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ISOLATION IDENTIFICATION AND ROLE OF ALGAL BLOOMS AT MAHANADI RIVER ARANG (DIST- RAIPUR) (C.G.)

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ABSTRACT

Blooms of Algae at Mahanadi River Arang were studied through observation from feb. 2017 to april 2017. Arang, a prosperous ancient town, is located on the west bank of the Mahanadi River, Raipur District in Chhattisgarh, at 21.2°N 81.97°E. It has an average elevation of 267 metres (876 ft). Algaal blooms, often composed of oceanic plants called phytoplankton, are potentially harmful to the marine life, water quality, human health and desalination plants, a chief source of potable Water. Algal blooms represent a natural phenomena caused by a mass proliferation of phytoplankton in water bodies. Many algal blooms are benign in their effects, especially in the ecosystem in which they reside; however some species of algae can have significant negative impacts on humans. Harmful algal blooms (HABs) are algal blooms that produce toxic or otherwise harmful effects on humans or on fish, marine mammals and characteristics of the ecosystem that humans value. For example, the toxins produced by some HABs can cause shellfish contamination, fish kills and respiratory irritation or illness in humans. These negative biological impacts often generate negative economic consequences that are borne by the affected residents, tourists, governments and businesses. Regions that have endured a HAB event often experience economic impacts due to the environmental effects of HABs. Some of these impacts are direct, such as the cost of health care for affected humans, expenses associated with rescue efforts for marine mammals, the cost of collecting data and monitoring the development of blooms, expenses to remove dead fish from beaches, and lost revenue for the marine-related businesses (e.g., commercial fishing, seafood markets, water proximate restaurants, coastal lodging, and marine-based activity rental fees). Other impacts may be indirect and more difficult to quantify such as the value of lost recreational opportunities of

visitors or lost wages to residents. In short, the socioeconomic costs of HABs can be wide and varied.

INTRODUCTION

Algal blooms represent a natural phenomena caused by a mass proliferation of phytoplankton in water bodies. The main groups of organisms generating HABs are diatoms, dinoflagellates and cyanobacteria. Algae are aquatic plants and are a natural part of the Swan and Canning rivers and estuary, as they are in waterways throughout the world. They include microscopic plants called phytoplankton and large plants often referred to as macroalgae or seaweeds. Algae are important because they oxygenate the water and contribute to the production of organic matter through photosynthesis. This productivity is the basis of the food web that supports all other aquatic organisms, from the microbes that decompose dead matter to zooplankton, fish and birds. When human activity alters the balance of the natural system, such as increasing nutrients (food for algae) and changing water flow (usually reducing it) that enters the rivers and estuary, algae often respond by growing rapidly in vast numbers and becoming a nuisance. Most algal blooms are harmless; they may discolour the water but do not pose a problem for the rivers, wildlife or humans. On occasion however, they are toxic and because of the health risk to people, waterways may be closed to recreational use (swimming, fishing, boating, etc.). Microscopic plants (usually algae) and bacteria that photosynthesise. They are often single celled and fl oat in the water. They support other life by releasing oxygen to the water and atmosphere, are essential to the food chain and are only a problem if they bloom excessively, are toxic, create a nuisance or decompose in large amounts, using up oxygen in the water and creating unpleasant smells. When conditions are favourable for growth (i.e. when there is a good supply of nutrients, warm temperatures, calm waters and abundant sunlight), phytoplankton can multiply rapidly producing extremely high numbers of cells. When this happens it is known as a bloom. An Algal blooms is a rapid increase or occumulation in the population of algae in freshwater or marine water system and are recognized by the discoloration in the water from their pigments. Cynobacteria blooms are often called blue-green algae. Blooms which can injure animals or the ecology are called “harmful algal blooms”(HAB), and can lead to fish die-offs, cities cutting off water to residents or states having to close fisheries. Phytoplankton are microscopic organisms which form the base of the marine food web and account for 50% of global primary productivity (F. E. Fritsch 1935). However, when dense blooms of phytoplankton occur, they disrupt marine ecosystems and human activities (Shumway 1990, Glibert et al. 2005). Deleterious effects

caused by certain freshwater microalgae include risks to human health, impacts on marine ecosystems such as mortality of water species via toxins or anoxia, and impacts on the recreational use of coastal areas such as economic losses due to decreases in tourism (Zingone and Enevoldsen 2000). Algal blooms can present problems for ecosystems and human society. Since "algae" is a broad term including organisms of widely varying sizes, growth rates and nutrient requirements, there is no officially recognized threshold level as to what a defined as abloom. For some species, algae can be considered to be blooming at concentration reaching millions of cells per ml, while others form blooms of tens of thousands of cells per liter.

