The Use of Green Algae in The Treatment of Wastewater Toxicity

ABSTRACT

Our current research includes treating the toxicity of wastewater using green algae, and this is done through a set of steps that involve withdrawing nitrogen and phosphorus from wastewater for algae to benefit from them in their growth, leading to a clear reduction in their concentrations. Since the algae depend on self-feeding for their living so that they carry out the process of photosynthesis, they thus consume carbon dioxide that is produced from the process of decomposing organic carbon in wastewater by the action of bacteria that work on consuming the oxygen liberated from the algae during the process of photosynthesis, and this leads to reducing carbon dioxide emissions on the one hand and reduces the requirements for ventilation necessary for the work of bacteria on the other hand.

Keywords: Green Algae, Wastewater Toxicity, Treatment, bacteria, algal biomass.

1. INTRODUCTION

The treatment of domestic wastewater is of great importance in many developing countries, especially those located in hot regions such as in the Middle East and Africa, where the lack of adequate treatment of wastewater inevitably leads to environmental pollution and contamination of domestic water as in drinking water. It is believed that the whole world will face a clear deficit in water at a high rate by the year 2030 or more. This is an enormous challenge that leads to societal and economic development. This large deficit is likely to arise from the increasing demand for water use, the large pollution of water resources, as well as the lack of technologies for the recovery of used water. For example, the period of rapid urbanization and industrialization in China caused great pressure on natural resources in the environment. The traditional techniques used for this purpose require the ion exchange process or what is known as electrochemical treatments as well as evaporation, precipitation and osmosis, with the need for energy inputs, which makes it more expensive. Most of these methods of processing pose significant challenges towards the sustainable removal of most metals from the environment [1, 2]. About 81% of rivers in China are highly polluted with organic matter at different levels, and this poses a real threat to public health and safety and poses a great threat to the environmental reality in general. In order to overcome this problem, the use of modern techniques such as biological methods, which are considered the most economical and sustainable approach to remove toxicity from heavy waters such as heavy metals [3], have been researched. These methods are easy to apply, leading to the treatment of heavy water pollutants and their toxicity using algae. Some wastewater treatment plants have failed in most areas, the reason is the complexity faced by the treatment processes from the physical, chemical and biological aspects, in addition to the significant increase in the cost of operating and maintaining those plants used in treatment, in addition to the lack of employees and trainers who work in this purpose. Algae cells can form up to more than approximately 10% of their total biomass with the minerals they contain. Toxic pollutants are bound to the cell surface by the attractive force known as electrostatic force [4]. There is a need for central wastewater treatment systems that are sustainable, simple, and effective at the same time. These systems can meet all the needs and requirements in wastewater treatment. Therefore, it was necessary to use systems that lead to the treatment of wastewater pollution such as algae, because it is considered one of the most appropriate and environmentally friendly ways and means to be considered as a regular biological treatment. Algae-based biofuel is expressed as green energy, as it in turn leads to the production of economical fuel [5, 6], in addition to being a treatment for heavy water toxicity. The use of algae in the treatment of water pollution in general is the correct and appropriate way as it is the means to solving many environmental problems. It can get rid of some sources of pollution with mineral waste and other harmful waste and at the same time, it gives a positive result in this treatment by making the water It is safe. There is no danger in it, and it is suitable for use by humans and animals.

2. MATERIALS AND METHODS

Algae isolates are prepared by serial dilution method, and grown in Modified Batch Culture (Chu-10) media, according to the previously approved method [7] , in volumetric flasks with a capacity of (250 ml), then incubated in the culture room at a temperature of (25 C), and a light intensity of (50 micro-Einsteins / m 2 / sec), according to the relative photosystem 2:1 light\dark.

Then the algae are restricted according to the method followed by [8] by taking 50 ml of the aforementioned culture (when it is in the stage of stability). It is concentrated by centrifugation for about 15 minutes, 3000 rotations per minute. The concentrated amount that resulted from the centrifugation is taken and placed for it 2% of sodium alginate solution in a volume ratio of 1:1. The mixture is shaken well and placed in a special syringe, then gradually dripped onto a beaker containing calcium chloride, and left for 10 minutes in order for the algae component to solidify completely in the form of beads.

3. RESULTS AND DISCUSSION

Table (1): Shows the steps of the process of treating heavy water toxicity represented by increasing the amount of carbon dioxide consumed with increasing the amount of algal biomass.

Algal biomass required for treatment (gm)	How much carbon dioxide do you consume (gm)
100	183
150	233
200	283
250	333

Test of Homogeneity of Variances

Table (2): Shows the stages of the heavy water toxicity treatment process represented by the amount of carbon dioxide proportional to the amount of algal biomass, (there are no significant differences).

