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# Algal Biodiversity in Coalfield Areas – A Critical Review

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***Abstract*— Algal communities were investigated in clean and pollution-impacted different zones of coal mining areas.Algal biodiversities studied through measuringfrequency, species richness etc. in polluted & non polluted areas. The different algal species found in different areas of polluted zone shows different signature of pollution.This paper briefly describes the pollution indicator algaeshows the intensity of pollution measured by algal biodiversity.**

***Index Terms*— Coalmines, Algae, Biodiversity and Pollution indicator.**

## I. INTRODUCTION

Nature is versatile in the way it has given the abundance of resources, but severe human anti nature actions have lead to the hazards.Coal mining for example has had a severe impact on nature &it's inevitable. Though we can reduce the environmental impact if this can be correlatedwith the available natural resources in accordance with the social requirements. Use of biodiversity for studying effect of pollution through like algae is a new idea.Although algae are usually known from marine and freshwater habitats, they also occur in a wide variety of terrestrial environments.The algae that inhabit terrestrial environments are designed by different terms in literature as microbiotic crusts, cryptogrammic crusts, subaerial algae, aerophytic algae and terrestrial algae[1].These plants require special adaptations for living submerged in water or at the water's surface.Apart from these pre existing qualities algae has an edge over other plant species as it is a unicellular (so the its easily growth able and easily sustainable).The different type of algal species grown in the different type of climatic & atmospheric conditions (cold, humid, mild arid etc.) give different account of pollution in different locations.This versatile nature of algae makes it a suitable tool for this studies.

Algae are unicellular or multicellular organisms that photosynthesize, but lack the parts such as leaves, roots, seeds and flowers of the 'higher' vascular plants (mosses, flowering plants, liverwort etc)[2]. Algae have a wide ranging classification, falling within several groups from plants through to protists (single celled organisms) and even bacteria (blue-green algae). They can commonly be found in aquatic—both freshwater and marine—environments, butcan be found in damp terrestrial environments or even dry environments where they can live in symbiosis with fungus as lichen. Many algae species move themselves through the water column, while others float, attach themselves toobjects in water or are terrestrial. Algae form an important part of many ecosystems and have a vast variety of body shapes, biochemistries and life cycles.Algae is good indicator of pollution because they have wide temporal and spittle distribution, respond quickly to the change in environment due to pollution. Some algae shows the types of pollution [3], such as many blue green algae occur in nutrient less water, while some grows organically polluted water[4]. Algae grow well in water containing a high concentration of organic wastes. *Green algae*,*Chlamydomonas*, *Euglena*, *Diatoms*, *blue green algae*, *oscillatoria* and *phormidium* are emphasized to tolerate organic pollution.

Algae are having symbiotic relation with bacteria in aquatic ecosystem. Algae support aerobic bacterial oxidation of organic matter producing oxygen through photosynthesis while release carbon-dioxide and nutrients in aerobic oxidation used for growth of algal biomass [5]. Algae and Bio-purification of waste water is major importance to the environment, because this will develop an efficient, low cost, and environment friendly process. Algae have a solution to emerging environment problems, they removes excess wastes efficiently at minimal cost .

## II. ENVIRONMENT FOR DIFFERENT ALGAL AVAILABILITY

1. Diatoms - are delicate, single-celled organisms with cell walls made of silica making them almost look like little glass houses. They are free floating or attached to objects or other algae in the waterway. They can be found in almost all water types. They can be pennate (pen-shaped) or centric (like a cylinder). Pennate are the most common. Eg.fragillaria
2. Green algae (Chlorophytes) - This is the most common type of algae and is the culprit for common pond scum. While commonly green, not all green algae is green. . Eg.spirogyrra
3. Dinoflagellates (Dinophyta)- These algae get their name from the flagella (hair- like projection used for locomotion) they possess. The cell wall of many dinoflagellates is divided into plates of cellulose like a suit of armour. Dinoflagellates are the organisms responsible for the toxic 'red tides' .Eg.peridinium
4. Blue-green algae (Cyanobacteria): It is actually a bacteria that has the ability to photosynthesize. It is one of the most commonly known types of algae, probably due to the toxic

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conditions some species can create when they bloom. An algal bloom occurs when algae flourish to such an extent that they dominate the water column, often discolouring the water or creating a scum on the surface.E.g. Nodularia[6]

