many studies on Syrian shore which studied nutrients. Like phenomena of red tides [9], including the effect of changes nutrient on the abundance of

zooplankton [9], and papers with [10,11] (ikhtiyar et al.,2012) The effect of changes nutrients on the abundance of bacteria and chlorophyll studied, and the research paper [12] showed temporal and spatial changes of turbidity and fecal micro flora, and paper [13,14] which present result of changes in nutrients concentrations and caused to appear many exotic species.

Nutrients play specific role in growth of phytoplankton, which is the first level in food chain. Rese archers [15, 16] defined nutrients as agroub of chemical elements, that necessary for the synthesis of organic matter and limiting the growth of phytoplankton. it is agroub of inorganic soluble electrolytes of nitrogen , phosphorous, and silicon.

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human activities supply shores, with important quantities of nutrients, which are gradually converted into electrolytes that can be used by phytoplankton [17-19].

The most common bacteria found in water are *Vibrio cholera*, *Salmonella*, *Shigella* and *Escherichia coli*, therefore, the study of bacteria is important because it is considered an indicator of water pollution.

2. METHOD AND MATERIALS

2.1 Sampling Site

The estuary of ALSin River in Mediterranean Sea, It is studying station in this paper. It located in Arab al-Malek area at 35. 15' 50.1" N 35.55'32.6" E Its Barakish water, There is many biological diversity in it.

We carried our sampling once a season, except in summer we were sampled twice, we noticed the effect of change in climate during seasons, and the range of ALSIN river level, in addition to the phenomenon of

oil pollution that occurred in the summer 2019, which clearly affected on marine environment Fig. 1.

2.2 Physical and Chemical Analysis Methods

To Carry out this study, we took 5 marine tours, once monthly, from the estuary of ALSin River in (3/4/, 18/6/, 30/7/ , 25/9/ and 23/12/2019) at ten o'clock in the morning, it covered four seasons to 2019 year. we studied environmental factor by HYDRO-BIOSKIEL -DBG Germany HB cat NO 436 305 to collect our water samples from 0.5 m.

We read temperature, Salinity and Conductivity by using WTW MULTYLIN P4 UNEVERSALMETER, and using (Orion -420 A. pH meter) for reported pH meter.

2.3 Identification of Nutrient Compounds

Were determined Phosphates in water according to [20], which, in principle, depends on the reaction of ammonium molybdate with phosphate ions, in the presence of triammonium as an intermediate,



Fig. 1. Topographical station to the estuary of Alsine river in Arab al-Malek area- SYRIA

by returning the complex with ascorbic acid and giving phosphor molybdenum blue, which absorbs light at 885nm.

And the concentration nitrite ions in water by a method [21], we added a solution of sulfanyl amid in n- methyl ethylene in acidic medium and left 5 minute, then add diamine compound to give a pink complex, that absorbs at 543nm.

We determined of ammonium ions by Koroleff, [22], we add C_6H_5OH with $Na_2(Fe(CN)_5NO).2H_2O$, then $C_6H_5Na_3O_7.2H_2O$ in hypo chlorite and alkalinity medium, it is stored in dark for a days and then measured at 630nm.

The nitrogenous and phosphorous nutrient salts were determined using a PHILIPS PU 8680 VIS /NIR KINETICS SPECTROPHOTOMETR with a light path length of cell 5 cm.

We determine Chemical Oxygen Demand by (Merck, 1982), which oxidize most water- soluble organic materials, except for nitrogen- containing compounds and dissolved hydrocarbons.

2.4 Bacterial Laboratory Work

Samples were collected in clean and sterile plastic containers, and then transferred to the laboratory, where bacterial analyzes, and conducted to sterile conditions, near the flame to avoid any laboratory bacterial contamination.

The total number of bacteria was determined by the method of cast plates using Plate Count Agar culture medium (Merck, Germany) [23].