The photosynthetic pigments in the algal cells determine the color of the algal bloom, and are thus often a greenish color, but they can also be a wide variety of other color such as yellow, brown or red, depending on the species of algae and the type of pigments contained there in. bright green blooms in freshwater systems are frequently a result of cynobacteria (colloquially known as blue-green algae) such as Microcystis. Blooms may also consist of macroalgal (non-phytoplanktonic) species. These blooms are recognizable by large blades algae that may wash up onto the shoreline. Eutrophication, of a river or water body, refers to the effects of increases in nutrient inputs caused by human activity in the estuary and its catchment. Estuaries naturally accumulate nutrients and sediments from their catchments, but this takes place over thousands of years, giving time for the plants and animals to adapt. Accelerated changes caused by human-induced eutrophication lead to extreme responses in the biota, such as sudden accumulations of macroalgae and large phytoplankton blooms, including toxic blooms that threaten human health, result in poor water clarity and lowered oxygen levels, and often lead to fish deaths and unpredictable water quality. Current water quality problems in the Swan-Canning estuary are largely due to the combined nutrient inputs from diffuse and small point sources spread across the urban and rural catchments. Diffuse and small nutrient sources are more difficult to identify, control and manage. The algae that now cause problems are not seaweeds or macroalgae, as was the case in the past, but microscopic phytoplankton (microalgae).

For example the cyanobacterium (blue-green algae) *Microcystis aeruginosa* does especially well in freshwater and low salinity conditions when nutrients are high, water temperature warm, days are long and conditions calm. This species can create adverse conditions for other potential competition species. Another example includes the dinoflagellate species

Scrippsiella that has a number of characteristics that give it an advantage over its algal competitors, especially during summer-autumn when salinity stratification is common in the upper reaches of the Swan River. A dinoflagellate uses its two flagella (whips) to stay near the surface during the day to photosynthesize and at night to migrate down the water column to absorb nutrients generated by bottom sediments and salt wedge conditions, i.e. stratified conditions. Harmful algal bloom (HAB) events involving toxic or otherwise harmful phytoplankton such as dinoflagellates of the genus Alexandrium and Krenia, or diatoms of the genus Pseudo-nitzschia. Dense blooms of algae, called harmful algal blooms (HABs), have been increasing in frequency, intensity and global distribution (Hallegraeff 1993, Anderson et al. 2012). Although HABs are natural phenomena occurring throughout history, range expansions driven by climate change, eutrophication and ship ballast water translocations continue to threaten new areas (Hallegraeff and Bolch 1991, Doblin et al. 2004, Hallegraeff 2010). Human health problems can occur after direct recreational contact with or consumption of toxic phytoplankton. Acute poisoning and fatalities can occur after the consumption of shellfi sh that have been contaminated with algal toxins.

MATERIALS AND METHODS

Study Site:- Blooms of Algae at Mahanadi River Arang were studied through observation from feb. 2017 to april 2017. Arang, a prosperous ancient town, is located on the west bank of the Mahanadi River, Raipur District in Chhattisgarh, at 21.2°N 81.97°E. It has an average elevation of 267 meters (876 ft).

Sample Collection:- Water samples with visible microalgal population were collected from the River that are located in the Mahanadi Arang. Sampling of large bodies of fresh water occurred at multiple site along the waterfront. Collections were made for the top and bottom of the water in sterilized bottles.

Preservation:- All feild samples(Algal samples) were collected in sterilized bottles with 1% Formaline Solution for further study.

Morphological Identification:- Collected all Algal samples observed under Bilocular Microscope for identification. The identification done with standard Litterature and other related book G. Smith Cryptogemic Botany (Vol.1), F. E. Fritsch (1998) Structure and Reproduction of Algae(Vol.1), R. E. Lee (2008) Phycology (4^{th} edition), Pettersson, Lase H. et al (2013) Monitoring of harmful Algal Bloom.

WATER SAMPLE ANALYSIS:- Accurate testing of drinking water is crucial to maintaining the health and safety of Islanders who rely on this resource. Blue green algae is a photosynthetic bacteria which grows in both fresh and marine water. Most typically, blue green algae grows in lakes, ponds and slow-moving streams where the water is warm and nutrient-rich. Most species are buoyant so float to the water's surface and form layers of scum known as algal blooms. It is able to multiply because it's generally not eaten by any other species. Algal blooms can be very noticeable because of the smelly scum that can form on the surface of the water, however there are not always visible signs of it in water bodies. This is where a blue green algae test comes in. It's important to monitor levels of blue green algae in water because blooms can have a devastating effect on a body of water. It causes discoloured water, reduced light penetration, dissolved oxygen penetrations during die-off, and toxin production. A reduction in light penetration affects other aquatic organisms in the habitat, such as phytoplankton and aquatic plants that need light for photosynthesis.

