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Ecological Study of Epipelic Algae in AL- Diwaniyah* River/Iraq

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Abstract

The present study is deal with the relationship between some physical –chemical characteristic and epipelic algae in Al-Diwaniyah River ,also called (Shatt Al-Diwaniyah) for six months started from November 2012 to April 2013.Three sites were chosen on the river, the first in the north of Al-Diwaniya city while the second is after the first about ten kilometers and the third site is after the second about thirteen kilometers.The results of the study cleared the water of the river was good oxygenated ,very hardness and tend to be alkalinity as the other water in Iraqi rivers .This study identified (234)species belong to four classes which started of *Bacillariophyceae,Cyanophyceae,Chlorophyceae* and *Euglenophyceae* in respectively.Som genera consisting of larg number ofspeciesas(*Nitzschia, Navicula,Cymbella,Amphora,Achnanthus,*Gomphonema and *Oscillatoria*).Species were appeared in the period of study were consisting of(*Nitzschia palea, Navicula cincta ,Synedra ulna,Surirella ovate,Spirulina gignata and Oscillatoria Formosa*).There was one peak in months of spring specially in (March and April).

Key words : epipelic algae , Environmental , River.

Botany classification :QK900-989

Introduction

Benthic algae refer to the type of algae habitate,these algae found on rocks,mud and organic debrisect(1).Benthic algae compris different groups of algae in aquatic systems such as river and these algae are influenced geomorphology of aquatic systems and human activities(2).Algae play vital role in all aquatic ecosystems by providing the food and energy base for all organisms living in lakes ,ponds,streams and river (3). Epipelic algae perform arrange of ecosystem functions including biostabilisation of sediments ,regulation of benthic-pelagic nutrient cycling and primary production(4).The role of benthic algae in ecosystem production has received little attention when compared to studies concering phytoplankton primary production pelagic food webs(5).Epipelic algae in rivers were studied by many world researchers(6,7,8,9,10,11) ,while in Iraq they were studied by(12,13,14,15,16,17,18,19 ect.).Studies of epipelic algae in Al-Diwaniya River were very limited,represented by(12),many studies focused on phytoplankton so that this study was carried out.

***The Research is apart of on M.Sc. thesis in the case of the Second researcher**

Material s and methods

Study Area

Al-Diwaniyah River branches from Al-Hilla River which is branching of Euphraties River.It is having length (132km) and width between(20-25km), (20) .Many pollutient materials were threwen in the river (21).Many aquatic plants as *Ceratophyllum demersum,Phragmites australis* and *Typha domingensis* (22).Three sites were selected on the river, the first in the north of Al-Diwaniya city while the second is after the first about ten kilometers and the third site is after the second about thirteen kilometers as in figure (1).

