



ALGAE AS BIOINDICATOR FOR POLLUTION OF TIGRIS RIVER BY INDUSTRIAL WASTE

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Abstract:

This study has been conducted during 2016, the samples were collected from discharge of General Company for Vegetable Oil Industry before and after treatment in Baghdad city. Some parameters were measured such as: Temperature, pH, Electrical Conductivity, Dissolve Oxygen and Phosphate, all reading before treatment are very high but the readings decreased rapidly after treatment. In contrast, oxygen concentration before treatment was low and elevated after treatment so much until reaches to the optimal condition for all biological and chemical properties. In this study 37 species of algal were recorded. The dominant group by the large number of species was Bacillariophyce (24 species) followed by Cyanophyce (6 species), Chlorophyce (5 species), Euglenophyceae (1 species). This study shows that species recorded in the this study eventually will stilted in Tigris river as a result of the discharge processing of this facility, therefore, some species can be found in Tigris river basin come from General Company for Vegetable Oil Industry.

Keywords: Algae; Bio Indicator; Discharge; Tigris River; Baghdad.

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1. Introduction

Tigris River is the biggest river in Iraq and the main source of water for Baghdad city [1], pollution of Tigris River may cause a direct pollution to Euphrates River and the related water sources since both rivers connected through Al Tharthar Lake [2]. Algae, a vital group of bacteria and plants in aquatic ecosystems and it's important components of biological monitoring programs for evaluating water quality. They are suited to water quality assessment because of their nutrient needs, rapid reproduction rate and short life cycle. Algae are valuable indicators of ecosystem conditions because they respond quickly both in species composition and densities to a wide range of water conditions due to changes in water chemistry. For example, increase in water acidity due to acid-forming chemicals that influence Lake PH levels, as well as heavy metals discharged from industrial areas affect the composition of genera that are able to tolerate these conditions [3]. Bio-indicator organisms can be any biological species that defines a trait or characteristics of the environment. Algae are known to be good indicators of pollution of many types for the following reasons: (i) Algae have wide temporal and spatial distribution (ii) many algal species are available

through the year (iii) response quickly to the charges in the environment due to pollution (iv) Algae are diverse group of organisms found in large quantities (v) easier to detect and sample (vi) The presence of some algae are well correlated with particular type of pollution particularly to organic pollution. [4]

Measurement of algal biomass is common in many river and lake studies and may be especially important in studies that address nutrient enrichment or toxicity. High nutrient concentrations can affect recreational water users when the nutrients produce dense growths of algae and (or) aquatic vegetation, which are aesthetically undesirable [5, 6].

The aim of this study is to use the algae as bio indicator to determine the quality of waste water of General Company for Vegetable Oil Industry by using physicochemical and algal analyses. It also aimed at accumulating information on algae that will reach to Tigris River through the discharging processing of the company.

2. Experimental Work

2.1. Sample Characteristics

Sample used in the present study was collected from discharge of General Company for Vegetable Oil Industry which is situated at coordinates: Latitude: 33°17'31.94" and Longitude: 44°27'8.02" in Al-Rasheed Camp/ Bagdad Province/ Iraq during 2016 (Fig.1). The company is one of the most important companies of the Ministry of Industry and Minerals in Iraq, which occupies a prominent position in the food industry.

2.2. Experimental Procedure

Phytoplankton samples were collected according to the method described in [7] by a phytoplankton's net (20 µm pores diameter), put it reversed to the water flow, pulled out, and collected the contents in a clean polyethylene bottles which used to identify phytoplankton. For preservation, five drops of Lugol's solution were added. Measurements of temperature, pH, and dissolved oxygen and electrical conductivity were performed in the field, while phosphate was done in a laboratory by using ascorbic acid method. All the parameter was done according to [8].

2.3. Identification and Counting of Phytoplankton

Phytoplankton species was identified by using a light Microscope. non-diatom were identified by preparing a temporary slides at 400X, while diatom were identified by preparing a permanent slides at 1000X after clear or remove the organic matters inside the cell by using Nitric acid [9], the identification of species made according to the following references [9, 10,11].

Sedimentation method was utilized to count phytoplankton cell by using counting chambers [12]. The counting cell chamber is filled (50µ) with the phytoplankton sample and placed on the stage of the microscope, after sedimentation; the organisms are counted (using Micro-transect method) from one corner to another. The cell chamber is moved horizontally along the first row of squares, then the stage is moved to reach the second raw and the organisms are counted in each square. The

total cell number is determined from multiple the individual number (which is counted in transects) by the proportion of the entire chamber area to the counted transects area. Finally, the total number of phytoplankton is presented in a liter of water [8].