Water samples takes in small bolltes in tops and bottom of the River, then perform the test for further study:-

Color:- Drinking-water should be colourless. Colour in drinking-water may be due to the presence of coloured organic matter, e.g. humic substances, metals such as iron and manganese, or highly coloured industrial wastes, Microorganism present in water like microalgae, phytoplankton. Changes in the colour of water and the appearance of new colours serve as indicators that further investigation is needed.

Taste and Odour:- Odours in water are caused mainly by the presence of organic substances. Some odours are indicative of increased biological activity, such as include organic compound, microorganism, phytoplankton. As water should be free of objectionable taste and odour, it should not be offensive to the majority of the consumers. If the sampling officer has reason to suspect the presence of harmful contaminants in the supply, it is advisable to avoid direct tasting and swallowing of the water. Under these circumstances, a sample should be taken for investigation to a central laboratory.

pH:- pH of water measured in a specific scale are called pH scale, then level 0-14. The term "pH" refers to the measurement of hydrogen ion activity in the solution. Since the direct measurement of the pH is very difficult, specific electrodes are needed for quick and accurate pH determination. pH is measured on a scale of 0 to 14, with lower values indicating high H+

(more acidic) and higher values indicating low H+ ion activity (less acidic). A pH of 7 is considered as neutral. Every whole unit in pH represents a ten-fold increase in or decrease in hydrogen ion concentration. Most natural waters possess the pH values ranging from 5.0 to 8.5. Rain water have a pH value of 5.4 to 6.0 which then reacts with the soils and minerals causing the reduction in H+ ion concentration and thus the water may become alkaline with a pH 0f 8.0-8.5. More acid water (pH<5) and more alkaline (pH >9) and other immediate changes in the hydrogen ion concentration (pH) suggest that the quality of the water is adversely affected due to the introduction of some toxic contaminants in water bodies.

Biochemical oxygen demand:- Biochemical oxygen demand (BOD, also called biological oxygen demand) is the amount of dissolved oxygen needed (i.e., demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of sample during 5 days of incubation at 20°C and is often used as a surrogate of the degree of organic pollution of water. Most natural waters contain small quantities of organic compounds. Aquatic microorganisms have evolved to use some of these compounds as food. Microorganisms living in oxygenated waters use dissolved oxygen to oxidatively degrade the organic compounds, releasing energy which is used for growth and reproduction. Populations of these microorganisms tend to increase in proportion to the amount of food available. This microbial metabolism creates an oxygen demand proportional to the amount of organic compounds useful as food. Under some circumstances, microbial metabolism can consume dissolved oxygen faster than atmospheric oxygen can dissolve into the water or the autotrophic community (algae, cyanobacteria and macrophytes) can produce.

Dilution method for BOD- The BOD test takes 5 days to complete and is performed using a dissolved oxygen test kit. The BOD level is determined by comparing the DO level of a water sample taken immediately with the DO level of a water sample that has been incubated in a dark location for 5 days. The difference between the two DO levels represents the amount of oxygen required for the decomposition of any organic material in the sample and is a good approximation of the BOD level.

1. Take 2 samples of water.
2. Record the DO level (ppm) of one immediately using the method described in the dissolved oxygen test.

3. Place the second water sample in an incubator in complete darkness at 20oC for 5 days. If don't have an incubator, wrap the water sample bottle in aluminum foil or black electrical tape and store in a dark place at room temperature (20oC or 68 °F).
4. After 5 days, take another dissolved oxygen reading (ppm) using the dissolved oxygen test kit.
5. Subtract the Day 5 reading from the Day 1 reading to determine the BOD level. Record final BOD result in ppm.

When BOD level is :-

1 -2 :- Very good

3 -5 :- Fair: Moderately Clean

6 -9 :- Poor: Somewhat Polluted

100 or Greater :- Very Poor: Very Polluted

ANALYSIS OF DATA

In present work survey was done in Mahanadi River Aarang, Raipur (C.G.) for the Isolation Identification and Role of Algal Blooms at two different sites of Mahanadi River. In first done sample collection at River, then isolation identification of algal species, Water sample analysis and role of Algal blooms information was gathered on Mahanadi River. After isolation and slide preparation of algae identification was done with the help of bilocular microscope with standard literature. All of the isolates were categorized based on the morphological appearance under Bilocular microscopic cellular appearance of the isolated colonies. Isolates include many common green microalgae and cynobacteria. The isolated strain of microalgae ranged fron unicellular to filamentous in form. The majority of our isolated strains were identified at the genus level based on microscopic morphological examination. Algal species of study site and photographic documentation listing of species with this effect. The specimen were collected during field tour after then identification and nomenclature was done. After then a study was carried out to access the suitability of potable water used for domestic activities in selected study area. Several water quality parameters such as colour, taste and odour, pH and BOD were measured. The water samples in two study site were test done with color, taste, odour, pH and BOD.

