INTRODUCTION
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Water is the most abundant substance in our planet. It covers more than 75% surface area of the earth. Chemically water is H₂O where the Hydrogen forms quadrinate bond. Positioning of the electron in a water molecule makes the molecule dipolar with slightly negative charge over the oxygen and similarly slightly negative charge over the two hydrogen atoms. With the conditions of the earth, the substance exists mostly as liquid. With dipolar properties of the molecule in liquid form none of the drops of natural water is pure H₂O. Always some or the other element or molecule is found dissolved in solution or colloidal form. Natural water may be broadly categorised into saline and fresh water. Saline water also called oceanic water, contains salinity at about 35‰ while the fresh water has salinity at at about 5% with much variation in salinity of water from different places. In general, saline water is present in oceans, while fresh water is present inland. However, either of them can be present in either of the areas. Of the total water in our planet about 97% is in oceans, remaining water is inland. Of the total water not more than 0.02 % is in the form of surface fresh water in the rivers, ponds and lakes. All the life forms with osmotic properties of tolerating only the fresh water depend upon this meagre proportion of water including the water present in the surface layer of soil up to the rooting depth and some amount of extractable ground water, through tube wells.

Water, possessing evaporative property is lost to the atmosphere from the earth surface. This loss is compensated through return of water mostly in the form of liquid with some amount of solid water falling over the earth surface with a little amount of vapour condensing over the earth surface structures. The periodicity of return of water is not uniform throughout the year, hence, during lean period the water received during rainfall period has to be used. In areas of human settlements with seasonal distribution of rainfall and not having natural, surface water storing structures, artificial structures have been created for the storage of water. Artificial structures, on the basis of their sizes had been named as ditches (bowly), pond, tarn and lake in increasing order of size.
Chhattisgarh region receives annually about 160 c.m. rainfall, about 90% of it is received within a span of 3 rainy months (15th June to 15th September). Ponds and tarns had been the most common structures for the storage of water. These surface water bodies not only fulfill the human requirement but also help in the recharge of ground water. The knowledge and technology about the extraction of ground water has resulted not only in stopping the construction of new ponds, contrarily a trend of reclaiming the ponds has started. Therefore, since last about 75 to 100 years, except for the construction of the dams there had been rarely any addition to the number of ponds. However, recently significance of ponds has been recognized resulting in promoting the maintenance, management and construction of new ponds. Chhattisgarh region is famous for its ponds. Plain area of the state is abutted with ponds with the number and volume of ponds in a village, town or city, in proportion to the population size of the place. During the few decades population has increased several times but is still depending upon the water in the ponds, constructed centuries ago has resulted in condemnable abuse of the water in ponds, mainly through in the mixing of fecal matter, either in raw form or as sewage.

The meagre amount of fresh water available on the earth surface is being burdened heavily with pollutants. Pollutants through domestic industrial and agricultural sources all are allowed to mix freely with the natural surface water, each of them had their own contributions. Domestic waste has higher proportion of organic matter. It is rich also in N, P but heavy metals are in traces. Quality of industrial effluents, with respect to their physico-chemical properties, depends mainly upon the type of the industry. However, the type of raw material, technology, water available and waste water generated for each unit of production had their effects on the quality of waste generated. Liquid effluents may be rich in nutrients resulting in eutrophication of the receiving water body, may be rich only in organic matter causing dystrophication of the receiving water body or may be rich in toxic substances. However, the liquid effluents are mostly a mixture of above category of substances in various proportions and concentrations.

All the three subspheres of our biosphere viz: hydrosphere lithosphere and atmosphere, called nature in common terminology, have the ability to maintain
stability. The stability is maintained through various physico-chemical and biological processes, involving recycling the substances. At the time, in the past, when the substances categorised as toxic or hazardous were small in amount, above mentioned processes of the nature were able to take care of such substances keeping the nature (environment) free from such substances. Over emphasizing this ability of nature, amount of toxic and hazardous substances released into the nature were increased to the extent, which was far beyond the capability of the cleaning ability of the nature resulting in the accumulation of substances posing threat to the existence of mankind itself. It is important, therefore, to evaluate the type and concentration of undesirable substances in the environment.

Heavy metal pollution in aquatic ecosystems, through intensive industrialization, urbanization and agricultural practices, is of serious concern to mankind. Planktons are located at the beginning of the food chain. Heavy metal pollution can remove them, resulting in complete destruction of the system.

Heavy metal, a term although often not rigidly defined, is generally held to refer to those metals having a density $> 5 \text{ gm cm}^{-3}$ (Passow et al 1961, Whitton and Say, 1975). As pointed out by Niebour and Richardson (1980), the term is used where there are connotations of toxicity and so data on lighter elements are sometimes included in general accounts of heavy metals. Niebour and Richardson (1980) proposed that it be abandoned entirely in favour of a classification separating metal ions into those which are nitrogen / sulphur – seeking and those which are intermediate. The separation of some essential and nonessential metal ions into class A (Ca, Mg, Mn, K, Sr and Na), borderline (Zn, Pb, Fe, Cr, Co, Ni, As and Va) and class B (Cd, Cu, Hg, and Ag) appears to be the most useful. According to this classification scheme of Nieboer and Richardson (1980) all “heavy metals” belong to either the “Borderline” or “B group”. Among ecotoxicologists, the term heavy metals is generally used to refer to metal that have been shown to cause environmental problem.