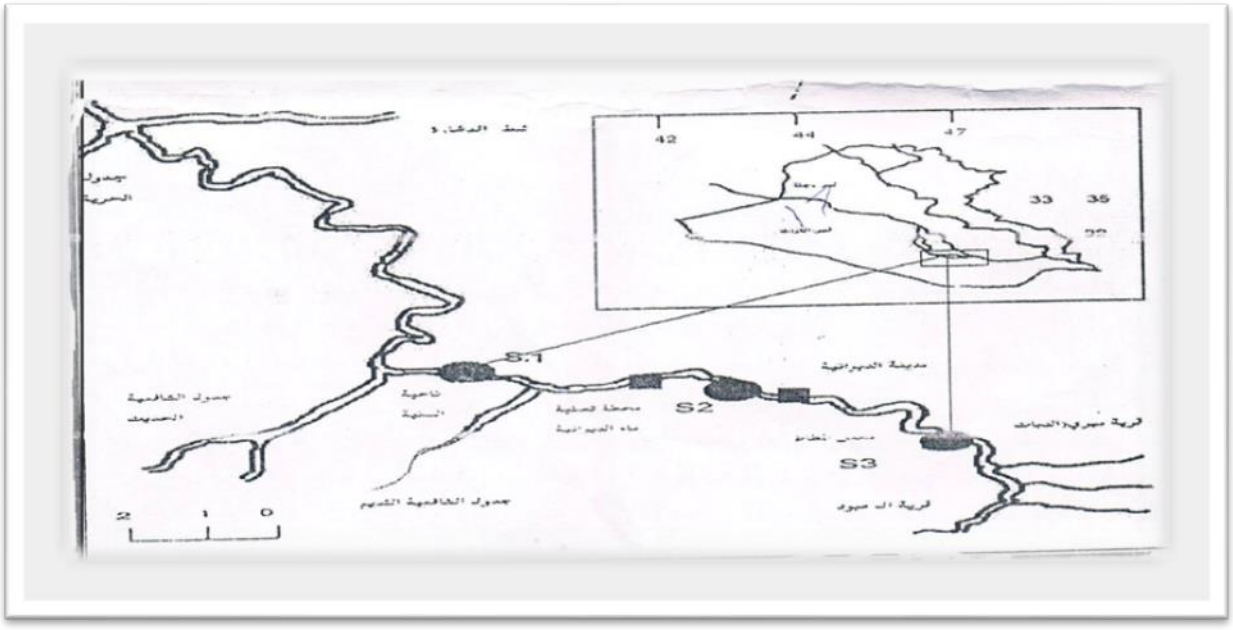

Figure (1): Map of study sites on AL-Diwaniya River

Study for six months started from November 2012 to October 2013.The samples of the water were collected from (30cm) depth of river by the plastic bottles which is capacity (5liter) to measure the physical-chemical characteristic,while Wingler bottles(250ml) used to measure (DO and BOD).The sample of sediments collected by Grab sampler until access to the lab so that measure the texture.The samples of epipelic algae collected by scratching of upper layer of clay surface then added the water from same place and preserved in the lab by adding some drops of logal solution (23).The temperature of(air and water) were measured by mercuric thermometer.PHwas measured by pH meter type HANAA after it standrized by standerd solution.Electric conductivity was measured by Ec.meter type (Bishof) while the salinity was calculated by Ec. Value(24).Disolved oxygen was measured by Azid modification to Wingler method which cleard in(25).Carbondioxid measured by(26).Hydrometer used to know texture of sediments according to(27).Epipelic algae isolated from the clay by (6) ,for preparation of permenant slides followed method(17,while non diatoms were examined according to(28).

Results and Discussion

Table (1) shows the average ,range and standard deviation for some physical-chemical characteristics to the water of the river in study area.The present study recorded minimum of the air temperature (17ºC) in the first site in February while the maximum(32ºC) in the third site in April.The water temperature was (15ºC) in the first site in February while the highest

Table(1): Physical-chemical characters of study sites of (AL-Diwaniyah River) the first line is range ,the second (average and devation).

Stations / Ecological factor	Station 1	Station 2	Station3
Air temp.(Cº)	17-28 20.66(±3.63)	18-30 22.6 (±3.90)	20-32 24.33(±3.77)
Water temp.(Cº)	15-21 18.16(±1.86)	16-23 19.5(±2.21)	17-21 19.66(±1.37)
pH	8.32-8.4 7.01(±0.07)	7.58-8.2 7.95 (±0.23)	7.67-8.5 7.94(±0.30)
ElecricConductivit(µ/m)	1020-1342 1228.83(±108.42)	1241-1477 1332.6(±78.26)	1309-1516 1376(±73.006)
Salinity %	0.65-0.85 0.78(±0.06)	0.79-0.94 0.84(±0.04)	0.83-0.97 0.88(±0.04)
Dissolve oxygen(mg/L)	7.45-8.5 7.88(±0.36)	7.32-8.09 7.60(±0.30)	7.2-7.66 7.40(±0.20)
oxygen(mg/L)			
Carbone dioxide(mg/L)	90.48-113.5 96.9(±8.42)	111.2-123.14 113.32(±5.28)	119.4-148.13 133.51(±10.15)
AL-Kalinity (mg$CaCo_3$/L)	121.36-218.4 156.1(±36.84)	128.8-219 168.58(±36.11)	147.13-250 176.06 (±44.5)
Total Hardness (mg $CaCo_3$/L)	302-415.2 346.95 (±36.77)	305-412.4 371.06(±34.82)	347-436 407.9(±29.86)
Calcium hardness(mg/L)	82.55-117.04 102.74 (±10.55)	84.55-126.35 105.83(±13.81)	91.2-136.3 116.16(±18.33)
Magnecium (mg /L	69.2-95.52 79.17(±8.67)	69.87-93.88 84.87(±7.99)	79.75-98.79 93.18(±6.46)

