Review of diversity, density and abundance of Karun River's phytoplankton (summer and winter 2012)

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Abstract: The study area was selected as the Karun River in Khuzestan from the branches of the beginning of Dez and Karkheh to Persian Gulf. This study was performed in the Karun River in summer and winter on 2012. Samples were taken at 11 designated stations with three replications. Phytoplankton is more sensitive to the environment where they live. Their Densities were 19,160 individuals per square meter in the summer and in winter 12,189 individuals per square meter that were significantly different. Among the categories identified, on average the highest frequency has belonged to Bacillariophyceae by 64.5% and the average density of 20,175 individuals per square meter, Cyanophyceae with 18% and the average density of 6,042 individuals per square meter, Chlorophyceae with 6%, and the average density of 2,036 individuals per square meter, Dinophyceae with 5.5%, and the average density of 1,684 individuals per square meter, Chrysophyaceae with 4% and the average density of 756 individuals per square meter and Euglnophyaceae with 2% and the average density of 656 individuals per square meter. The most abundance of phytoplankton the two seasons of sampling was observed at The Dez station (Station 6) and the lowest abundance at Saponification Khorramshahr station (Station 10). The results of biological indicators have indicated that the highest Shannon index has been related summer season with 2.058 ± 0.09 at the Zargan station and the lowest frequency has been recorded in the Shatit station (0.546± 0.36) in the summer. Also the highest Simpson's dominance index has been recorded in the Shatit station (0.826± 0.36) and the lowest at Zargan station (0.288± 0.36) in the summer. The other hand, the highest of Camargo's index has seen at the Gatvand station (0.624 ± 0.07) in the summer and the lowest frequency (0.213± 0.09) has been in the summer at the Shatit station. The highest of Berilion index has been recorded (4.11± 0.1) at the Gatvand station and the lowest (1.21±0.01) at the Shatit station in the summer. There are significant differences in terms of biological indicators among stations and seasons.
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1. Introduction

Phytoplankton is the most important aquatic organisms who are able to perform photosynthesis as the first ring on the food chain of aquatic ecosystems. They have a high nutritional value in all water resources due to the pigment carotene, various vitamins, fatty acids and proteins.

As well as their populations are very sensitive to the environment in which they live And any changes in the environment lead to changes in the abundance, diversity and dominance of phytoplankton communities in habitats. These communities are living in the virtually every ecosystem; the population of phytoplankton can be used as a useful tool For the Study of biological control and assessment of water pollutants. Phytoplankton is biological clarifiers of water resources and adjusts the PH environment and is indicators ecological status of the environment (Ekwu, A.O. and F.D. Sikoki, 2006).

So far several studies have been done to identify and evaluate of phytoplankton diversity, distribution and population density in the world and Iran. A study was conducted in Tajan River. In this study, have been investigated plankton, fish and plants in the river at 4Station. 34 species of phytoplankton were identified in 4 categories. A study was conducted as Limnologic study an ecological balance of domestic water (Shadegan) by the Department of Environment of Khuzestan province. In this study has investigated the effects of physical and chemical factors of water on phytoplankton populations Shadegan wetland.

A study was conducted as evaluate the distribution and abundance of plankton in the Karganrod river that this study led to the identification of 4 branches and 16 phytoplankton species. Most species were observed, which has corresponded to the branch of Bacillariophyceae.

A study was conducted to identify phytoplankton and water quality in the Bahmanshir River (from hafar branch up the estuaries of the Persian Gulf River) in the

12 months of sampling at 5 stations. The results are expressed in 5 classes and 52 genera of phytoplankton in this area. Unrein and et.al (1999) has studied the structure and dynamics of phytoplankton in Antarctic Lake in Argentina. Quantitative and qualitative analyzes of phytoplankton with limnological characteristics analysis is the first study with the aim in the lake (Anrein &vinocur 1999).

A study as the flagellated algae (Chrysophyaceae, Dinophyceae) in 48 mountain lakes southern part of eastern Alpine has reviewed the effects of physical and chemical factors of water on mentioned algae. 68% of the population of reviewing flagellate algae was belonging to the Chrysophyaceae category (Tolotti & Monica2003).

A study has been performed with as impact of hydro chemical factors of water on phytoplankton populations in tropical wetlands of India, Gujarat and Kenval. In this study has been investigating the effect of physical and chemical factors of water on phytoplankton populations (Kumar, 2008). Karun River is the longest and the most watery rivers in Iran.

It is located in the main body of the Khuzestan Province. Karun River is 950 km long and its extent of the catchment area is 60,000 sq.

These rivers originate from the Zagros Mountains in the region known as Gatvand and enter into the Khuzestan plain. Karun River joins the Arvand Rud in Iran-Iraq border and enters the Persian Gulf. This river is the Iranian largest river in terms of case of discharge capacity (4). For the reason this is an important point. .

