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Microalgae Bioremediation: Practices and Perspectives

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ABSTRACT
Recent waste water treatment plants are extremely mechanical and costly to build and sustain. Domestic waste water treatment and remediation is an exclusive practice due to substantial time and scheduling needed for fruitful management. Maximum of the domestic waste water is considered feeble or average in strength with nitrogen levels between 20 and 40 mg/L and phosphorus levels between 4 and 8 mg/L. These concentrations of nitrogen and phosphorus are unwanted as they can lead to remarkable pollution and eutrophication of downstream waterways. Waste equilibrium ponds provide a dynamic bioremediation method to clean domestic waste water and they can also produce microalgal feedstocks for the production of valuable bioproducts. Importance in the use of microalgae will continue to develop as rural cities and emerging countries look for sustainable and inexpensive methods to clean domestic wastewater.

Keywords: bioremediation, biproducts, wastewater, management, microalage

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INTRODUCTION

Domestic wastewater treatment and remediation is an exclusive practice due to substantial time and scheduling needed for fruitful management. Recent waste water treatment plants are extremely mechanical and costly to build and sustain. In fewer economically established parts of the world, substitute methods of wastewater treatment are indispensable. Waste equilibrium ponds, provide an ultimate solution for waste water treatment in emerging nations and rural regions. These ponds enable the oxidation of organic matter through complex symbiotic associations between bacterial groups and incorporation of waste water nutrients by photoautorophic microalgae [1]. In the United States, more than 7,000 ponds systems are used to treat domestic waste water [2]. Maximum of the domestic waste water is considered feeble or average in strength with nitrogen levels between 20 and 40 mg/L and phosphorus levels between 4 and 8 mg/L [3]. These concentrations of nitrogen and phosphorus are unwanted as they can lead to remarkable pollution and eutrophication of downstream waterways [1].

Microalgae in Bioremediation of Waste Water

Open pond systems have several benefits over mechanized methods and are capable to eliminate nitrogen and phosphorus to required EPA levels. Remarkably, nitrogen and phosphorus found in weak domestic waste water are at a perfect level for microalgae cultivation and progress of growth. Microalgae can grow to high densities by assimilating nitrogen and phosphorus, thus eliminating these inorganic nutrients from the waste water. In addition, open pond lagoon systems also permit paramount mingling and satisfactory light exposure for microalgae growth. Microalgae play a dynamic role in recycling carbon in the biosphere by converting carbon dioxide into organic compounds through photosynthesis [2], although generating oxygen via the oxidation of water. Metal compounds such as chromium, copper, lead, cadmium, manganese, arsenic, iron, nickel, mercury and zinc can also be bioremediated by microalgae. Microalgae such as Scenedesmus and Chlorella have shown tolerance and bioremediation proficiencies to certain heavy metals [4]. Furthermore, microalgae have been used for the bioremediation of textile dyes in waste water from industrial textile methods. These bioremediation abilities of microalgae are advantageous for environmental sustainability and algal biomass can be used as feedstock for the production of high vitality complexes [5, 6].

Microalgae in Valuable Production of Biproducts

Algal biomass can be treated by both the methods- biologically and chemically to produce more valuable products such as biomethane, biobutanol, biodiesel and bioacetone. Microalgae as feedstocks provide high concentrations of carbohydrates, triacylglycerides and free fatty acids that can be used to produce biofuels and biodiesel. It has been proved that microalgae can be a privileged feedstock and will play a very important role in the forthcoming production of clean, sanitary and renewable energy [5].

The drawbacks to an open pond lagoon system are that the microalgae nutrient requirement may not match the stoichiometric ratio of the microalgae biomass, where the optimum nitrogen to phosphorus ratio for microalgae growth is 16:1. Thus, photoautotrophic bioremediation of inorganic compounds might not be carried out to satisfactory stages. To meet nutrient requirements for microalgae growth, further chemicals (usually nitrogen rich sources) may need to be accompanied to the wastewater, which is adverse.

Microalgae grown in open pond lagoon systems are at low densities and focused harvesting technologies need to be employed in direction obtain appropriate biomass yields. Harvesting techniques such as a Rotating Algal Biofilm Reactor (RABR) [2], filtration, sedimentation, and dissolved air flotation (DAF) units can be engaged to harvest the microalgae from open pond lagoon structures. There are benefits and hindrances to each technique, but the cost of harvesting is presently high and more proficient technologies need to be generated [6].

CONCLUSION

To review, waste equilibrium ponds provide a dynamic bioremediation method to clean domestic waste water and they can also produce microalgal feedstocks for the production of valuable bioproducts. Importance in the use of microalgae will continue to develop as rural cities and emerging countries look for sustainable and inexpensive methods to clean domestic wastewater. Procedures where wastewater is bioremediated through heterotrophic and photoautotrophic organisms, and in turn high value bioproducts are produced have excessive prospective to motivate regional and local cost-effective improvement.

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