Was(23ºC) in second site in April ,these results may be returned to long noon and high of light intensity in dry season (28).The relationship between air and water temperature is positive whichis cleared by correlation analysis .Water temperature is basic water characteristcs for determines the oxygen concentration in water in water and further more,many aquatic organisms have very narrow limits of tolerance to change in water temperature,resuts cleared high number of algae when high temperature of water because of more photosynthesis and detritous materials as well as available of nutrients which produced from activity of micro organisms.Water temperature mainly depends upon three factors(air temperature,earth temperature and sun light),the results agreed with(29).The PH ranged from (7.67-8.83) that made the water of the river tend to be alkalinity that's agree with many studies on Iraqi waters as(30.31,12),the relationship between temperature and PH is negative.The alkalinity of wateris also consider is important key to aquatic organisms which is most adapted to live in water withpH between(5-9),and many organisms are adapted to specific PH limits where any devations leads to problems in reproduction processes,ion exchange and viability the PH of water depends on both the substratum in the river course,rain water and abrupt changes in PH also occure when wast waters are discharge into the river(28).Elecric conductivity refers to water have ability to coducte electric conductivity because finding the dissolve salts init.The study recorded(1020µ/L)in November in first site to(1516µ/L)in April in third site while water salinity gradiented from(0.65-0.96%),so this result classified the water of the river as fresh water.Salinity is always fallowing Ec.when high temperature of water lead high EC.because evaporation processes as well as asbsence of dilution when rainless in the worm months(33).Increase for each Ec.and salinity were noticed in aquatic systems that influenced agricultural and industrial activities,so the high values of Ec. were obtained in April,this results was agreed with other studies(35**,**36,37,38 ,39, 32).The hardness ranged between(352-422mg $CaCo_3$/L) the minimum in the first site while the maximum in the third ,the calcium ions was more than the magnesium ions because the availability of $CaCo_3$ in the Iraqi rivers and theMg^{+2} is reaction with sulfat ions ,this result agreed with(32,33).Alkalinity ranged from (139.6-225.17mg$CaCo_3$/L) the lower value in first site while the high in the third site .The low values during the study may be due to dilution factor(LIND1974)as well as increasing of photosynthesis rates by algae and precipitation of carbonat(40,41).The results showed the hardness values more than alkalinity that is refered to another ions take part with calcium ion in formation of hardness this result agreed with (43**).**Dissolved oxygen, theimportant feature of any water cause is it oxygen contents ,most of the aquatic organisms (breath),Dis concentration of water depends mostly water temperatureand salinity whilesource of oxygen are the atmosphere and the photosynthesis of river plants and algae.Ecological factors affected on life of aquatic organisms and water quality,the water temperature is negative with Do,study cleared the water was good oxygenated as values ranged between(7.02-8.16 mg/L).The relationship between the epipelic and Do is positive that is agreed with (12,32,41).The composition of sediments of the river(texture) was consisting of clay(46.50%,45.62%,48.04%) sand(31.14%,30.08%,26.43%)silt(22.10%,24.30%,25.5%)for three sites inrespectively as figure (3),this mean the the texture of sediments ofriver is sandy clay or mix clay.Among of(243) taxa of epipelic algae were identified in this study ,table(2) illustrated the list of identified algae were include four classes in which started with *Bacillariophyceae* ,*Cyanophyceae,Chlorophyceae* and*Euglenophyceae* for three sites in respectively.*Bacillariophyceae included (*159 species belong35 genera*),Cyanophyceae* included (33 species belong *14* genera*),Chlorophycea* included(32species belong25 genera)and *Euglenophyceae(*10 species belong 3 genera*).The Bacillariophyceae* was dominante in all period of study aspecially *pennales* diatoms this result may be returned availability ofsilica in Iraqi earth**(**40), the result is agreed with many studies as (12**,**13, **7**).*The presence some of* Cyanophyceae *Oscillatoria*,Spirulina was adivence of organic species in river .The second site

