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Metal Aquifers Phytoremediation

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Introduction

Aquatic ecosystem environmental pollution is primarily caused by the discharge of urban wastewater that has not been properly treated. Because microalgae have the potential to remove nitrogen (N) and phosphorus (P) from wastewaters, they represent an appealing alternative among effective and environmentally friendly remediation technologies. In this study, microalgae from an urban wastewater treatment facility's centrate stream were isolated, and a native species resembling Chlorella was chosen for research on nutrient removal from centrate streams. Comparative tests were set up using BG11 synthetic medium that had been altered with the same N and P as the effluent and 100% centrate. Since microalgal growth in 100% effluent was inhibited, cultivation of microalgae was performed by mixing tap-freshwater with centrate at increasing percentages. While the differently diluted effluent had little impact on algal biomass or nutrient removal, morpho-physiological measurements (such as the FV/FM ratio, carotenoids, and chloroplast ultrastructure) revealed that cell stress increased with increasing concentrations of centrate. But the production of an algal biomass rich in carotenoids and P, along with the reduction of N and P in the effluent, supports promising microalgal applications that combine centrate remediation with the creation of biotechnologically interesting compounds, such as for organic farming [1].

One instance where additional treatment is necessary due to the presence of high nutrient concentrations is the stream produced by the dewatering process of anaerobically digested sludges (the so-called "centrate"). Nevertheless, centrate is a potentially suitable substrate for microalgae cultivation due to its high content of carbon, nutrients, and different minerals. Microalgae, which are unicellular photosynthetic organisms renowned for their quick development, high biomass productivity, and impressive capacity to sequester CO_2, can actually grow in substrates rich in both organic and inorganic compounds, such as urban wastewaters. The use of a microalgae-based system as tertiary treatment in a WWTP is thought to be an affordable and environmentally responsible alternative method for removing nutrients from wastewaters because microalgae assimilate and consume N- and P-containing inorganic compounds to grow. Additionally, microalgae can eliminate persistent organic pollutants like chlorinated hydrocarbons, textile industry dyes, and herbicides as well as micropollutants like heavy metals that are insufficiently eliminated by conventional treatment methods. Interestingly, using microalgae to treat wastewater would result in the production of, in addition to the phytoremediation effect [2].

Description

Population growth and industrialization are linked to water pollution. Industry and urban areas use about 30% of the world's freshwater resources, and they also generate a significant amount of wastewater that contains a number of chemicals in various concentrations. The behaviour, lifestyle, and laws that control local activities all have an impact on the composition of urban wastewaters (UWW). Biodegradable organic matter, nutrients, pathogenic microorganisms, heavy metals, hormones, detergents, pharmaceuticals, pesticides, fats, and oils are some of the contaminants that define UWWs. The breakdown of urea and proteins, as well as the microbial degradation of organic phosphates and polyphosphates, respectively, result in the high concentrations of nutrients in inorganic form, such as nitrogen (N) as ammonium and phosphorus (P) as orthophosphates [3].

Wastewater discharge into water bodies leads to a variety of ecological imbalances, such as eutrophication, which can lower water quality and pose health risks to humans. To avoid eutrophication, Europe Directives 91/271/EC and 98/15/EEC establish the allowed nutrients level before treated wastewater can be discharged (European Union Legislation) . For example, the Environmental Protection Agency in the USA developed the NPDES permitting system as a response to the serious environmental degradation that was taking place prior to its introduction. In this regard, legislation is available everywhere to limit the same problems. Wastewater treatment plants (WWTPs) are used to remove nutrients and organic matter through physical, chemical, and biological processes. Biological processes, which combine aerobic and anaerobic processes to convert ammonium to gaseous nitrogen. Processes are frequently employed to remove nitrogen. However, as a side effect of these processes, there is a significant amount of waste sludge produced, in addition to high costs and complicated operation. Similarly, the process typically used to remove phosphates in many WWTPs is the chemical precipitation of P, but this process requires the addition of high concentrations of metal coagulants which can alter the biological activity of activated sludge and contribute to increase pollutants in the sludge. However, some wastewater streams involved in the process still contain high concentrations of N and P, primarily in the form of ammonium and phosphates, even though depurated water discharge from WWTPs does not pose an environmental risk. In order to increase management, these streams are typically recycled in the WWTPs for additional treatments [4,5].

Conclusion

Improving the economics of both the acquisition of microalgal biomass and the costs associated with remediation. Biomass that can be used as a source of value-added products in the energy, nutraceutical, agricultural, and feed sectors. However, not all algal species can adapt their growth in wastewaters and remove N and P to the same degrees. Therefore, choosing the right microalgal strains is essential to creating systems that effectively remove nutrients. Since many different species of microalgae are found naturally in wastewaters, isolating these species may be a successful strategy for obtaining microalgal strains appropriate for treating such waste matrices. In fact, it has been shown that native microalgae are more able to remove nutrients from wastewater at higher rates than commercial ones because they are already accustomed to the conditions.

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Conflict of Interest

There is no conflict of interest by author.

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