Some heavy metals, are needed by living organisms for various metabolic processes (Whitton and Say 1975). At high concentrations, heavy metals are almost always toxic to all types of organisms. Heavy metals cannot be eliminated from a
water body as they persist in sediments from where they are slowly released into the water with their release from sediments, heavy metals pose serious hazards to aquatic organisms including algae. There are differences in the degree to which various species of algae react to the environmental concentration of heavy metals. The essential elements such as Cu, Zn, Fe, and Co have important biochemical functions in algae. The concentration of these trace elements is generally higher in the organisms than in the aquatic system and if it is otherwise, the metal content in the organism is regulated by homeostatic control mechanism (Bryan and Hummerstone 1973). At higher concentrations of heavy metals the homeostatic mechanisms get disrupted. Thus, during bioaccumulation of the heavy metals, the organism may be damaged. (Venkataraman et al 1992).

Trace amounts of copper are essential for metabolic processes of algae (O'Kelly, 1974, Sorentino, 1979), it has particular significance for plastocyanin. Copper at higher concentration inhibits growth as well as photosynthesis of algae (O'Kelly, 1974, Thomas et al, 1977, Gupta and Arora, 1978, Whittaker et al, 1978 and Rai et al, 1981b). Copper also affect permeability of plasma membranes causing loss of potassium from algal cell (McBrien and Hassal, 1967, O'Kelly, 1974). The most detailed study of Cu as an algicide is that of Elder and Horne (1978), they had found that blue green algae are especially susceptible to Cu toxicity primarily because of the inhibition of nitrogen fixation.

Zinc is an important micronutrient for growth and metabolism of various algae. Zinc plays a vital role in maintaining the integrity of ribosomes. At high concentration, zinc inhibits the growth of various algae (Rana et al, 1971, Rana and Kumar 1974, Whitton, 1970b, Say and Whitton, 1977, Say et al 1977, Whitton, 1980). Chlorophyll content falls at high concentrations of Zn in algal cultures and the ratio of carotenoid chlorophyll decreases after addition of higher amounts of zinc (DeFilippis and Pallaghy 1976b, Rai et al 1981b). Davis and Sleep (1979) have shown that photosynthesis is also severely affected by zinc. High concentrations of Zn affected plasma membranes, eventually leading to increased permeability and leakage of electrolytes (Passow et al 1961).
Lead is a biologically non-essential element. Relatively low concentrations interfere with biological processes to general metabolism of the plants. There is extensive report of lead accumulation in living systems. Photosynthesis and cell division of various algae are inhibited by lead (Rivkin 1979).

Nickel is an inhibitor of growth of microalgae at high concentrations ngadi and Mathad (1994) reported the pigment content indicate that chlorophyll a and b were maximally inhibited at higher concentrations suggested that the metal may cause disruption of the thylakoid membranes resulting in the degradation of the light harvesting pigment.

Like other essential elements cobalt has important biochemical functions in the microalgae (Bryan and Hummerstone 1973). The metal content in the organism is regulated by homeostatic control mechanisms. The effect of cobalt has not been thoroughly investigated. Some preliminary findings of Rai et al (1981a). High concentration of this metal, algal growth is significantly reduced.

Most studies of water pollution are usually expressed with physical and chemical standards, placing the biological concepts in a subsidiary. The limitation of chemical method is more evident with the occasional or pulse release of pollutants, which may get rapidly dispersed. Later analysis may indicate absence of such pollutant but its past presence can be detected with the biota. Similarly chemical method is not much useful with the combination of pollutants having additive or synergistic effects. These facts then have attracted workers towards the use of organisms, for predicting (toxicity), assessing (bioassay) recognising (bioindication) and monitoring (biomonitoring) the pollution impacts.

Beginning of biomonitoring has been made over 2000 years ago use of organisms as bioindicators could be found in Indian writings as old as Varahamihira’s (AD 505-587) magnum opus Brihat Samhita (master collection). With respect to the use of the organisms for assessing the environment, terms like “Bioindicators” and “Sentinels” have been in use but the terms and their definitions have often been confusing and ambiguous. Bioassays may be for prediction (anticipating environmental impacts) or for assessment (monitoring actual impacts), each category-employing single or many species (Maltby & Calow, 1989).
Earlier workers based the presence or absence of species with different tolerances to decomposable organic matter. However; effects of organic pollutants differ from those of inorganic pollutants and thus do not provide a basis for estimating system responses to inorganic inputs. Pollution has variously been correlated to biological diversity by a large number of workers. It is interpreting correctly the pollution level-biodiversity results, has shown that biodiversity may be both low or high at low or moderate pollution level, but it decreases to low level at higher pollution level. Toxicity tests involve exposing a well-defined test organism to a toxicant under controlled laboratory conditions. In contrast to toxicity tests, bioassays are often used to assess the toxic effects of mixtures of compounds on biota by exposing test organism to naturally contaminated environment (Hertz 1991). However, it may not be possible through bioassays to identify the specific chemical or the concentration and may require toxicity tests of the chemical individually as well as in combinations. Many complications complicate the complicated response of the organism towards the complex of substances. The response under nutrient rich condition may be different from the response observed under nutrient deficient condition and so on and practically it is almost impossible to create all the possible conditions in the laboratory. Choice of species for toxicity testing, bioassaying or biomonitoring requires fulfilment of several criteria and hence it is difficult to gets a species satisfying all the requirements. Use of a single most sensitive species or a group of species or the whole community have been suggested.