The abundance of bacterial groups, which considered as bacterial indicators of faecal contamination, determined by membrane filtration method [24]. Then the culture is grown on media nutritious for each type of bacteria and then incubated at appropriate temperatures for a specific period of time. Then we enumerate the bacterial colonies developing on the nutrient media in Petri dishes after the incubation. M-TERGITOR AGAR culture medium (HIMEDIA, INDIAN) was used to grow total coliform bacteria, and M -FC- AGAR medium (TITAN- BIOTECH, INDIA) was used to grow faecal coliform bacteria.

KF-STREPTOCOCCAL AGAR (TITAN-BIOTECH) This medium is used for the detection of *Streptococcus faecalis*.

After completion of the incubation process, the developing colonies were enumerated on the culture media for each bacterial group, and the bacterial

results were recorded in the form of the number of colonies growing in 100 ml of water (CFU/100 ml).

3. RESULTS AND DISCUSSION

3.1 Hydrological Factors

The temperature ranged between $(15.9-27.9)^\circ C$, during the period from December to July 2019, and recorded 20.4 during April 2019. Salinity ranged from (0 - 1.2) recorded during April and June, where the estuary region between marine and fresh waters, pH meter ranged between 7.2 and 8.2 in December and April in winter season and spring, in conductivity meter recorded a clear difference throughout the year, and many different during seasons. it ranged between 8 - 726 NTU in december and july 726, in april its recorded 469 NTU.

The results indicate the presence of significant spatial-temporal changes between nutrient ions in addition to environmental factors. These results are similar to a study conducted against the city of Lattakia [25].

3.2 Nutrient Variation

The highest value to the concentration of ammonium ions was observed during winter, which recorded 18.25 $\mu\text{mole/L}$ in December 2019, and lowest value was recorded 7.17 $\mu\text{mole/L}$, during the spring.

Significantly phosphate concentration increased during the summer, when it compared with other seasons. It reported 36.83 $\mu\text{mole/L}$ in July 2019, and The lowest value recorded in the autumn season 5.61 $\mu\text{mole/L}$ in September.

Nitrite: we noticed convergent gradient in the concentration of nitrite ions in this region throughout the year, and it ranged between $(2.35 -3.68) \mu\text{mole/L}$ in September and April 2019, the difference in our results is due to rainfall and sewage [26,27, 28], In addition to the effect of pesticides which comes by river water [29,6].

3.3 Chemical Oxygen Demand COD

This station recorded the highest concentration throughout the year 2019 in December and it reported 520mg/L, while the lowest value was recorded in April 360 mg/L.

3.4 Conductivity Ions

There is differences in conductivity water throughout the year in different seasons, where the lowest value was recorded in December 8 $\mu\text{s/cm}$ and the highest

value in July 726 $\mu\text{s}/\text{cm}$, while it was detected in April 469 $\mu\text{s}/\text{cm}$.

3.5 Total Bacteria

The general number of germs increased during July in the estuary it reported 40,000 cells/100ml, where it significantly decreased in September and we recorded the lowest value in January, which reached to 5000 cells/100ml. This difference is due to differences in

temperatures throughout the year and natural factors and human activities. These results are an indication of the degree of water pollution resulting from the discharge of sewage water to the villages near the river. They are consistent with [30] study using bacterial flora as an indicator of water pollution in the Al Kabeer Al Janoubi River. Some microorganisms assist in the removal of nutrients from water bodies [31].

