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RESEARCH ARTICLE

Production of highly efficient Bacterial flocculant in water treatment

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Abstract

A bioflocculant is a kind of biodegradable flocculants produced by many microorganisms Including different type of bacteria during their growth. The aim of this study was the production of bacterial bioflocculant highly efficient and which has special advantages: such as safety, susceptibility to degradation and harmless to humans and the environment and to make a comparison with electrostatic precipitators industries such as salts of aluminum (alum) , and therefore is likely to be applied in drinking water and sewage treatment to benefit from bioflocculants widely in the areas of water purification.

Where were isolated and purified kinds of different bacteria and diagnosis by vitek 2 compact and traditional ways of some isolates to confirm them either isolation Bacillus spp. then preparation bioflocculants. The results showed the highest value for the type of bacterial Bacillus ssp. were 94 % and less value was Enterobacter spp. % 82 compared with alum aluminum salts recorded 95% , with kaolin suspension when the pH optimum was (7) at room temperature, the presence of calcium chloride have shown the results of the statistical analysis and there is a difference significant at * ($P < 0.05$) in the density values optical (OD).

Introduction

Bioflocculation is basic phenomenon used in the treatment of domestic sewage and industrial for separation of suspended solids from wastewater is achieved with the help flocculants, There are three classes of flocculants, namely: (i) inorganic flocculants such as aluminum sulfate and polyaluminum chloride; (ii) organic synthetic flocculants such as polyacrylamide derivatives and polyethylene amine; and (iii) naturally occurring flocculants such as chitosan, sodium alginate, and microbial flocculants(Saharet.al.,2013; Zhi-qianget.al., 2007).Bioflocculation is the dynamic process resulting from the synthesis of extracellular polymer by living cells such as extracellular polysaccharide, glycoprotein, protein, cellulose and nucleic acid (Piyoet.al.,2011).Bioflocculants have gained much wider attention due to their biodegradability and safety in waste water treatment, bioflocculants have been used to treat dye solutions, inorganic solid suspensions, downstream processing, food and industry waste water heavy metals, among others(Luvuyoet.al.,2013 and Zhang, et.al.,2012)

Bioflocculant is producing from of bacteria during this product growth used to purify water and its ability to biodegradation and the lack of secondary pollution deposition of pollutants in the water as a substitute for flocculate organic or chemical the advantage of being biodegradable environmentally friendly does not have toxic effects, although chemical flocculants have been widely used for their effective flocculating and low cost, they have increased environmental risk, and threatened human health including neurological toxin, cancer and Alzheimer's diseases (Luvuyoet.al.,2013;Piyoet.al.,2011).The use of bioflocculants in wastewater treatment seems to be an economical alternative to physical and chemical means, Bioflocculants are capable of removing inorganic or organic particles through their flocculating activity. It has been investigated that bioflocculant is effective in removing suspended solids, heavy metals and bacteria, and in reducing the turbidity of different types of industrial wastewater

,knowledge of microbial growth and substrate utilization has been of tremendous help for the prediction of the fate of organic compounds in natural and engineered environment(Adebami, et.al.,2013), so it may potentially be applied in the treatment of drinking water and fermentation processes (Leonard et.al ., 2012) .

4. MATERIALS AND METHODS

Bacterial were isolated and diagnosed by using (vitek 2 compact) and traditional methods (Macfaddin, 2000) and prepare sintered material and calculate the efficiency of activity according to the source (Piyoet.al., 2011; Zhanget.al.2012) which include the following:

First: Source of bacteria and culture media

The pre-culture medium consisted in 100ml Peptone 0.5g, (NH4)2SO4 0.2g, Yeast extract 0.1g, CaCl2.2H2O 0.07g, NaCl 0.01g, MgSO4.7H2O 0.02g, K2HPO4 0.1g, Glucose 0.1g (3). Two loopful of bacterial isolate detection colonies transfer to 500 ml flask have 300ml culture media were inoculated into 50 mL of the medium and incubated with shaking at5days or more in 120rpm at 30c.After incubation centrifuge 6000xg for 30min take supernatant or take precipitation cell (pillate) re-suspend, supernatant 2 volume ethanol added and put in forgetter for 24h centrifuge 4000xg for 15min and take pillate and dried.