included high numpers of algae because multi factors effected as available of nutrients which come from many sources as fertiliz of agriculture or that swept with water of rain.Some genera contained large numbers of algae (*NitzschiaNavicula,Cymbella,Amphora,Achnanthus,*Gomphonemaand*Oscillatoria*).Species were appeared in the period of study were consisting of(*Nitzschia palea, Navicula cincta ,Synedra ulna,Surirella ovate,Spirulina gignata and Oscillatoria Formosa*).There was one peak in months of spring. The density of algae (254.456x103cell/cm2) ,the maximum in Spring season while the minimum in Wintere and Autman ,the second station is showed highest density while the third station is lowerest,this result didn't agree with(4) that's may return to change in ecological factors or as difference of bottom of river **(**9**)** ,as well as the heavy rains which accombination the study period that may due to swept away nutrients to river in this station if we compaired with the first station which coverd by many plants in addition to the lack of meandering which provides larger spaces to growth epipelic algae that's from one side ,from anothr side, the third station were contained little algae composition to persistent organic waste generated from factories and diesel engines which made water more pollution than two study stations. clay samples (4) ,while some epipelic were performed to phytoplankton because of high wind (40).The high densities of epipelic algae were showed in starting of Spring this may due to change of temperature and decomposed of organic substances in specially blue-green algae (Cyanophyceae) in spit of some species were common in study period example Oscillatoria and Spirulina which presenting them represente avidence to organic pollution in water.The Cyanophyceae were came second degree in quantity this agree with while Clorophyceae were came third degree this agreed with (4**)**but didn't agreed with**(9**).The Euglenophyceae were came in fourth degree that consist of three genera which also consider sign for organic pollution .Lastly the diatoms were found in larg numbers of species that's probably due to richness of silica which need **(32**)or to have resistance for critical ecological factors.

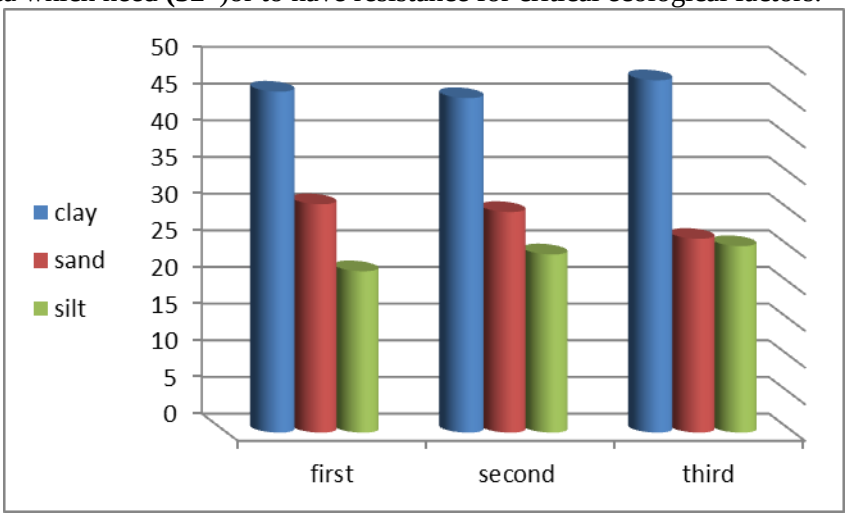

Figure (2):The texture of sediments of Al-Diwaniyah River.

