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Control of Water Pollution and Phytoplanktonic Algal Flora in Bayındır Dam Reservoir (Ankara)

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Özet: ***Su kirliliğinin ve fitoplanktonik alg florasının Bayındır Baraj Gölü'nde kontrolü.*** Bu çalışmada Bayındır baraj gölü'nün bir plankton kepçesi ile toplanmış olan fitoplanktonik algleri Mart 2003 ve Aralık 2003 arasında incelendi. Toplam 76 fitoplankton türü saptandı. Bunların 13'ü Cyanophyta, 17'si Chlorophyta, 2'si Dinophyta, 6'sı Euglenophyta ve 38'i Bacillariophyta'ya aitti. Ayni periyotta, fiziksel ve kimyasal analizler ayrıca sürdürüldü ve türlerin bollukları ile varlıkları değerlendirildi ve böylece barajda kirliliğe toleranslı alg tiplerinin olduğu bulundu. Ayrıca, Ankara'ya içme suyu sağlayan baraj gölünün devamlılığı üzerine bazı öneriler getirildi.

Anahtar Kelimeler: Su kirliliği, Cyanophyta, Chlorophyta, Dinophyta, Euglenophyta, Bacillariophyta, Bayindir baraj Gölü, Turkey.

Abstract: In this study, the phytoplankton algae of Bayindir Dam Reservoir (BDR), which was taken by help of the plankton net, has been investigated between March 2003 and December 2003. A total 76 phytoplankton species were identified; of those 13 belong to Cyanophyta, 17 Chlorophyta, 2 Dinophyta, 6 Euglenophyta and 38 Bacillariophyta. In the same period, Physical and Chemical analysis have also been carried out and relative abundance level of the species and their presence have been determined and it has also been found out that there are tolerant to pollution algae types in the dam. In addition, it was given some suggestion to bring the continuity of the dam lake which was provided the drink water to Ankara.

Key Words: Water Pollution, Algae, Cyanophyta, Chlorophyta, Dinophyta, Euglenophyta, Bacillariophyta, Bayindir Dam Lake.

Introduction

Algae are used to define water pollution, to produce single cell protein to produce cosmetic goods and also it was used as food and fertilizer. The one of the most important problems in the future is the finding enough foods and to maintain its continuity makes absolutely necessary to find new food resources. Therefore many researches are related to using new food resource effectively (Atici, 1997; Anonymus, 1989; Hecky, 1987; Hoek et al., 1995). So the present potential should be find out and its defined how this potentials should be used (Wetzel, 1983; Gönülol, 1987).

Material and Methods

The samples were brought to the laboratory and 100 ml was mixed with 4 ml of a solution prepared by mixing 1 l alcohol, 1 l glycerin and 1 l formaldehyde (36%) (Heckey and Kiling 1987). Temporary preparate were prepared to diagnose algae except Bacillariophyta were diagnosed by using permanent preparates.

The land works which were done in 15 April 2003, 15 May 2003, 29 September 2003 and 3 December 2003 in Bayindir dam which is at 10 kilometers of Ankara-Samsun border, and necessary samples were gotten from the define three station by the aid of plankton net. The months in which planktons growths and presents greatly were preferred as the sampling date. Also the algae taken from benthic samples which can pass into plankton form were diagnosed.

In this period the chemical and physical analysis were done with the water samples of Dam Lake which provides drink water to Ankara and also the bacteriologic test was applied to define coliform bacteria contents. Before that a study were done about benthic algae at this dam lake (Gönülol, 1985). To diagnosis of algae this resource were used; (Gönülol and Çomak, 1992, 1993; Cirik and Cirik, 1989, 1992, Gönülol and Arslan, 1992; Gönülol, 1985; Fremy, 1930; Germain, 1981 ; Korshıkov, 1987; Lind and Brook, 1980; Patrick and Raimer, 1966, 1975; Pestalozzi, 1938, 1950, 1982, 1983; Prescott, 1975; Altuner and Gürbüz, 1994; Husted, 1985).