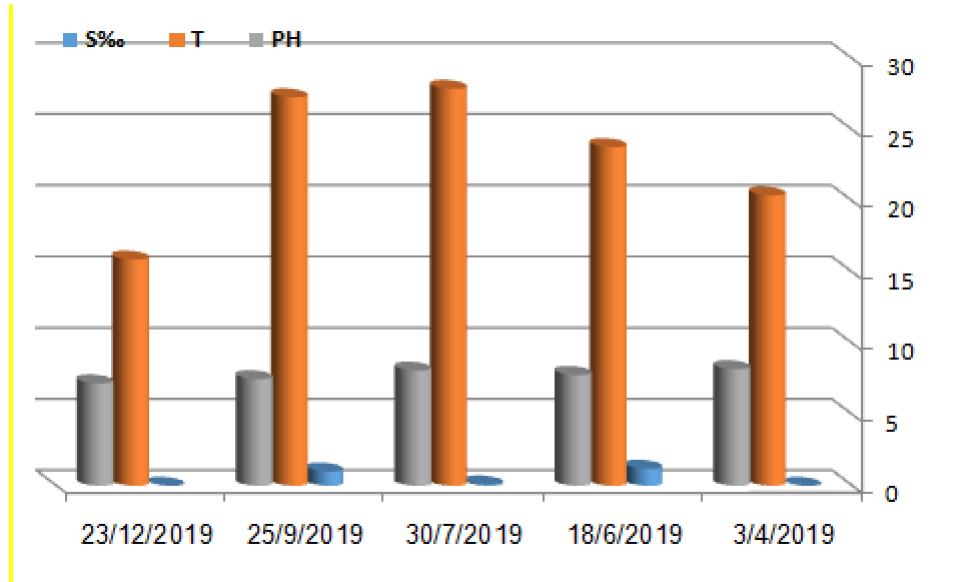


Fig. 2. Studying Hydrological factors (temperature, Salinity and pH) to the estuary of Alsin river in Arab al-Malek area- SYRIA

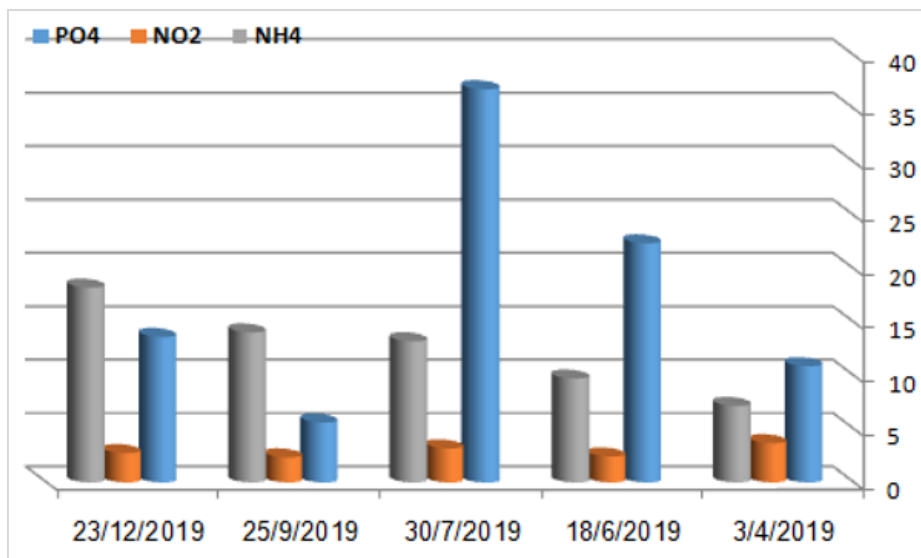


Fig. 3. Nitrite, phosphate and ammonium concentration to the estuary of Alsin river in Arab al-Malek area- SYRIA