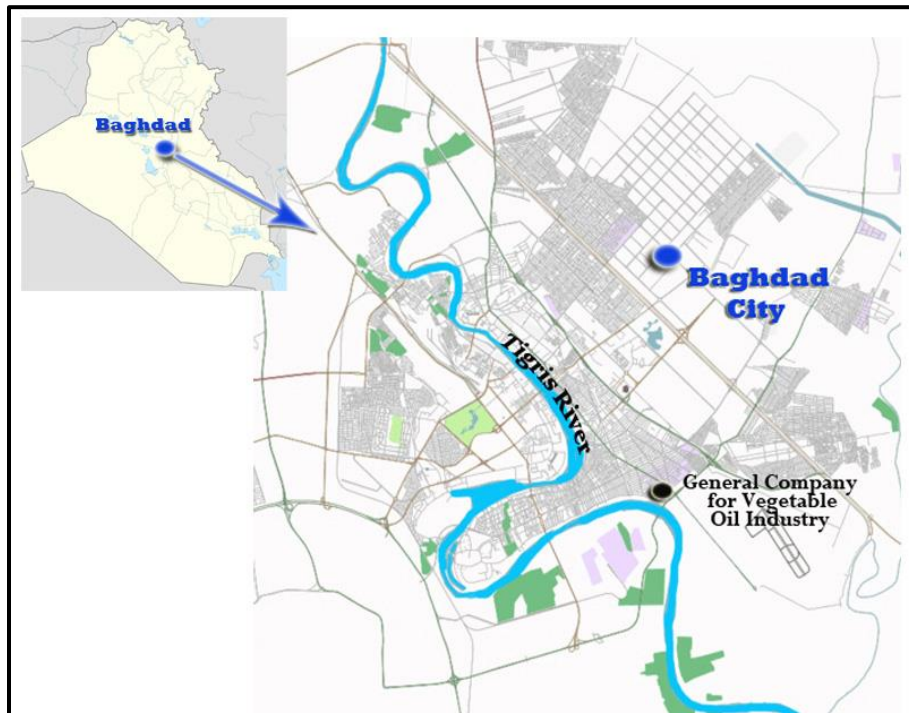


Figure 1: Map of Baghdad illustrating Study Site

3. Result and Discussion

Table 1 illustrates the physical and chemical Characteristics of the Sample (discharge after and before treatment) were all reading before treatment is very high but the readings degreased rapidly after treatment. In contras oxygen concentration before treatment are low yet elevated after treatment so much to reach the optimal condition for all biological and chemical properties. This readings (before and after treatment) indicate the efficiencies of treatment process in the plant.

Many kinds of Algae are good indicators of water quality and many aquatic systems are characterized based on their dominant phytoplankton groups. In this study 37species of algal are recorded, the dominant group by the large number of species isBacillarariophyce(24 species) followed by Cyanophyce(6species), Chlorophayce(6 species), Euglenophyceae (1species) table 2.

Table 1: physical and chemical Characteristics of the Samples

PARAMETER					
Samples	Temperature, C°	pH	Electrical Conductivity (EC), μs/cm	Dissolve Oxygen (DO), mg/l	PO ₄ mg/l
Before	20.8	9.6	20600	0.38	3.1
After	19.1	7.8	969	10.2	0.6

Table 2: Total Number of Cell (Individual/L)

Phytoplankton	Before Treatment	After Treatment
Cyanophyta	1255	982
Chlorophyta	70	256
Euglenophyceae	7	22
Centrales	254	85
Pennales	111	3154
Total Number	1697	4117

Obviously, table (2) indicates the increasing of total number of algae that's return to improving of quality of the waste water and therefore it can support the growth of algae, whereas increasing of the pennals group can prove that's, because this particular group can exist in a clean water, In contrast of Centrales group represented by *Cyclotellacatenata* which can exist in polluted water, table (2) shows that the number of Centrales before treatment are higher than after treatment [13].

A list of more than 850 algal taxa was published based on the reports of considerable number of authors. According to this list, many algal genera have species that grow well in water containing a high concentration of organic wastes. Including species recorded in this study like; Green algae *Chlamydomonas*, *Euglena*, Diatoms, *Navicula*, *Synedra* and blue-green algae *Oscillatoria* are emphasized to tolerate organic pollution[14,15], *Ankistrodesmusfalcatus*, *Scenedesmusquadricauda* appear in water rich with organic. *Nitzschiapalea* always appear to be dominant in the mild pollution zone [16] *Navicula* is stressed to be a good indicator of organic pollution as the species comfortably occur in the most heavily polluted zones in which other species cannot occur[17].