Results

A total 76 phytoplankton alg species were identified. Of those 13 belong to Cyanophyta, 17 Chlorophyta, 2 Dinophyta, 6 Euglenophyta and 38 Bacillariophyta (Table 1). In Dame Lake some alg species which was toxic effect were identified what their number were low enough to say that it was absent.The taxons belong to *Oscillatoria* in Cyanophyta section, *Oocystis* in Clorophyta section and *Cyclotella, Melosira* and *Synedra* in Bacillariophyta section were seen in a relatively high number.

Especially the alg species that shows difference between in lakes and the presence of blue-green alg that generally cause toxicty was considerable, but ıt was not seen a high algal growth during work period. The high alg growth generally called alg explosion sometimes cause the death of the other livings. Phosphorus and nitrogen is namely responsible of the effect (Atici 1997). These with enough light and other elements cause high alg growth. But according to Bayindir dam chemical results there was no enough phosphorus and nitrogen to cause high alg growth.

Also in bacteriologic tests very little amount coliform bacteria were seen. Only as to the results of 3.12.2003 analysis the number of *E.coli* was identified as 6.4 in 100 cc that is why we can say there is no coliform and also the total coliform bacteria number was identified <200 in 100 cc.

But Staphylococcus and Streptococcus bacteria which were normal bacteria flora were seen. According to Word Health Organisation this amount can be eliminate by coagulation and filtration.

Four different alg group dirty water algae, flavour and odour producer algae, clean water algae and filter plug algae were identifed in Bayındır dam phytoplanktonic alg species (Anonymus 1989) and average number were given in the table.

Table 1. Phytoplanktonic algal flora ın Bayındır Dam Reservoır (BDR) (Ankara).

Phytoplanktonic species list of Bayındır Dam(Ankara)	Avarage*
CYANOPHYTA	
Chroococcus varius A.Braun *	+ + ++
Chlorella vulgaris Bayernick. ▫ *	+++
Merismopedia elegans G.M. Smith	+ ++
Gomphosphaeria aponina Kuetz.	+++
Spirulina laxissima G.S. West	+ + ++
Spirulina major Kuetz.	+ ++
Oscillatoria limnetica Lemm ▫ *	+ + + + +
Oscillatoria tenuis C.A. Agardh ▫ *	+ + +
Oscillatoria curviceps C.A.Agardh	++
Phormidium tenue (Menegh.) Gomont *	+ +
Anabaena circinalis Rabenhorst Δ ▫ *	+ +
Microcystis robusta Kuetz.	+ +
Aphanizemenon flos-aqua (Lemm.) Ralfs. Δ	+
CHLOROPHYTA	
Pediastrum boryanum (Turp.) Meneg	+ +
Pediastrum tetras (Ehrenberg) Ralfs	+ + +
Coelastrum pseudomicroporum Kors.	+
Coelastrum microporum Naeg.	+ + +
Chlamydomonas pseudopertyi Pascher	++
Scenedesmus acuminatus (Lag.) Chodat.	++
Scenedesmus armatus Chod.	++
Kirchneriella obesia (W. West) Schmidle	+ + +
Tetraedron minimum (A. Braun) Hansg. *	+ + ++
Closterium aciculare G.S. West	+ + +
Dictyospherium ehrenbergianum Näg.	+ +
Oocystis borgei Snow.	+ + + +
Oocystis parva W.&G.S.West	+ + +
Cosmarium botrytis Menegh.	+ +
Chlamydomonas globosa Snow. *	+ +
Spirogyra princeps Kütz. ▫ *	+
Spirogyra subsalsa Kütz. ▫ *	+ +
DINOPHYTA	
Peridinium cinctum (Muell.)Ehr. Δ	++
Ceratium hirundinella (Muell.) Dujardin Δ	++
EUGLENOPHYTA	
Euglena acus Ehr. *	+ +
Euglena elongata Schewiakoff *	+ ++
Euglena proxima Dangeard *	++
Lepocinclis fusiformis (Carter) Lemm. *	+
Trachelomonas hispida (Petry) Stein ▫	+ +
Phacus pleuonectus (O. Müller) Dujardin *	+
BACILLARIOPHYTA	
Achnanthes lopponica Hust.	+
Amphora ovalis (Kütz.) Kütz.	+ +
Amphora pediculus Kütz.	+ + ++
Cocconeis placentula Ehr.	+ +
Cyclotella meneghiniana Kütz. ◊▫	+ + + +
Cyclotella ocellata Pantock. ◊▫	+ + + ++
Cymotopleura elliptica (Breb.) W.Smith.	+ + +
Cymbella amphicephala Naeg.ex. Kütz. ▫	+ + +