Levene Statistic	df1	Levene Statistic	df1	Levene Statistic	df1
.000	1	.000	1	.000	1

Algae are of great importance from a biological point of view, as they are autotrophic, that is, they carry out a basic process, which is the process of photosynthesis. The oxygen released by the algae during the process of photosynthesis which leads to a reduction in carbon dioxide emissions on the one hand, and a reduction in the ventilation requirements necessary for bacterial activity and work on the other hand. Algae, in general, are the main responsible for nearly 40% of global carbon fixation. Seaweed is also considered one of the best types of algae that are the main source of bioenergy production at the maximum growth rate and production rate [9]. It has been shown that each ton of algae biomass needs to consume approximately 1.83 tons of carbon dioxide, thus contributing to the reduction of carbon dioxide emissions. In addition, the biomass of algae generated during wastewater treatment constitutes a resource of important value, since the algal threads consist of protein, carbohydrates, and fats. For example, biofuels can be generated through the hydrothermal liquefaction process, and gas can also be produced bioavailability by anaerobic digestion. Table no. 1 shows the relationship between the biomass of algae with the amount of carbon dioxide consumed by them during the treatment process, table no. 2, shows that there are significant differences between them because there is no significant difference between each of the biomass of algae and the amount of carbon dioxide consumption.

Means Plots

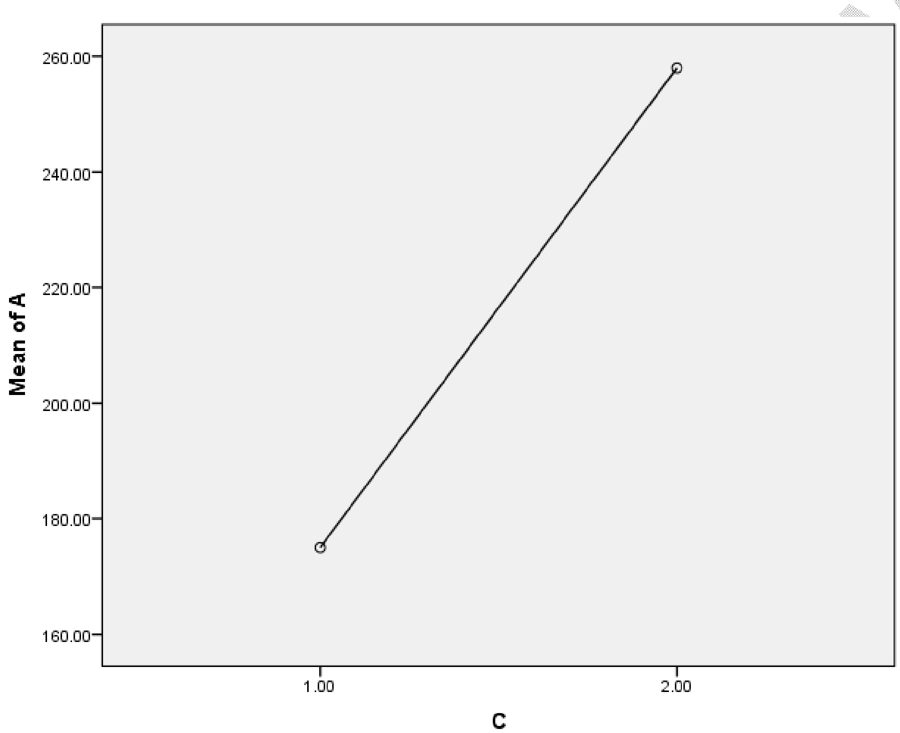

Figure (1): The illustration represents the biomass of algae, which is expressed by the letter A, so that the greater the biomass, the greater the consumption of carbon dioxide which is expressed by the letter C. This proves that the processing process proceeds naturally biologically and that the relationship between them is directly proportional.

The use of algal biomass, which is rich in protein, as a nutritional supplement for aquaculture, as well as as a feed for animals, or as a fertilizer for agricultural crops. There are four main criteria for selecting algae used for wastewater treatment. These criteria are high productivity, their ability to adapt to all different conditions, the fact of competitive dominance of unwanted organisms, and the stability of their biochemical composition. Algal cells can bind about 10% of their biomass with minerals. The association of pollutants with the surface of the cell directly through the presence of the electrostatic force of both gravity and formation [4]. Algae can produce basic nutrients through their consumption of nitrogen and phosphorus in addition to their consumption of carbon dioxide. They produce protein by 45 to 60% and also produce nucleic acids and phospholipids. They also work to remove and convert vital pollutants into compounds and substances. Simpler [10, 11]. Algae also play the main role in correcting the pH and working to maintain the balance of the oxygen biological requirement and the oxygen chemical requirement [12], [13].

4. CONCLUSION

The green algae that is used in the treatment of toxicity and water pollution with heavy elements cannot be used later as animal feed, as it is considered toxic and may cause many diseases. The use of algae in bioremediation is a good, environmentally friendly, and beneficial method, since its production does not add any kind of other pollutants to the environment, and also contributes to the removal of many pollutants that affect the environment and the possibility of recycling them again to benefit from them in most Other economic aspects indicate that the application of such technology is inexpensive and does not necessarily require the presence of infrastructure.

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