At species level, *Euglena viridis* (Euglenophyta), *Nitzschiapalea* (Bacillariophyta), *Oscillatorialimosa*, *O.tenuis*, *O.princeps* (Cyanophyta) (table3) are reported to be present than any other species in organically polluted waters [18].

Form table (2) its can see a high number of cyanophyta in both site (before and after) with regards to the number after the treatment is lower than before treatment but still the occurrence of this group at any number its conceder an environmental problem, where high densities of this group are an undesirable component of freshwater ecosystems because they can produce hepatotoxins and neurotoxins that are ecological and public health concerns as a result to discharging of this waste water to the river [21]. Toxin producing blooms may disrupt lake food webs by killing fish, birds and zooplankton and can be responsible for hypoxia conditions that follow bloom die-offs. Toxic blooms can also restrict recreation like swimming, fishing and pet-related activities. Additionally, toxins produced from blooms can pose problems for households that get their drinking water from lakes and reservoir [21].

Nutrients, like phosphorus (PO₄) support the growth of algae and other plants forming the lower levels of the food chain. However, excessive levels of nutrients from any sources can cause over-growth of aquatic vegetation (eutrophication), the concentration of PO₄ before treatment are higher than after treatment(table 1), but any way the concentration of PO₄ in

both treatments are considered a high and exceed the Iraqi Rivers maintaining system which is (0.4 mg/l) [19].

This study was showed that's species recorded will stilted in Tigris river eventually as a result of the discharge processing of this facility, therefore , it can be declared that some species that can found in Tigris river basin come from General Company for Vegetable Oil Industry.

Table 3: list of identified algae during the study

Taxa	before	after
Cyanophyceae		
<i>Chroococcus</i> G.M.Smith	-	+
<i>Oscillatoria</i> sp.	+	+
<i>O. princeps</i> Vaucher	-	+
<i>O. tenuis</i> Agardh	+	-
<i>O. limosa</i> O.	+	+
<i>lingbaea</i>	+	+
Chlorophyceae		
<i>Ankistrodesmusfalcatus</i> (Cord.) Ralfs	-	+
<i>Kirchneriella</i> sp.	-	+
<i>Chlamydomonas</i> sp.		
<i>Scenedsmusacuminatus</i> (Lag.) Chodat	-	+
<i>S. bijuga</i> (Turp.) Lagerheim	-	+
<i>S. quadricauda</i> (Trup.) Brèbisson	+	-
Euglenophyceae		
<i>Euglena viridis</i>	-	+
Bacilariophyceae		
Centrales		
<i>Cyclotella</i> <i>catenata</i> Brun.	+	-
Pennales		
<i>Caloniespermagna</i> Bailey	-	+
<i>Cymbellaaffinis</i> Kützing	+	+
<i>Cymbella</i> sp.	+	-
<i>Fragilariabicapitata</i> Mayer	-	+
<i>F. brvstriata</i> var. <i>inflata</i> (Pant.) Hustedt	+	-
<i>Fragilaria</i> sp.	+	-
<i>Navicula atoms</i> (Kütz.) Grunow	+	-
<i>N. cryptocephala</i> Kützing	-	+
<i>Naviculacryptocephala</i> Kützingfo. <i>minuta</i> Boy-p	-	+
<i>N. cryptocephala</i> var. <i>intermedia</i> Grunow	-	+
<i>Navicula.</i> sp	+	+
<i>Nitzschiaaacularis</i> W.Smith	-	+
<i>N. frustulum</i> var. <i>snbsalina</i> Hustedt	-	+
<i>N. palea</i>	-	+
<i>N. holsatica</i> Hustedt	-	+
<i>Nitzschia</i> sp.	-	+

<i>Syndraactinaastroides</i> Lemmermann	-	+
<i>S. delicatissima</i> W. Smith	+	-
<i>S. ulna</i> var. <i>oxyrhynchus</i> Kützing	-	+
<i>Syndrasp.</i>	+	+
<i>S. ulna</i> (Nitz.)Ehrenberg	+	+
<i>S. ulna</i> var. <i>oxyrhynchus</i> Kützing	+	-
<i>Syndra</i> sp.	+	-

4. Conclusions

In the present paper work, we try to investigate on the biological effect of Company for Vegetable Oil Industry on Tigris River, were this plant disgorged its effluent directly to the river. The result elucidate that's wastes of the plant have a diverse species of algae. Cyanophyceae and Centralesgroup dominant in wastes Before Treatment where this two group represent the undesired water condition, in other side Chlorophyceae and Pennales group dominant in wastes after Treatment where this two group represent the desired water condition, all species we find in this research eventually tack place in the water of Tigris River and effect on the biodiversity.

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