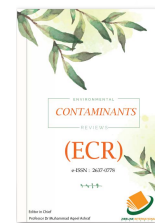




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RESEARCH ARTICLE

IDENTIFICATION OF ALGAL FLORA AND EVALUATION OF PHYSICOCHEMICAL STATUS OF SEWAGE DRAIN IN SAMANABAD LAHORE PAKISTAN

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ARTICLE DETAILS

ABSTRACT

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The present study conducted in 2015-2016 focused on the identification and classification of algal flora in relation to physicochemical parameters of sewage drains in Samanabad, Lahore, Pakistan. Three sites were selected along this drain for the collection of algae and water samples, each 1 km apart. Total 25 species of algae were identified belonging to 14 genera. The kingdom Monera included genera Gloeocapsa (4%), Oscillatoria (16%), Arthrospira (8%) and Navicula (8%), Nitzschia (12%), Pinnularia (4%), Cyclotella (4%) and Tetraedron (4%). The kingdom protocista included these genera i.e. Ulothrix (12%), Schizomeris (4%) and Microspira (8%). These genera represent the 4 phyla, Cyanophycota, Bacillariophyta, Volvocophycota and Chlorophycota. Eight species of algae were identified from site 1, Gulshan-e-Ravi drain, 12 from site 2, Nonarian and 5 from site 3, Babu saboo Interchange. The physical parameters included EC, pH, temperature of water and air while determined chemical parameters were Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD). Maximum number of algal species (12) were identified from site 2, which had highest BOD. The site 2 had lowest pH (7.0), lowest EC ($8.7\mu\text{sm}^{-1}$) but highest temperature (28°C). All these parameters seemed to be suitable for the gravity of maximum number of algal species.

KEYWORDS

Algal flora, Lahore, Physico-chemical parameters, BOD, Temperature.

1. INTRODUCTION

Lahore is located in Punjab (Pakistan), second biggest city in country and in South Asia it is very famous historical city. Samanabad is the oldest area of this city and situated in the center of Lahore. It is located nearby Gulshan-e-Ravi, Iqbal Town, Mozang, Ichra and Multan road. The coordinates of Samanabad is $31^{\circ} 32' 25''$ North, $74^{\circ} 18' 25''$ East. Sewage drain passes from the different areas of Lahore. At Phunch road sewage drain starts and ends at Babu Sabu interchange at chowk Yateem khana. Lahore has drainage system since 1936. At the time of partition of the sub-continent, the major drains in Lahore were Cant Drain (Mian Mir Drain), Sukh Nehar Drain and Chota Ravi Drain [1].

Algae are the organisms which contain chlorophyll and live in form of colonies or single, sometime as organisms collaborating together as simple tissue. Habitat of algae is usually places where light is present for photosynthesis such as rivers, lakes, soil, sewage, stagnant water and canals etc [2]. Wastewater is mixture of liquid and wastes from many different sources like industries, institutions, commercial places and groundwater. It contains major portion of water and some solids [3].

The wastewater with hazardous effluents also carries some nutrients which are very useful for the growth of plants, algae and other microorganisms. The chemical, biological and physical properties of water ecosystems are adversely affected by the drainage and the pollutants it carries which greatly impact habitat of aquatic species and water quality. The parameters considered for the study are pH, BOD, COD, EC and TSS etc. This study attempts to make estimate the harshness of pollutants level in sewage which in the end discharge into river or any surface water

ecosystem without any pretreatment and ultimately affect aquatic organisms and human beings [4].

The objectives of the present study were to collect and identify algal species from three sites of sewage drain in Samanabad Town, Lahore and to study the physicochemical parameters of sampled water from the sewage drain. These were used to find out any linkage between occurrence of algae and water parameters.

2. MATERIALS AND METHODS

During 2015-2016 the present study examined the identification, classification and distribution of the unicellular and filamentous algae from three different sites of sewage drain in Samanabad. It also determined the physical and chemical parameters of sewage water. Three sites along sewage drain, Samanabad, were selected for the collection of algal specimens. These sites are Gulshan-e-Ravi, Nonarian and Babu Saboo Interchange each one kilometer apart as shown in figure 1.