So that is dependent on more than 70 per cent of the 4 million people living in Ahwaz and Abadan and Khorramshahr to the Karoun and its branches ; Therefore, information about the surface water of quality provides the possibility, In addition to use it's for various cases; it is causing will be adopted methods with minimal damage to water resources.

The purposes of this study are the use of presented biological indicators and diversity, density and abundance of phytoplankton, and realize the impact of diversity and abundance on ecosystem then proceed to running Management plans and improve the environment.

2. Material and methods:

The studied stations on the Karun River such a way have been considered to cover the whole intervals of the river.

Thus, according to geographical situation and hydrological of the river, the samples were taken from 11 following stations respectively and continually: Kvpyth, Gatvand, Bndmizan, Shatit, Gorgor, Dez, Zargan, sixth Bridge of Ahvaz, the third of khordad bridge, saponification in Khorramshahr, Samen alaeme bridge.

In Figure 1 is determined by the position of the station. Location of stations is selected based on the actual situation and availability in the river.

Figure 1: Location of study stations in the Karun River (Summer 2012 – Winter2012)

Phytoplankton sampling was performed three replications using 10-liter buckets per station that in each iteration has passed 30 liters of net phytoplankton and finally crossed 90 liters of water from tour and filtered water is collected in the tour collection tank.

The appropriate amount of the formalin 5% was added to the sample container to maintain the appropriate amount. In order to identify and enumeration of phytoplankton, after homogeneous and stirring the sample, 1 cc of it was transferred to slide chamber by the pipette and was examined by inverted microscope with lenses 20 and 40.

To increase the accuracy in counting, each sample was counted 3 times under the microscope and then the mean numbers were counted at 3 times was reported as the main number.

Total counted phytoplankton were calculated as the following procedure (Formula clesceri 1989) and extended to the whole of filtered water of the net plankton and finally has calculated the number of phytoplankton in a liter of water of the river. In order to calculate the frequency of a liter of the river water has been used in the following formula Avila, I.R et.al 2004).

$$N = \frac{C \times Vf}{Vt \times Vm}$$

N= The Number of samples in a liter of water
C= counted Phytoplankton numbers under a microscope (cell/l)
V_F = Volume of filtered water (sample size) per ml.

V_T = the total volume by taking water per liter of each sample

V_m = volume of the sample under the microscope per milliliter

The ecological methodology software has used to calculate the index of diversity, dominance and evenness. It also was used software SPSS for the statistical analysis.

3. Result:

Class	species	summer	winter
Baciliarophyceae	*Fragilaria*	1011	241
	Melosira	214	102
	Cymbella	86	57
	Synedra	4235	1170
	Gyrosigma	1524	728
	Naviculla	1546	1381
	Surirella	1745	1057
	Nitzschia	3081	1245
	Stephanodiscus	912	1150
	Bacillaria	31	26
	Plerosigma	53	-
Chlorophyceae	*Strastrum*	214	111
	Pediastrum	226	85
	Scenedesmus	691	238
	Coelastrum	135	59
	Actinastraum	5	-
	Spirogira	180	75
	Closterium	17	-
class	species	summer	winter
Cyanophyceae	*Merismopedia*	765	528
	Oscillatoria	1596	2318
	Anabaena	182	120
	Anabaenopsis	161	56
	Spirulina	221	95
Dinophyceae	*Ceratium*	269	160
	Peridinium	509	746
Chrysophyaceae	*Dinobryon*	895	45
Euglnophyaceae	*Euglena*	246	401

In the whole study period gathered an average of 33452 individuals Phytoplankton in the square meters.

On average the total abundance of phytoplankton at the stations indicates that Dez Station (Station 5) has the highest frequency with 7472 individuals per square meter and saponification of Khorramshahr station (station 10) have the minimum frequency with 290 individual per square meter.

The highest frequency percentage and the average among identified groups in 2 sampling seasons Belongs to the class Bacillariophyceae with 70 %t and (14438) in summer and lowest frequencies is related to the categories of Euglnophyaceae.

In winter the highest frequency percentage 59% and the average of density (7152) is related to the class Bacillariophyceae and the lowest frequency percentage is relevant to the category Chrysophyaceae.

The relative frequency of phytoplankton groups identified in the summer and a winter season is shown in Chart 1 and Chart 2.