Table 1. continued

Cymbella cymbiformis (Ag.) Ag. ▫	+ +
Cymbella helvetica Kütz ▫	+ +
Cymbella lanceolata Ag. ▫	+ + +
Diatome elongatum (Lyngby.) Ag. ▫	+ +
Diatomea vulgare Bory. ▫	+ +
Diploneis ovalis var. *oblanga* (Hilse) Cl.	+ +
Diploneis elliptica (Kütz.)Cleve	+ + ++
Epithemia sorex Kütz.	+ + +
Fragilaria intermedia Grun. ▫	+ +
Fragilaria constricta Ehrenberg ▫	+ +
Fragilaria virescens Ralfs ▫	+ + +
Gomphonema constrictum Ehr.	+ +
Gomphonema acuminatum Ehrbg.	+ +
Gomphonema olivacecum (Lyngby.)Kütz.	+ + +
Melosira varians Ag. ▫	+ + + ++
Navicula cuspidata (Kütz.) Kütz. ▫◊	+ +
Navicula lanceolata (Ag.) Ehr. ▫◊	+ + +
Navicula menisculus Schumann. ▫◊	+ +
Navicula minuta Kütz. ▫◊	+ + ++
Navicula radiosa Kütz. ▫◊	+ + +
Nitzschia amphibia Grun. *	+ + ++
Nitschia linearis W.Smith *	+ +
Pinnularia biceps Greg. ◊	+ + +
Stauroneus smithii Grun.	+ +
Stephanodiscus astrea (Ehr.) Grun.	+ + ++
Surirella angustata Kütz. ◊	+ + +
Surirella ovata ◊	+ + ++
Synedra capitata Ehr. Δ	+ ++
Synedra ulna (Nitzsch.) Ehr. Δ	+ + + ++
Synedra acus Kütz. Δ	+ +
Average number abundance of algae*	+ very little / ++ little / +++ normal / ++++ ample / +++++ very ample

** Dirty water algae; ◊ Clean water algae; Δ Flavour and odour producer algae; ▫ Filter plug algae*

Color differences were seen in the water that's come from the conjunction points of the river and the stream mouth in the region that's closer to the river enter of the identified dam station. This color differences were not caused by high alg growth it was caused by the soil and some materials that contaminate the dam source. But there wasn't this situation in other stations. The precipitation and the breaking of the water in cleaning period were caused this effect.

Table 2. The comparison of materials that effect drinking according to physical and chemical property of Bayındır Dam (ANKARA) TSE.

Parametres	Bayındır Dam (yearly average worths)	TSE	
		Min.	Max.
Colour, PT – Co Skalası	10 Unit	5 Unit	50 Unit
Turbidity, NTU	6.5 Unit	5 Unit	25 Unit
Floride, mg/l	0.2 Unit	1.0 mg/l	1.5 mg/l
Calcium, mg/l	44.0	75 mg/l	200 mg/l
Magnesium, mg/l	10.3	50 mg/l	150 mg/l
Sulphate, mg/l	30.2	200 mg/l	400 mg/l
Chloride, mg/l	14.2	200 mg/l	600 mg/l
pH	7.5	7.0 – 8.5	6.5 – 9.2
Odour and Flavour	Odourless normal	Odourless normal	Odourless normal
Nitrogen of nitrate, mg/l	0.060	1.5-mg/l	6 mg/l
Orto Phosphate, mg/l	<0.05	0.07-mg/l	0.4 mg/l

The organic materials of waste materials in dam lake water were mineralizeted and converted to harmless materials by the aid of some bacteria. To be formed this high amount of oxygen were needed. The dissolve oxygen amounts were measured as 6.6 mg/l.