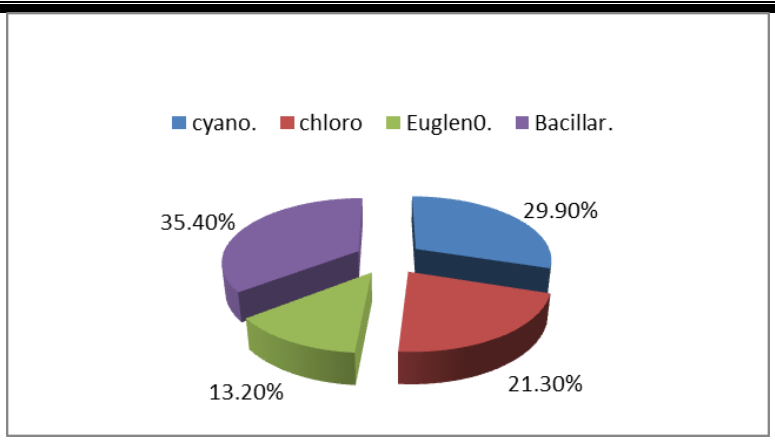

Figure (3):Percentage of classes of algae in Al -Diwaniyah river

Table (2): Algale taxa in study sites.(+) mean presence (-) absence.

Taxa	S1	S2	S3
Cyanophyceae			
Anabaena azolla Strasburger	-	+	-
Aphanocapsa endophytica G.M.Smith	-	+	-
A.saxicola Naegeli	-	+	-
Aphanocapsa koordersi Storm	+	-	-
C hrococcus disperses Lemmermann	-	+	-
Gleocapsa calcarea Tilden	-	+	+
Gleocapsa sp	+	-	-
G .po lydermatica Kuetzing	+	-	-
Gomphospheria lacustris var.compacta Chodat	-	+	+
Merismopedia convolute de Brebison	-	+	+
M. Minima Beck	+	-	-
Microcystis aeureginosa Kuetzing	+	+	+
Microcystis sp	+	-	-
Lyngbya birgei G. M. Smith	+	-	-
L.limitica Lemmermann	+	-	+
Nostoc sphaericum Vaucher	+	+	+
Nostoc sp.	+	+	+
Oscillatoria articulate Grande	+	-	-
O.angustissima W&W	+	-	-
O.formosa Bory	+	+	+
O.nigro-viridis Thwaites	+	+	-
O.limosa Roth Agardh	+	+	-
O.princeps Vaucher	+	-	-
.*O.sp*	+	+	-
O. subbrevis	+	+	+
P hormidium inundatum Kuetzing	+	+	-
P.mucicola Naumann & Huber	+	+	+
Spirulina gignatea Schimdle	+	+	+
S.miaor Kuetzing	+	+	+
Chlorophyceae			
Actinastrum gracilimum G.M.Smith	+	+	-
Ankistrodesmus spiralis Lemme	+	-	-
Chaetophora elegans Agardh	+	+	-