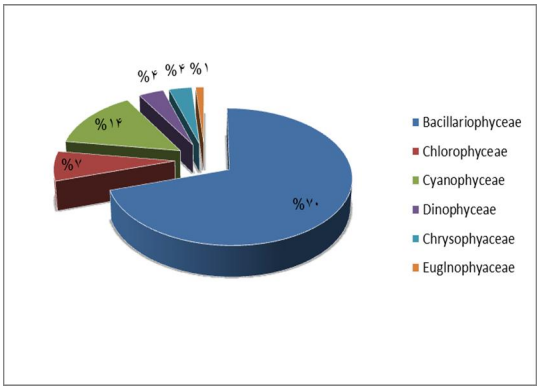

Figure1: The relative frequency of phytoplankton classes in the Karun River (Summer 2012)

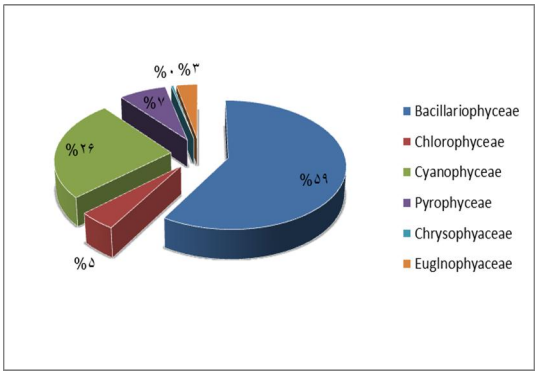

Figure2: The relative frequency of phytoplankton classes in the Karun River (winter 2012)

Average of phytoplankton group's density, Bio-variety of Shannon index and Simpson dominance, and Camargo evenness and Berilion index calculated for all stations sampling in the two seasons.

The results of biological indicators have indicated that the highest Shannon index has been related summer season with 2.058 at Zargan station (7 station) and the lowest frequency (0.546)has been recorded in the Shatit station (4 station) in the summer.

Also the highest Simpson's dominance index (0.826) has been recorded in the the Shatit station (4station) and the lowest (0.288) at the Zargan station (2station) in the summer. The highest of Camargo's index (0.624) has seen at the Gatvand station (2station)

in the summer and the lowest frequency (0.213) has been in the summer at the Shatit station (4station).

The highest of Berilion index has been recorded (4.11) at the Gatvand station (2station) and the lowest (1.21) at the Shatit station (4station) in summer. Shannon diversity index with Chlorophyceae and Cyanophyceae showed at 0.01 a positive significant correlation in summer. The Simpson dominance index with the Cyanophyceae, Euglnophyaceae has negative significant correlations at 0.01 and with Chlorophyceae at 0.05. Camargo's evenness index showed a positive significant correlation with the Cyanophyceae at 0.01 and Euglnophyaceae at 0.05.

Berilion diversity index with Cyanophyceae has been a positive correlation the 0.01. Shannon diversity index with Dinophyceae and Euglnophyaceae have been at 0.01 a positive significant correlation and a negative significant correlation with Chrysophyaceae in winter. Also it showed a positive significant correlation with Chlorophyceae and Cyanophyceae and a negative significant correlation with Baciliarophyceae at 0.05. Simpson dominance index with the Chrysophyaceae have a positive significant correlation and negative significant correlations with Chlorophyceae, Cyanophyceae and Dinophyceae at 0.01.

Camargo's evenness index has been a negative significant correlation with the Chrysophyaceae and a positive significant correlation with Dinophyceae at 0.01. Also it showed a negative significant correlation with Baciliarophyceae and a positive significant correlation with Cyanophyceae at 0.05.

4. Discussion

In this study, a dynamic model was developed to simulate composting processes of solid waste based on the thermodynamics and kinetics of microbial growth. The model provided an excellent vehicle for explaining and demonstrating the complex interactions which occur in the composting processes. Variations of compost indexes, such as substrate degradation, temperature fluctuations, moisture exchanges, and oxygen concentration were simulated for a readily composted input mixture.

The model could be used to optimize operational parameters. For example, it was used to develop different aeration regimes through controlling the oxygen concentration in exhaust air to optimize the composting processes and reduce the air flow. Another component should be controlled is the initial moisture content, the effect of initial moisture content on the composting processes was significant.

If the initial moisture content was too high or too low, it would reduce the rate of substrate degradation. Particularly, when moisture content was more than 71.5% or lower than 33% the composting processes was impossible. The simulation result was consistent with results of pilot scale experiment.

It was found that function of air supply in the later stage was mainly cooling compost bulk. Developed numerical model could be used to help identifying more cost-effective operation condition for composting processes. Adjusting operation conditions through changing key factors, optimal operation condition could be determined through comparing the results of numerical simulation.

In this study, the optimal way of air supply was designed with the help of numerical model. Real experimental results showed that it could reduce 79.61% of oxygen supply with the same compost efficiency. Therefore, developed numerical model is of great significance to instruct the operation of real composting processes and reduce the operation cost.

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