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Identification and evaluation of the efficiency of cladophore *glomeratag* in industrial wastewater treatment

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Abstract

The study included an evaluation of the industrial water of the State Company for Pharmaceutical Industry - Samarra - Iraq and a test of the efficiency of *Cladophore glomeratag* in the treatment of industrial wastewater. Measurements were made before and after treatment, then the removal percentage was extracted. The results showed that *C. glomeratag* have efficiency in reducing the concentrations of the studied properties of water, especially when used in the form of live algae, i.e. cultivated in industrial wastewater.The high removal rate was recorded for most of the studied properties, especially heavy elements, and the percentage of each of the following was (T.D.S.) 98.4) Electrical conductivity (96.80), T.S.S (17.29%), basicity (14.28), total hardness (54.08), salinity (66.66), chloride (91.28), sodium (92.37), calcium (26.66), nitrates and phosphates(92.37) and (39.73) respectively, sulfur (90.10), iron (28.57) and lead (5.79)%. Table (1) shows the results of using *C. glomeratag* in the form of living algae in SDI industrial wastewater treatment.), total hardness (91.32), calcium ion (70), sodium (94.50). Chloride was (82.35), and phosphate concentrations decreased, as the removal percentage reached (80.13), nitrates (95), and heavy elements recorded significant differences after treatment, as their concentrations decreased and a high removal rate was recorded, as the percentage of sulfur removal reached (92.75), iron (76.81), lead (94.20) Cadmium (95.83) Total %

Introduction

The rapid development and industrialization witnessed by the world, in addition to the increase in population and the rise in the standard of living, have led to

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increased pressure on existing water resources in order to meet the growing needs for food production (Sousa, 2018), in addition to the fact that cities have industrial facilities such as iron factories, oil factories, or Battery factories, or pharmaceutical factories, which makes them a source of water pollution in those cities (Bharagava, 2020).This led to an environmental crisis. The use of water increased in very large quantities on the human and industrial levels (Fleming and Roberts, 2019). Industrial waste is the most important and most important source of water pollution, especially with chemicals because it contains heavy elements such as mercury, silver, copper, iron, lead, And cadmium, oils, soaps, and disinfectants that are indissoluble, such as acids, bases, and toxic substances (Fahad and Rabie, 2011 and Yassin and Abbas, 2018). It led to the use of alternative sources and methods of water conservation such as wastewater recycling (Hassanli, 2013), if countries plan to increase the use of treated wastewater by 5% and its use for irrigation by farmers and is still widely applied in the irrigation system in China, India, Lebanon, Egypt and Mexico . Algae play an important role in the treatment of domestic wastewater by removing nutrients and organic and inorganic pollutants with high efficiency and analyzing them (Muthukumaran, 2005). In the treatment of industrial wastewater, algae have been used to correct the pH and reduce sludge, as well as both The biological oxygen requirement (BOD) and the chemical requirement (COD), which avoids the use of hazardous chemicals (Mohd Udaiyappan, 2017). Treating wastewater with algae is a new environmental approach that removes ions from that water. Algae can represent significant amounts of nutrients because they need large amounts of nitrogen and phosphate. 2012AbdelRaouf,). During this treatment, harmful chemicals are converted into water and non-toxic gases by living organisms for the purpose of frying. For or removal of pollutants from the soil, water, and air, or through the oxidation of organic matter and its conversion into safer and less dangerous compounds, and environmental detoxification (Wang, 2017), which includes the removal of biodegradable organic matter and suspended solids through biological i.e. the decomposition of organic matter, whether under air Or anaerobic conditions, and the aerobic biological unit is the treatment reactors that oxidize the organic materials present in the wastewater by aerobic bacteria (Kainthola, 2016; Abdullah, et al.,2015).