Closterium ehrenbergii Menegh Ex Ralfs	-	+	+
*Cladophora fracta(*Dillw)Kuetzing	-	-	-
C.insigins K g.	+	-	-
Coleochaeta orbicularis Pringsheime	+	-	-
C. scutata de Bression	+	-	-
C.meneghinii de Brebssion	+	-	-
Heamatococcus lacustris (Girod)	+	-	-
Microspora loefgrenii Lagerheim	+	+	-
Oedogonium sp	+	+	-
Pandorina morum Bo.	+	+	-
Pediastrum boryanum Meneghini	+	-	-
Scenedesmus bijugua (turp.) Lagerheim	+	+	-
Selenast rum gracile Korsch	+	+	+
Strastrum gracile Ralfs	+	+	+
Stigeoclonium attenutum Collins	+	+	-
Tetradron caudautm Hansgirg	+	+	-
Treubaria setigerum G.M.Smith	+	+	+
U lothrix tenera Kuetzing	+	+	-
Euglenophyceae			
Euglena minuta Prescott	+	+	-
E.deses Ehrenberg	+	+	+
.E.sp	+	+	+
Phacus acuminatus Stoken	+	+	-
P.caudata Huebner	+	+	-
P.longicauda Dujardin	+	+	+
P.orbicularis Huebner	+	+	+
Trachelomonas hisipde Stein	+	-	+
Bacilariaphyceae			
Centrales			
Aulacosiera granulata Her	+	+	-
Cyclotella glomerata Bachmann	+	+	+
C. meneghiana Kuetzing	+	+	+
C.stelligera Cleve et Grunow	+	+	+
Melosira granulate(Ehr.)	+	+	+
M.italic Kuetzing	+	-	-
Stephanodiscus hantzschii Grunow	+	+	-
S.asterea(Ehr.) Grunow	+	+	+
Pennales			
Achnanthes affinis Grunow	+	+	+
A.conspicua A.Myer	+	+	+
A.microcephala(Kuetzing) Grunow	+	+	-
A.linearis Grunow	+	+	+
Amphora alata Kuetzing	+	+	-
A.coffeaeformis Agardh	+	+	+
A.normanii Rabh	+	+	+
A.ovalis Kuetzing	+	+	+
A.veneta Kuetzing	+	+	+
A.pediculus Kut.	+	+	+
Amphora sp.	+	+	-
Amphiprora alata Kuetz	+	+	+
A.costata Hust.	+	+	+
Anomoeonies sp.	+	+	+
Bacillaria paxillifer(Muller) Hendy	+	+	+

Calloneis bacillum Cleve	+	+	+
C.ventricosa Meister	+	+	-
Cocconies pedicalis Ehrenberg	+	+	+
C.placentula Ehr.	+	+	+
C.pseudomarginata Gregory	+	-	-
Cymbella affinis Kuetzing	+	+	-
C. caespitosa (Kuetzing) Brun.	+	+	+
C. helvetica Kuetzing	+	+	+
*C.lanceaolata(*Ehr.) Van. Heurck	+	+	-
C.microcephala Grunow	+	+	+
C.obtusiuscula(Kutz.) Grun.	+	+	-
*C. tumida(*Breb.)V.Heurck	+	+	+
C.tumidula Grunow	+	+	+
*C.ventricosa (*Greg.)Cleve	+	-	+
*Cymatopleura solea(*Breb.*)*	+	+	+
Denticula sp.	+	+	-
Diatoma vulgare Bory	+	-	+
*Diplneis minuta(*Petersen)Cleve	+	+	+
D.ovalis (Hisle)Clev	+	+	+
Epithemia turgida(Ehr.)Kuetzing	+	+	+
*E.zebra(*Her.)Kuetzing	+	+	+
E.pectinalis var.undulata Rabenhorst	+	+	+
Fragilaria brevist riata Grun.	+	+	+
F.intermedia Grunow	+	+	+
F.virescens Ralfs	+	+	+
Gomphonema acuminata var intra Her	+	+	-
G.augur Ehrenberg	+	+	+
G.gracile Ehrenberg	+	+	+
G.intricatum Kuetzing	+	+	+
Gyrosigma acuminatum(Kuetzing)Rabenhor	+	+	+
*G.attenuatum(*Kuetzing) Rabenhorst	+	+	+
G.peisonis Husted	+	+	-
Mastogloia elliptica Cleve	+	+	+
*M.muradi V*oig*t*	+	+	-
Navicula angilica Ra lfs	+	+	+
N.angilica var.subsalsa Grunow	+	+	+
N.bacillum Ehrenberg	+	+	+
*N.cincta(Ehr.)*Kuetzing	+	+	+
N.cocconiformis Gregory	+	+	+
N.creptocyphala Kuetzing	+	+	+
N.gastrum(Ehr.) Kuetzing	+	+	+
N.graciloides A.Mayer	+	+	+
*N.gracilis(*Ehr.*)*	+	+	+
N.grimmei Krasske.	+	+	+
*N.halophila (*Grun.)Cleve.	+	+	+
N.salinarum Grunow	+	-	+
N.shroeteri Meister	+	+	-
*N.*sp.	+	+	+
Nidium iridis (Ehr.) Cleve	+	+	-
*Nitzschia acicularis(*Kuetzing)W.Smith	+	+	+
N.acuta Hantzsch	+	+	+
N.amphibian Grunow	-	+	+
N.angustata(W.Sm.) Grunow.	-	+	+