## III. ALGAL APPEARENCES IN DIFFERENT ENVIRONMENT

BLOOMS:When dense algae populations develop, they turn water a green or greenish brown color referred to as a "bloom." Blooms are simply high concentrations of algal cells that give the water a "pea soup" appearance . Dense blooms near the surface may resemble a layer of green paint. Problem blooms occur in the summer months and are more frequent in times of drought. As the number of algal cells in water increases, the chances for problems are also increased.
SCUMS:Under certain conditions, algae cells float at the surface of water and form a layer, or "scum." Scums typically form during still weather after a period of warm and windy conditions. This layer can be pushed to one side by the wind, forming a thick mass of algae . Scums come in a variety of colors – yellow, green, bluish green or even red. Exposure to intense sunlight will kill algae, turning some cells white, so that scums may also develop mottled colors. Red euglenoids are often responsible for red scums on freshwater ponds.
MATS:Algae can also grow in long strands or chains of cells called filaments. Some forms of filamentous algae grow in a submerged mat over the pond bottom, especially in shallow areas . As bubbles of oxygen from photosynthesis accumulate in these submerged mats, clumps of algae will break loose and float to the surface. Algae mats and floating clumps are unsightly and create problems for anglers by fouling hooks. Filamentous algae mats are more common in ponds during the spring.[7]

## IV. ALGAE AS A BIOINDICATOR

Pollution of the atmosphere with hazardous substance likeammonium, carbon-dioxide and orthophosphate as main nutrient source of algae [8]**. Grobbelaar et al**. reported thatto oxygen releases 1.9gO2/1g of algal biomass [9]. Algae using nitrogen and phosphorous in growth may remove the nutrient load of waste water frown a few hours to a few day[10] . In comparison to common treatment system oxidation pond increase dissolved oxygen and pH concentration because algae remove phosphorous, sedimentation, ammonium, hydrogen, sulphur, high pH in algal waste water purification leads to pathogen disinfection [11]. Some species of algae have capacity to remove heavy metal i.e. chrome byOscillatoria[12,13] cadmium, copper and zinc by *chlorellavulgaris* lead by *chlamydomnas* and *molybdenium* by *scendsmuschlorelloids* may remove successfully[14,15,16].Algae has adapting ability to sub-lethal concentration; accumulation of heavy metals in cells may be potentially toxiceffect to the other circles of food web [17].
Algae as good bio-indicators identify and quantify the effect of pollution in the environment. Five algal species are selected which are good bio-indicators of pollutant in river inEngland, Stigeoclonium tenue is present at the down strem margin of the heavily part of river, Nitzschia palea andGamphonema parvulum always appear to be dominant in the mild pollution zone whilest cocconeis and chamesiphon reported to occurs in unpolluted part of the stream or repurifiedzone[18]. Navicula accomda is good indicator of organic pollution, the same species Gamophema[19], which is commonly found in highly polluted water. Amphora ovalis and Gyrosigma attenuatum are also introduced as good example of diatoms affected by high organic content of water [20]. In small scale, waste water treatment through algae arebeneficial for suitable for growth in pH, salt etc, it fixes carbon-dioxide, produces biomass with greater feasibility.

## V. METHODOLOGIES

Algal biodiversity is being studied through conducting survey & sampling by doing experiments and calculating by-
1.) (IVI) Importance value index method-this method helps out in determining importance of an particular species in a community by comparing the its relative frequencies with other species & its relative density , relative dominance etc[21].
2.) Species richness- Basically, it deals with the study & collection of data of a particular species in a biodiversity .It helps in determination of quality& quantity of a particular species by discovering important aspects [22].
3.) Frequency-algae acts a friendly habitat for many aquatic species ,since algal spores are settled & attached it requires sunlight & water throughout lifetime. Thus, by studying their distribution pattern, observations are made & measurements are taken[23].

## VI. FUTURE SCOPE

In upcoming future, determination of pollution through algae will prove itself, because this way will help in the planning and managementin the reduction of adverse impact of pollutants Algal biodiversity will help us out in pollution check of an area ( helping in determination of level of toxicity of an particular pollutant in area).Thus it will help us in building an way for pollution amendment plan in future.

## VII. CONSTRAINTS

Algal biodiversity determines the type of algae we can estimate with the extent of pollution & its effect on the environment.But it will require continuous evaluation of sites in different climatical conditions to study the growth of different types of algae in different conditions.Lack of Proper data bank to compare the extent of biodiversity in the population of different algal species in ecological disturbed area.

## VIII. CONCLUSION

Study of biodiversity of algal population in polluted environment on the basis of identification of pollution level through algal technology concluded that methods can be

used economically.Determination of pollutant through algal biodiversity will help in pollution eradication, planning & environmental management in economical and sustainable way.

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