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:Materials and methods

Industrial wastewater samples were collected from the General Company for Pharmaceuticals / Samarra before entering the treatment units in clean plastic containers with a capacity of (15) liters. Then the pH, electrical conductivity (EC),Chlorides (Cl), Calcium (Ca), Sodium (Na), Suspended Solids (TSS), Dissolved Solids (TDS), Phosphates (Po4), Nitrates (NO3) and Sulfur, some heavy metals are cadmium, lead and iron, tests have been conducted Total dissolved salts (Page et al.,1982) The electrical conductivity was measured using a conductivity meter, manufactured by Ezdo, and the results were expressed in microsiemens/cm-Cl. Chloride was measured (APHA, 2017), total alkalinity (Makode, 2021) (Abbawi & Hassan 1990). Measurement of nitrates (APHA, 2005), determination of phosphates (1984, ASTM.). Measurement of heavy elements: cadmium, lead and iron. Treatment: algae were used in two forms, the first as a dry powder and the second in the form of live natural algae grown in industrial wastewater. An amount of 5 grams of dry algae was placed in 500 ml of industrial wastewater, then the studied tests were measured. The same amount of live algae was taken before drying. And also put in industrial waste water.

Results and discussion

Table (1) shows the efficiency of using *C. glomeratag* to treat the industrial wastewater of the General Company for Pharmaceutical Industry before and after using it in the form of dry powder and live. If the results of the analysis showed that there were significant differences between the concentrations of the studied properties before and after treatment, The results were similar to those reached byAl-Samarrai (2017). As shown in the table, the efficiency of algae in removing pollutants from the industrial wastewater of SDI company, T.D.S. recorded the highest removal rate in the form of dry powder was 98.45%, and the electrical conductivity value was 96.80%, while the values of T.S.S concentrations did not decrease, as its removal rate was 17.29%, and the base removal rate was 14.28%. The pH did not decrease significantly after the treatment, while the total hardness removed 54.08%, salinity recorded a removal rate of 66.66%, chloride 91.28, sodium ion after treatment as a removal rate of 92.37%, calcium ion 26.66%, nitrate and phosphate removal rate 92.37% , 39.73%, respectively, sulfur 90.10%, cadmium 0, iron 28.57%, lead 5.79%. These results were consistent with Al-Asadi (2014). Table (1) also shows the results of using Cladophora glomeratag algae in

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the form of living algae in SDI industrial wastewater treatment.The study showed significant differences in all the studied properties of industrial wastewater, as most of the concentrations of the study properties decreased after treatment, and a high removal rate was recorded in most measurements. Then T.D.S recorded a removal rate of 99.50%, while T.S.S removed 85.41%, electrical conductivity 91.14%, while the total basal removal rate was 61.25%.

Table (1) Efficiency test of Cladophora glomeratag for SDI industrial wastewater treatment

Parameters	Unit	SDI washeswaste water befor	*Cladophoraglomerata*	Percentage removal as dry powder %	*Cladophoraglomerata*	% of live removal
TDS	mg/L	700a	10.2 b	98.54	10.50b	99.50
TSS	mg/L	2.66a	2.25a	17.29	0.92b	85.41
pH	-	7.9a	7.0 a	11.39	7.00b	11.39
EC	Ms/m	955a	30.5 b	96.80	43.60b	91.14
Alkalinity	mg/L	1750a	1500 b	14.28	678b	61.25
Total hardship	mg/L	980a	450 b	54.08	85b	91.32
Ca	mg/L	150a	110 a	26.66	45b	70
Na	mg/L	400a	.30.51 b	92.37	22b	94.50
salinity	mg/L	600a	200 b	66.66	1.50b	99.75
P	mg/L	7.55a	4.55	39.73	0.16b	80.13
N	mg/L	30a	11 b	63.33	1.50b	95
S	mg/L	965a	95.5b	90.10	70b	92.75
Fe	mg/L	0.56a	0.4b	28.57	0.03b	76.81
Pp	mg/L	0.69a	0.65 a	5.79	0.04b	94.20
Cd	mg/L	0.24a	0.24 a	0	0.01b	95.83
CL	mg/L	680a	59.25 b	91.28	120b	82.35

PH after treatment 7.0, total hardness 91.32%, calcium ion 70% and sodium ion 94.50%. The chloride ion reached 82.35%, and the phosphate concentrations decreased, as the removal rate reached 80.13%, while the nitrates removal rate reached 95%. Lead recorded a removal rate of 94.20%, while cadmium, in contrast to the results of using the alga Cladophora glomeratag in the form of dry powder, recorded a decrease in its concentration when used live, as the removal rate reached 95.83%. The results of the current study agreed with the study of Shaker .((2018

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