Biotic indices of pollution are determined by measuring the abundance, presence or absence of certain organisms as an indication of the type and level of adverse effects induced by a toxicant sooner than will other species. Single species toxicity test has provided the great majority of data used in evaluating the hazard of waste materials and to derive limits of exposure to protect entire ecosystem (Maltby & Calow, 1989). The most sophisticated and expensive, in the application of single species is the search and testing of “the most sensitive species.” Some inherent assumptions with this criteria. Thus the absence of contaminant-sensitive endemic species in an area may be used as an indication of the presence of pollution in that environment.
Biomonitoring may be performed in two general ways that differ only in the kind of organisms sampled: endemic organisms (passive biomonitoring) and introduced organisms (active biomonitoring) (Chaphekar, 1991). Preference is given to passive biomonitoring probably due to the ease of performing such experiments (Moriarty, 1990). But, it will provide a limited information, due to the possibility that most contaminated individuals have already, selectively suffered mortality, predation and reproductive impairment. In pollution stressed environments the most sensitive individuals would not be collected in field surveys. Moreover, if the pollution-stressed individuals of a population are differentially preyed upon, the observed levels of contaminants will underestimate their true impact and availability. An interesting extension of this scenario is that if individuals containing the greatest body burdens of toxicants are selectively preyed upon, the extent and rate at which biomagnification of pollutants occurs would be accentuated. In contrast to passive biomonitoring, if a responsive organism is used for active biomonitoring, it may provide a kind of alarm system for the detection of environmental stress. Organism used as an ideal to monitor the health of a habitat should all of its food from the food chain in the habitat (Philips, 1978). Top predators have been used more as biomonitors because of higher concentration of the contaminants within them resulting through biomagnification. The higher concentration makes the detection and determination of the substance easier as compared to smaller concentration.

Palmer (1959) has listed 60 genera and 80 species of freshwater algae in order of their tolerance to pollution. Although members of each group varied widely in response, green and blue-green algae generally were most tolerant to pollutants. The five most tolerant genera were *Euglena, Oscillatoria, Chlamydomonas, Scenedesmus* and *Chlorella* and the five most tolerant species were *Euglena viridis, Nitzschia palea, Oscillatoria limosa, Scenedesmus quadricauda, and Oscillatoria tenuis*. The five most sensitive genera were *Crucigenia, Cymatopleura, Dictyosphaerium, Selenastrum* and *Stauroneis* and the five most sensitive species were *Tetraedron muticum* (now *Goniocloaris mutica* (A. Br.) (Fott), Pyrobotrys gracilis, *Euglena proxima, Gonium pectorale* and *Cryptomonas ovata*. A long list of persons are there, contributing to the development of the science of systematics and taxonomy. All of them are praiseworthy for their, pain stalking hard labour.
Pond of Raipur city area are receiving huge amount of pollutants, effects of which are clearly visible to the naked eye. Polluted water of these ponds are supporting several group of algae. Important group with respect to density are volvocales, chlorococcales and the cyanobacteria, loosely being, considered as a group of algae. The polluted water harbour several groups of other animals like the protist groups protozoan and metazoan groups like rotifers, cladocerous, copepods, arthropods and the pisces. With these groups of organism, undoutably, the eubacteria were most abundant, density wise. Pollution level of these ponds could have been evaluated by considering the entire biotic community. However, that was found to be a very difficult task hence it was decided to take only one group as the indicator of heavy metal pollution. Any one group from the above mentioned groups could have serve the purpose and so the chlorococcales group of algae was selected for the purpose. The selection was not based upon any criteria because the volvolcales or cyanobacteria could have also been taken as the group for present studies. Thus, it is only a chance that the present studies were made with chlorococcales group. Nevertheless, some advantages could be attached to the chlorococcales selected for such studies. The advantages are that the members of the groups are nonmotile and green, hence, could be observed and counted under the microscope, easily. The members can be preserved with common preservatives like, formaline or iodine and thus could be stored for a long time for observations.

The present studies were, thus, planned to investigate the different concentrations of heavy metals with the help of chlorococcalean algae present in the pond water and expose to the heavy metals was present in the pond water, they are inhabiting.