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Biopurification of Waste Water Through Algaae – A Review

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Abstract— **Biopurification of wastewater through algae is an advanced technology of wastewater purification. Algae can be used for tertiary treatment of wastewater due to its capacity to assimilate nutrients. This invention uses a cheap and efficient, ecologically safe hybrid photo bioreactor for the simultaneous detoxification of industrial wastewater and production of micro-algal biomass. The advantages of this invention result with no pollution of hazardous substances and cost benefits (Commercialization of algal biomass will reduce the cost of wastewater treatment). In the current review we will highlight on the role of biological purification of waste water.**

Index Term — **Wastewater, Biopurification, Heavy metal, Algae**

I. INTRODUCTION

The waste water can be formed by a variety of an activities, including washing, bathing and using the toilet e.t.c. Waste water is more commonly known as sewage. The biopurification of waste water through algae is an old idea, and several techniques for exploiting the algae's fast growth and nutrient, removal capacity [1]. Algae are prokaryotic & eukaryotic [2]. Algae are structurally not seen by naked eye, it can't see with the help of microscope. The main classes of algae which is used for waste water treatment are – *chlorophyta*, *euglena*, *chryophyta*, *cynophyta*, e.t.c.

The algae release the oxygen while carrying out the photosynthesis which ensure a continuous supply of oxygen for biodegradation. Algae based waste water purification is mainly used for nutrient removal as nitrogen and phosphorous. Algae is cultured for waste water treatment, because they provide tertiary biotreatment along with the production of potentially valuable biomass. This can be used for several purposes. Algae uses nitrogen, phosphorous and inorganic substance for their growth, does not leads secondary pollution.

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, Navicula,*** **Synedra** and **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 biopurification 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 [6].

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II. BIOPURIFICATION OF WASTE WATER THROUGH ALGAE

Biopurification of waste water through algae helps not only in waste water treatment but also in algal cultivation. Phosphorous removal rate are commonly considered for waste water treatment, which allows the growth of algae as well as waste water treatment.

Two types of waste water treatment through algae given below:

a) Waste stabilization pond system- This biopurification of waste water in waste stabilization pond. This is green treatment achieved by the growth of algae and heterotrophic bacteria. The algae is a product of photosynthesis in which oxygen is used by the bacteria as they aerobically oxidized the organic compound in the waste water and the end product of this bio oxidation is carbon–dioxide, which is fixed into cell carbon by the algae during photosynthesis.

b) High rate algal pond system- This is a combination of intensified oxidation in pond and algal reactor in which high rate algal ponds are shallow, paddle wheel-mixed open raceway ponds and provides efficient waste water treatment than conventional oxidation ponds. As a result of intense algal photosynthesis which provides saturated oxygen to drive aerobic treatment and assimilation of waste water nutrient into algal biomass. The fuel is being extracted from biological component.

III. ECONOMICS & USES

Biopurification of waste water through algae is low cost method and environment friendly, this method removes heavy metal and toxic substance [7]. It releases carbon-dioxide and balance green house gases (GHG), so does not pollutes

atmosphere with hazardous substances and also does not exposes the microbial hazards.

If land is not expensive, since the method demands larger area than conventional waste water treatment. This also makes more promising small scale treatment than conventional waste water treatment. This also makes promising small scale treatment than in large centralized urban treatment plants. In addition, algal harvesting treatment ponds are widely used as nitrogen and phosphorous supplement for agriculture purpose and can be subjected to fermentation in order to obtain energy from methane. Algae are also able to accumulate highly toxic substance such as selenium, zinc, etc. in their cells, thus eliminating such as substances from aquatic environments.

Radiation is also an important type of pollution as some water contain naturally radioactive materials and others become radioactive through contamination. Many algae can be taken up and accumulate many radioactive minerals in their cells even from greater concentration in their water [8]. Different algal species purify water, it is worth to emphasize that algal technology in primary, secondary and tertiary stages [10]. Algae has an important role in self- purification of organic pollution in natural waters [11]. Algae remove nutrient, heavy metal, pesticides, organic and inorganic toxic substances from water by accumulating their cells [12, 13] and algae may be used successful for waste water treatment as a result of their bioaccumulation abilities.

IV. ENVIROMENTAL BENEFITS

Pollution of the atmosphere with hazardous substance like ammonium, carbon-dioxide and orthophosphate as main nutrient source of algae [14]. **Grobbelaar et al.** reported that to oxygen releases 1.9gO2/1g of algal biomass [15]. Algae using nitrogen and phosphorous in growth may remove the nutrient load of waste water frown a few hours to a few day [16]. 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 [17]. Some species of algae have capacity to remove heavy metal i.e. chrome by ***Oscillatoria*** [18,19], cadmium, copper and zinc by chlorella vulgaris lead by chlamydomnas and molybdenium by ***scendsmus*** chlorelloids may remove successfully [20,21,22]. Algae has adapting ability to sub-lethal concentration; accumulation of heavy metals in cells may be potentially toxic effect to the other circles of food web [23].

Algae as a good bioindicators, identify and quantify the effect of pollution on the environment. Five algal species are selected which are good bioindicators of pollutant in river in England, Stigeoclonium tenue is present at the down strem margin of the heavily part of river, Nitzschia palea and *Gamphonema 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 repurified zone [24]. *Navicula accomda* is good indicator of organic pollution, the same species *Gamophema* [25], 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 [26]. In small scale, waste water treatment through algae are beneficial for suitable for growth in pH, salt etc, it fixes carbon-dioxide, produces biomass, greater feasibility, of culture.

V. FUTURE SCOPE

In upcoming future, waste water purification through algae will prove itself, because this treatment costs is less for the removal of heavy metal and toxicity purification from waste water which prevent the pollution in comparison to varies chemical waste water purification. The purified water can be used in agricultural field which encourage the growth of crops. There are so many company use algal purified water for fermentation. Combining algae for waste water remediation with Biofuel production is an economically feasible process. The waste water treatment plants are an invaluable source of algal as a feedstock for a variety of purpose. Mac Kenthun emphasized show that spirogyra can accumulate to the ratio of phosphorous by a factor of 85000 times that of water. Consider all these abilities of algae to purify the polluted water of is worth to emphasise that algal technology in waste water treatment system are expected even more common in future years.

VI. CONSTRAINTS

Algae are primary producers in all kinds of water bodies and they are involved in water pollution. In water algal species producing massive surface growth or blooms that in turn reduce water quality and affects its use. During biopurification of wastes water through algae, pollutants are produced which are toxic to fish and also mankind and animal using polluted water. Algae can play significant part of food chain of aquatic life thus alters the number and kind of algae is commended strongly for fishes.

VII. CONCLUSION

On the basis of biopurification of waste water through algal technology it can be concluded that photobioreactor are not economic for such treatment in the short and medium term, biopurification of waste water through algae uses simple oxidation ponds or with or high rate algal ponds. Biopurification of waste water through algae which is applied to improve the quality of waste water remove solids substances, heavy metal and toxicity. Initial cost of industrial plant waste water treatment through algae is highly expensive which can be minimized through more research in future.

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