The presence of dissolve oxygen was provided these activities. Also the high amount of these inorganic materials was removed from the environments by algae using in photosynthesis. Phytoplankton are used phosphorus in the form of orto phosphate. The high concentration phosphorus was rarely found in freshwater because the algae absorb the phosphorus from the water continuously. The phosphorus amount of Bayindir Dam is under the 0.005 mg/lt and in eutrophic lake has 0.09-1.5 mg/l phosphorus totally. It was possible to put forward an idea about the trophy level of dam by using the result of physical and chemical analysis of Dam Lake. According to this the Bayindir dam was mesoeutrophic pass periods because of the suitable structure of the dam bowl of the Bayindir Dam (Wetzel 1983). With this feature it can be said that the dam water has good quality (Table 2). The *Navicula* kind of the listed in table were represented in the term of high number of the variations.

The presence of individuals that is belong to this kind in high number is a situations absorbed in oligoeutrophic lakes.

The life of the dam water was affected by this parametres food material concentrations metal compound and other physical, chemical and biologic features when we compare the obtained bacteriologic and biologic data from the table any unreliable of situation were not found in dam water. İn the point of physical and chemical cares. Also when we look at the abundant of alg kinds pollute water algs, flavour and odour producer algae, clean water algae and filter plug algae we saw that filter plug algae were in abundance flavour and odour producer algae were in small amount, clean and dirty water algae were in normal level. Till now, there are some studies about phytoplanktonic algae in lakes and dam lakes at Turkey (Gönülol and Çomak, 1992, 1993; Cirik and Cirik, 1989; Altuner and Gürbüz, 1994 and Atici, 2001-2002a, 2001-2002b). The phytoplankton algae species which are determined in Bayındır dam are show similarity about the species variation with the algae which are determined in the other lakes.

The species of Bacillariophyta found 50 % of total species number (Table 3). There hasn't been found any algae species which will be reason to pollution in BDR.

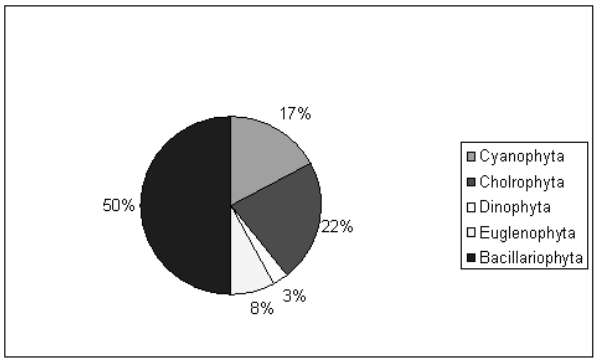

Table 3. Separation of algae according to division in BDR.

Suggestion

The wastes of the animal farm in the upper region of the down (Near the 2. station) the fertilizer and related waste soil erosion and pesticides form agricultural pollution. To decrease this kind of pollution the waste should be utilize in different ways instead of leaving the dam water directly.

Also the rain water and the canal water from inhabitation regions accumulate in dam. It may be useful leaving the dirty resource like this after refine application with a substructure study.

The arranging meetings with people to made conscious and to give information about this subject may be useful to carry on the productivity.

Environment of Dam Lake should be afforested to maximum the distance between the dam lake and agricultural area.

To get benefits from lake, small lake, dam lake, and river effectively ıt must be known the variety features of this environments also the organisms that's the first hoop of the food chain and acts as a oxygen recourses for other livings aquatic environments must be well known in ecologic and taxonomic respect.

Making use of the water product that's important protein resource and especially it is not utilize effectively in Turkey provides a lot of value.

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