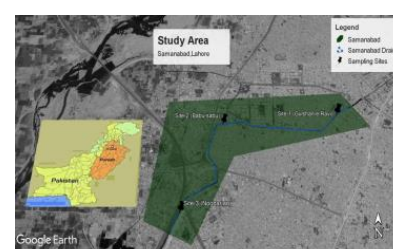


Figure 1: Map of Study Area

The samples of algae and water were collected in small plastic bottles and brought into laboratory. These samples were stored in 4% formaline solution. Temperature of water and air, pH and Electrical conductivity (μsm^{-1}) were recorded on the spot. Slides of these samples were made and observed under the microscope and pictures were taken by lucida camera. The algal specimens were observed under the compound microscope using the magnification power 10x and 40x. The length, width and size of the cell were measured. The algal specimens were identified by using standard literature [5-7]. The BOD and COD of water samples were determined by some researcher [8,9]. Physical and chemical parameters were analysed from the water samples of the research sites at Department of Environmental sciences laboratory in Punjab University Lahore. The algal specimens were preserved in the laboratory, Department of Botany, Government Post Graduate College Samanabd, Lahore.

3. RESULTS

As the objectives of the study were to identify algal flora of samanabad and find their linkage with physico-chemical parameters so the algal species diversity identified along with Physico-chemical parameters are given below:

Site 1: Gulshan-e-Ravi Sewage drain Samanabad, Lahore:

Following six genera were recorded from this site: *Arthrospira* Stizenbberger, *Nodularia* Mertens ex Bornet, *Gloeocapsa* Kützing, *Fragilaria*, *Cyclotella* (Kützing) Brebisson, *Microspora* Thuret. The temperature of water 20°C, pH 7.3, EC $9\mu\text{sm}^{-1}$, The average value of BOD was 144.66mg/L. Average value of COD was 384mg/L.

Site 2: Nonarian Sewage drain Samanabad, Lahore:

Five genera were recorded from this site: *Oscillatoria* Vaucher, *Navicula* Bory de saint-Vincent emends.Cleve, *Nitzschia* Hassall, *Pinularia* Ehrenberg, *Synedra* Ehrenberg. The temperature of water 28°C, pH 7, EC $8.7\mu\text{sm}^{-1}$. The average value of BOD was 199.33mg/L. Average value of COD was 364.8mg/L.

Site 3: Baboo Saboo Interchange Sewage drain Samanabad, Lahore:

At this site algal flora was represented by these genera *Tetraedron* Kützing, *Ulothrix* Kützing and *Schizomeris* kützing. The temperature of water 23°C, pH 7.6, EC $8.96\mu\text{sm}^{-1}$. The average value of BOD was 181mg/L. Average value of COD was 406mg/L. Total twenty-five species of unicellular and filamentous algae were determined from three different sites of sewage drain in samanabad. The phylum Cyanophycota included genus *Oscillatoria* Vaucher was represented by 4 species (16%) of the total filamentous and unicellular algae, genus *Gloeocapsa* Kützing with 1 species (4%), Genus *Arthrospira* Stizenbberger with 2 species (8%) and Genus *Nodularia* Mertens ex Bornet with 1 species (4%). The phylum Bacillariophyta recorded Genus *Synedra* Ehrenberg with 2 species (8%), Genus *Fragilaria* with 1 species (4%), Genus *Navicula* Bory de saint-Vincent emends.Cleve with 2 species (8%), Genus *Nitzschia* Hassall with 3 species (12%), Genus *Pinularia* Ehrenberg with 1 species (4%), Genus *Cyclotella* (Kützing) Brebisson with 1 species (4%). Only one Genus *Tetraedron* Kützing with 1 species (4%) was found in phylum Volvocophycota. The phylum Chlorophycota included Genus *Ulothrix* Kützing with 3 species (12%), Genus *Schizomeris* kützing with 1 species (4%), Genus *Microspora* Thuret with 2 species (8%). All species were systematically arranged according to the classification proposed [10]. All the identified species are shown in figures as given after conclusion.

Table 1: Species of Algae recorded at various sites in sewage drain of Samanabad Lahore.

Species	Genus	Phylum	Site
<i>Arthrospira masartii</i>	<i>Arthrospira stizenberger</i>	Cyanophycota	Site 1: Gulshan-e-Ravi
<i>Arthrospira khannae</i>	-	-	-
<i>Nodularia spumigena</i>	<i>Nodularia Mertens ex Bornet</i>	-	-
<i>Gloeocapsa atrata</i>	<i>Gloeocapsa Kützing</i>	-	-
<i>Fragilaria constrenus</i>	<i>Fragilaria</i>	Bacillariophyta	-