RESULTS

A large number of algal species belonging to the tribal community are collected from the two different study site and this sites the total number 10 algal species belonging to 9 families and

10 genera have been reported in Mahanadi river Aarang, Raipur. Family wise distribution of dominant families of Algae show Cynophyceae, chlorophyceae and Bacsillariophyceae.

Table 1 Showing the family with number and name of species & genera in study area site 1:-

SN.	Algal species description			Genera	Species
	Family	Genus	Species		
1.	Cynophyceae	Ocsillatoria	priceps	3	3
		Nostoc	muscorum		
		Anabeana	circinalis		
2.	Chlorophyceae	Volvox	globater	2	2
		Eudorina	elegans		
3.	Bascillariopphyceae	Pinnularia	viridis	1	1

Table 2 Showing the family with number and name of species & genera in study area site 2 :-

SN.	Algal species description			Genera	Species
	Family	Genus	Species		
1.	Cynophyceae	Scytonema	simplex	3	3
		Rivularia	mehrai		
		Microcystis	aeoruginosa		
2.	Chlorophyceae	Zygnema	czurdae	1	1

Water samples collected from two different sites of study sites in Mahanadi River for analysis. Water color appearance greenish blue color in both site. Other test of Water samples show in following table.

Table 3 Showing the Water sample Analysis on two different site of study site :-

SN.	SITE	COLOR	ODOUR & TASTE	pH	BOD
1	Site 1	Greenish - blue	Nuisance	7.5	9.0
2	Site 2	Greenish	Nuisance	8.0	12.0

DISCUSION

Most harmful algal blooms result from the transport of off shore populations to inshore regions, i.e., physical relocation independent of human activities. Examples of the importance of water circulation and bloom events abound. The largest blooms observed, those of Trichodesmium in the open ocean, occur far from any coastal inputs, (Sellner 1992).

In the beginning of 19th century when microscope developed into a workable tools many European biologists started taking interest in the study of Algae. Roth (1797-1805)

discovered and described *Hydrodictyon*, *Batrachospermum* and *Rivularia*. Turner (1802) described fertilization in *Fucus*. H.E. Link (1820-1833) worked out the Algae of Germany asnd described *Tetraspora*, *Oedogonium* and *Spirogyra*. M.S. Randhawa (1931-1959) worked on *Zygnemaceae*, *Oedogoniales* and *Vaucheriaceae* of Punjab and U.P. He contributed the a number of papers recording 70 species of Zygnemaceae which included one new species of *Debarya*, 2 of *Mougeotia*, 2 of *Zygogonium* and 11 of *Spirogyra*. His monograph on the *Zygnemaceae* is monumental. The present work show the 10 algal species with 3 family and 10 genera in Mahanadi River Aarang, Raipur (C.G.).

Excluding fat, water composes approximately 70% of the human body by mass. It is a crucial component of metabolic processes and serves as a solvent for many bodily solutes. Water is essential for the growth and maintenance of our bodies, as it is involved in a number of biological processes. The amount of water needed varies with the individual, as it depends on the condition of the subject, the amount of physical exercise and on the environmental temperature and humidity. An individual's thirst provides a better guide for how much water they require rather than a specific fixed quantity. In terms of mineral nutrients intake, it is unclear what the drinking water contribution is However, inorganic minerals generally enter surface water and ground water via storm water runoff or through the Earth's crust. Treatment processes also lead to the presence of some minerals. Examples include calcium, zinc, manganese, phosphate, and sodium compound (Greenhalgh, 2001). In present work The water samples in two study site were test done with color, taste, odour, pH and BOD.

CONCLUSSION

The results of the study shows that the 10 Algal species were isolate and identify from the two sites of study area of Mahanadi river Aarang, Raipur. This sites the total number 10 Algal species belonging to 9 families and 10 genera have been reported in Mahanadi river Aarang, Raipur. Family wise distribution of dominant families of Algae show Cynophyceae, chlorophyceae and Bacsillariophyceae.

After then a study was carried out to access the suitability of potable water used for domestic activities in selected study area. Several water quality parameters such as colour, taste and odour, pH and BOD were measured. The present study indicates the polluted condition of the water resource which will have serious effects. Water samples color are show yellowish and greenish appearance and odour are nuisance in both study area site 1 and site 2. In Study site

2 BOD of Water sample are more than Study site 1, so it is very polluted. Water sample pH of Site 2 are higher then site 1 i.e. more alkaline.

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