N.apiculata(Greg.)Grunow	-	+	+
N.closterium(Ehr.)W.Smith	-	+	+
N.cluasii Hantzsch	+	+	+
N.dubia W.Smith	+	+	+
N.dissipata(Kuetzing)	+	+	+
N.filiforms (W.Smith) Hustedt	+	+	+
N.fonticola Grunow	+	+	+
N.frustulum(Kuetzing)Rabh	+	+	+
N. hantzschiana Rabh	+	+	-
N.hungarica Grunow	+	+	+
N.inconspicua Grunow	+	+	+
N. ignorata Krasske	+	+	+
.N.longissima Ralfs	+	+	+
N. lorenziana Grunow	+	+	+
N.microcephala Grunow	+	+	+
N.Paleacea(Grunow)	+	+	+
N.palea (Kuetzing) W.Smith	+	+	+
N.pusilla (Kuetzing) Grunow	+	+	+
N.obtus W.Smith	+	+	+
N.recta Hantzsch	+	+	+
N.rostellata Hustedea	+	+	+
N.romana Grunow	+	+	+
*N.sigmoidea(*Ehr.) W.Smith	+	+	+
.N.vermicularis Hantzsch	+	+	-
Pinnularia borealis Ehrenberg	+	+	+
P. leptosome(Grun.) Cleve	+	+	-
P.sp.	+	+	+
Pleurosigma angulatuta W.Smith	+	+	+
Rhopaladia gibba (Ehr.) Muller	+	+	+
Rhoicosphenia curvata (Kuetzing) Grunow	+	+	+
R. marina Grunow	+	+	-
Stauroneis sp.	+	+	-
Surirella linearis w. Smith	+	+	-
S. robusta Ehrenberg	+	+	+
.Surirella tenera Gregory	+	+	+
Synedra acus Kuetzing	+	+	+
S. capitata Ehrenberg.	+	+	-

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*دراسة بيئية للطحالب الملتصقة على الطين في نهر الديوانية

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الخلاصة

تناولت الدراسة الحالية العلاقة بين الخصائص ا لفيزيائية والكيميائية والطحالب الملتصقة على الطين في نهر الديوانية وكذلك يدعى (شط الديوانية) لستة اشهر بدأت من تشرين الثاني 2012 الى نيسان 2013. اختيرت ثلاث مواقع من النهر ،الموقع الاول يقع شمال مدينة الديوانية بينما يبعد الموقع الثاني عن الاول بمسافة (10) كيلومتر ويبعد الموقع الثالث عن الثاني بمسافة (13) كيلومتر. اوضحت نتائج الدراسة ان مياه النهر جيدة التهوية وعسرة جدا وتميل الى القاعدية كما في مياه الانهار العراقية الاخرى. شخصت الدراسة (234) نوعا تعود الى اربع صفوف تبدا بالطحالب العصوية و الخضر المزرقة فالخضر ثم اليوغلينية على التوالي. امتلكت بعض الاجناس عدد كبير من الانواع مثل (*Nitzschia*و*Amphora* *Achnanthus,Cymbella,Gomphonema,Oscillatoria)* . اما الانواع التي كانت سائدة فترة الدراسة فكانت(*Nitzschia palea,Synedra ulna,Surerrella ovate,Oscillatoria Formosa,Spirulina gignata*) . رافقت الدراسة الحالية كثافة واحدة في اعداد الطحالب في اشهر الربيع وخاصة في شهري اذار ونيسان.

الكلمات المفتاحية:الطحالب الملتصقة على الطين، البيئة،نهر

Botany classification :QK900-989

***البحث مستل من رسالة ماجستير للباحث الثاني.**