<i>Cyclotellam eneghiniana</i>	<i>Cyclotella</i> (Kützing) Brebisson	-	-
<i>Microspora floccose</i>	<i>Microspora Thuret</i>	Chlorophycota	-
<i>Microspora tumidula</i>	-	-	-
<i>Oscillatoria bornetii</i>	<i>Oscillatoria Vaucher</i>	Cyanophycota	Site 2: Nonarian
<i>Oscillatoria tenuis</i>	-	-	-
<i>Oscillatoria princeps</i>	-	-	-
<i>Oscillatoria granulate</i>	-	-	-
<i>Navicula radiosa</i>	<i>Navicula Bory de saint-Vincent emends.cleve</i>	Bacillariophyta	-
<i>Navicula contenta</i>	-	-	-
<i>Nitzschia paradoxa</i>	<i>Nitzschia Hassall</i>	-	-
<i>Nitzschia linearis</i>	-	-	-
<i>Nitzschia denticula</i>	-	-	-
<i>Pinularia interrupta</i>	<i>Pinularia Ehrenberg</i>	-	-
<i>Synedra ulna</i>	<i>Synedra Ehrenberg</i>	-	-
<i>Synedra tabulate</i>	-	-	-
<i>Tetraedron tumidula</i>	<i>Tetraedron Kützing</i>	Volvocophycota	Site 3: Babu Saboo Interchange at chowk Yateem khana)
<i>Ulothrix aequalis</i>	<i>Ulothrix Kützing</i>	Chlorophycota	-
<i>Ulothrix subconstricta</i>	-	-	-
<i>Ulothrix cylindricum</i>	-	-	-
<i>Schizomeris leibleinii</i>	<i>Schizomeris Kützing</i>	-	-

As the physico-chemical parameters were also determined, the average values of all these parameters are shown in figures below. The figure 2 shows that temperature of water was higher than air and pH was also more than EC and figure 3 shows the difference between BOD and COD values according to different sites.

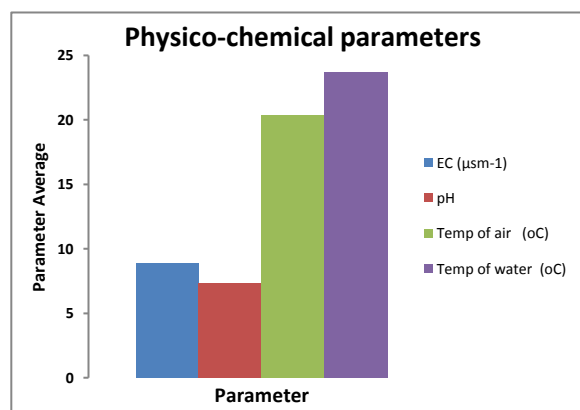


Figure 2: Average Values of Physico-chemical Parameters

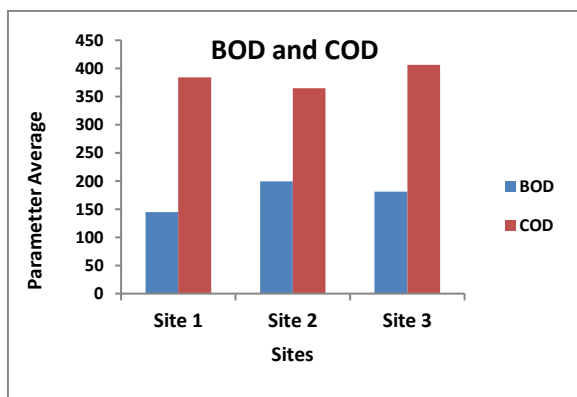


Figure 3: Difference between BOD and COD of site 1, 2 and 3

4. DISCUSSION

The present study clarifies the identification of the algal flora from sewage drain of Samanabad Town, Lahore and its linkage with physico-chemical parameters as Among 25 species studied unicellular, unbranched filamentous, branched filamentous, Colonial, Pseudo filamentous, heterotrichous and irregular forms were observed. The algal species were identified up to species level on the basis of their morphological and taxonomical characteristics. They were systematically arranged [10]. Mostly Bacillariophyta members were found to be present at three different sites in the sewage drain representing 10 species. Sewage water seemed to be a conducive environment for the growth of algae. *Nitzschia* sp were also identified. The commonly occurring species were Bacillariophyta members, *Oscillatoria* sp, *Ulothrix* sp, *Arthrospira* sp and *Microspora* sp. A rarely occurring member of phylum Volvocophycota was found from site 3 of the sewage drain. Only one species of phylum Volvocophycota i.e. *Tetradron tumidulum* was found in the fast and slowly running water. The green algae were also found in sewage water.