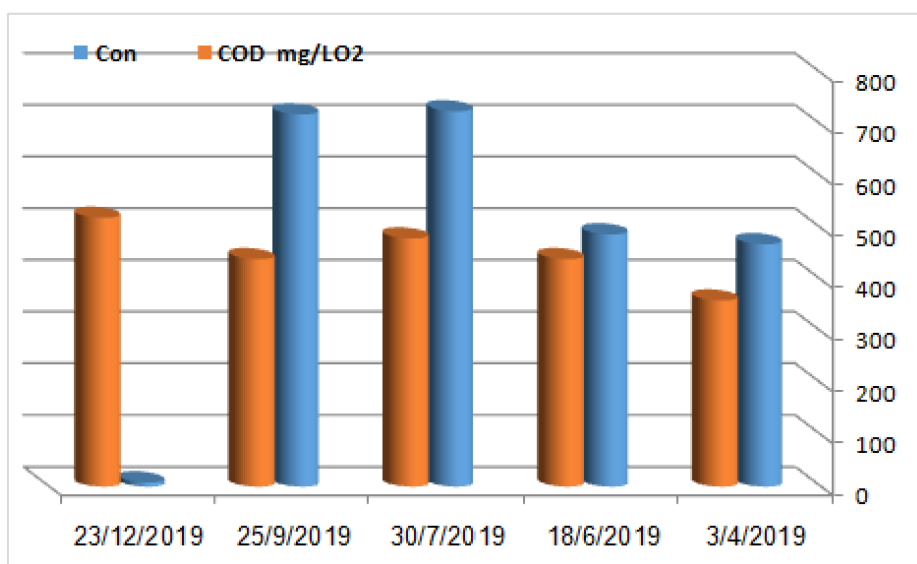


Fig. 4. Chemical Oxygen Demand COD, Conductivity ions in the estuary of Alsın river in Arab al- Malek area- SYRIA

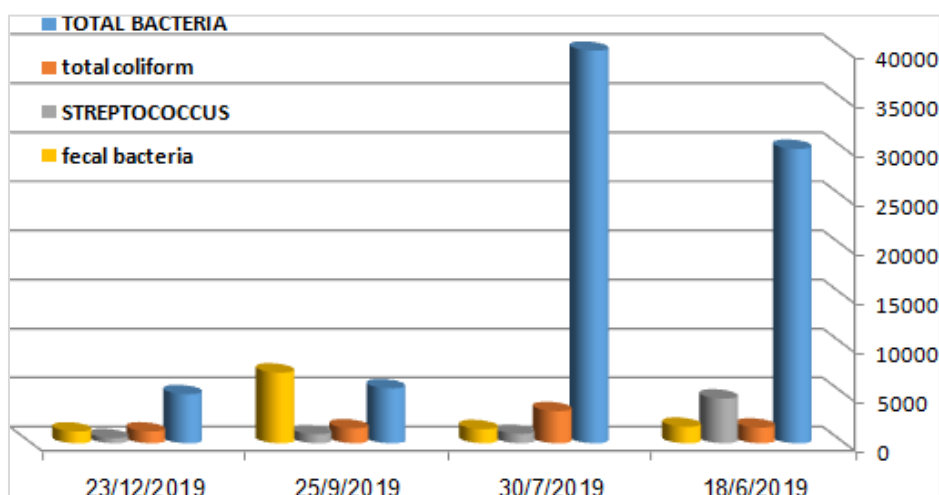


Fig. 5. Study of Total bacteria, Streptococcus bacteria, Total coliform, Fecal coliform bacteria count in the estuary of Alsın river in Arab al-Malek area- SYRIA

3.6 Streptococcus Bacteria Count

In June we noticed that streptococcal bacteria increased, and in December recorded the lowest one, it reported (4560 -520) cells/100ml respectively.

The reason for the increase in the number of streptococcus bacteria is due to pollution from animal origin such as the remains and feces of animals living in the studied area.

3.7 Total and Fecal Coliform Bacteria

The lowest values for total and fecal coliform bacteria were recorded in December due to lower temperatures

and increase in river flow in winter. The highest value for total coliform was recorded in April, while the highest value for fecal coliform was recorded in September.

The reason for this increase is due to the presence of algal bloom periods in spring and autumn in addition to the increase in human activities [32,33].

4. CONCLUSION

- The results indicated to the influence of environmental factors, which differents according seasons on nutrient concentrations, watering and irrigation from human activities

are the direct relationship to rise orthophosphate ions, where nitrite ions increased in April due to increased raining and river flooding, and increase the level of sewage.

- The highest general population of germs was associated with the highest temperatures.
- A slight elevation of environmental factors was associated with an elevation of Streptococcus .
- A small increase in the values led to an increase in the general number of germs.

5. RECOMMENDATIONS

The estuary of ALSin river is considered a safty place to presence of living creatures, because it is forming a Bay, which is rich in nutrients. for this we can saw quantities of mollusk remains and the presence of algae green and brown algae, in addition to the presence of fish, and we where noted large number of fish fingerlings and prawns and a large number of oysters, so it is necessary to pay attention on this area because of its biological importance.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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