Sewage water seemed to support a variety of algal flora. The 25 species identified were *Gloeocapsa atrata*, *Oscillatoria bornetii*, *Oscillatoria tenuis*, *Oscillatoria princeps*, *Oscillatoria granulate*, *Arthrospira masartii*, *Arthrospira khannae*, *Nodularia spumigena*, *Synedra ulna*, *Synedra tabulate*, *Fragilaria construens*, *Navicula radiosa*, *Navicula contenta*, *Nitzschia paradoxa*, *Nitzschia linearis*, *Nitzschia denticula*, *Pinnularia interrupta*, *Cyclotella meneghiniana*, *Tetradron tumidulum*, *Ulothrix aequalis*, *Ulothrix subconstricta*, *Ulothrix cylindricum*, *Schizomeris leibleinii*, *Microspora tumidula* and *Microspira floccose*.

BOD was found to be maximum at site 2 and the algal biodiversity was highest as 12 species were recorded at this site. The greater variety at this site demanded relatively more oxygen, thus resulting in greater BOD. But also at site 2 the pH was lower and temperature was higher than other two sites. It is assumed that the number of algae was also greater from the visual observation of the water at this site. Site 3 and 1 showed lower values of BOD, temperature of water, higher pH and were accompanied by fewer types of Algae. The result of COD however varied. Over all the sewage drain was found to support a large number of algal species.

A group researchers investigated on the diversity of unicellular and filamentous algae and determined the water quality from the valley district Swabi [11]. The filamentous, unicellular and identified algae recorded with sum of 22 genera with 35 species from areas of district Swabi. The most common genus was *Chaetophora* with 3 species (8.57 %). Other genera were *Stegoclonium* 3 species (8.57 %), *Apanochaete* 3 species (8.57%), *Ulothrix* 2 species (5.71%) and *Mugeotia* 2 species (5.71%). The genera *Ankistrodesmus* and *Oocystis* were represented by 4 species each (5.71%), *Spirogyra* and *Cladophora* 2 species each (5.71%) and *Zygonium* single species (2.58%). The study of algal species in Lahore area showed that further work is required about algae and characteristics of their habitat. The concentration of pH, EC from water bodies varied in this area. The current study is related to previous study on algal flora and physicochemical parameters.



Figure 4: *Gloeocapsa atrata*

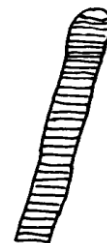


Figure 5: *Oscillatoria bornetii*



Figure 6: *Oscillatoria tenuis*



Figure 7: *Oscillatoria princeps*



Figure 8: *Oscillatoria granulate*

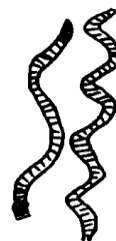


Figure 9: *Arthrospira masartii*



Figure 10: *Arthrospira khannae*



Figure 11: *Nodularia spumigena*



Figure 12: *Synedra ulna*



Figure 13: *Synedra tabulate*



Figure 14: *Fragilaria construens*



Figure 15: *Navicula radiosa*



Figure 16: *Navicula contenta*



Figure 17: *Nitzschia paradoxa*

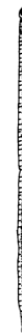


Figure 18: *Nitzschia linearis*



Figure 19: *Nitzschia denticula*



Figure 20: *Pinnularia interrupta*



Figure 21: *Cyclotella meneghiniana*

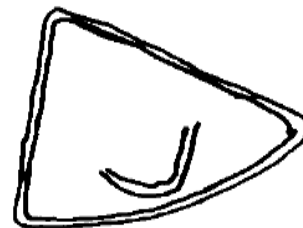


Figure 22: *Tetradron tumidulum*



Figure 23: *Ulothrix aequalis*



Figure 24: *Ulothrix subconstricta*



Figure 25: *Ulothrix cylindricum*



Figure 26: *Schizomeri leibleinii*



Figure 27: *Microsporum tumidula*



Figure 28: *Microspora floccosa*

5. CONCLUSION

Identification of algal flora and evaluation of physicochemical parameters was carried out from three selected sites of Sewage drain in Samanabad, Lahore. A total of 25 species were recorded from this Sewage drain. Bacillariophyta was the dominant group as compared to Chlorophycota and Cyanophycota. Only one species of Volvocophycota was recorded. The growth of algal flora seemed to be affected by the composition of sewage drain and different physicochemical parameters like pH, EC and BOD.

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