Second: Flocculation Test The mixture contain (0.5 g) of Kaolin suspension take with (50 ml) with calcium chloride CaCl2 (0.1 g) of bacteria added to the (1000 ml) of distilled water .shake mixes quickly (60rpm) for (30 minutes) with mixing using (jar test) then stop for a period of confusion (5 minutes) and leave at room temperature and then we measured the turbidity device or optical density.

Third: Measurements of Flocculating Activity (%)

The flocculating activity was calculated according to the equation:

Flocculating activity (%) = $[(B - A)/A] \times 100$

where A is the optical density of the sample at 550 nm; B is the optical density of control experiment at 550 nm.

5. Statistical Analysis

Use statistical program Statistical Analysis System-SAS (SAS, 2010) to study the effect of the factors studied in different qualities and compared the differences between the averages of the moral or percentages tested less significant difference test (Least significant difference-LSD test).

6. Result and Discussion

Different microorganisms are reported to produce variety of Bioflocculants. The culture was performed and the flocculation activity of its fermentation medium was measured simultaneously.

Flocculation activity this shows that strain had a higher productivity in the bioflocculant production in compared with other strains. The isolation Bacillus spp. diagnosed by traditional methods and bacterial isolates Citrobacter spp.,Kocuravaridia,Klebsiellapneumonia and Enterobacter spp. diagnosed by (vitek 2 compact) as shown in Table (1) also showed the results of the absorbance susceptibility to bacterial types and aluminum salts before and after the addition of flocculant material as well as table shows the efficiency ratio compared to aluminum salts (alum).

Table 1 shows the bacteria isolated and portability flocculation ratio compared to alum.

Type of Bacterial and Alum	Concentration (g)	Before addition OD	After addition OD	Flocculation of kaolin clay (%)
Bacillus spp.	0.1	1.712	0.095	94%
Citrobacter spp.	0.1	1.128	0.169	%85
Kocuravaridia	0.1	1.128	0.098	%91
Klebsiella pneumonia	0.1	1.712	0.250	85%
Enterobacter spp.	0.1	1.128	0.202	%82
Alum	0.1	1.128	0.194	%95
LSD( )	-- -	0.409 *	0.055 *	7.092 *
* (P<0.05)				

The result of table above shows the extent of the difference between the lowest value and the highest value obtained when adding biofliculant and shows readings as well as the rates for all bacterial species used compared to aluminum salts (alum), which recorded the highest value of the type of bacterial Bacillus spp. was 94 % and the lowest value was Enterobacter spp.% 82 and contrast those values bacterial species were Kocura varidia spp.% 91

and Citrobacter spp. Klebsiella. pneumonia % 85,at a concentration of 0.1 mg/l, this result depend on capability of sugars and proteins on the surface of bacterial cells in addition to molecular weight and active substances in the molecular chains that determine the activity of bioflocculant (Cosaet.al.,2011). The statistical analysis results showed significant differences when* ($P < 0.05$) in the values of optical density (OD) before and after addition and for all types of bacteria and aluminum salts (alum) used. Removal bioflocculant percent depends on the concentration of bioflocculant, size of the inoculum , speed of shakes incubator for clture media , time period , degree of temperature and pH (Zhi-qianget.al.,2007),studies show difference in rates of flocculation different bacterial species due to different requirements (Nontembisoet.al., 2011). Many studies have reported optimum dosage of different bioflocculants from sole microorganisms but reportson of microorganisms are still very scarce in the literature.This study we observed a good flocculating activity in the bioflocculant produced by Bacillus sp. flocculating activity of 90% while another similarly reported that the bioflocculant showed that the optimal amount of bioflocculant of Bacillus sp. for domestic wastewater was the flocculating activity (turbidity removal) was 62.7% with pH 11 (Bajlanet.al.;2013) and another results obtained indicated that the flocculation activity of Bacillus thuringiensis from sand biological soil showed can be achieved at over 80.4% in kaolin suspension and this occurred at a concentration of 0.4 mg/l(Wang,et.al.2011).Show results that optimum pH (7) at room temperature is more appropriate degrees of acidity other where the highest percentage bioflocculant of various bacterial species used , where the high grades of temperatures working on denaturation of proteins and amino acids that are this working to reduce the waste water treatment (Saharet.al.,2013), as well as the results are consistent pH value ranging from (6 -8) and values are optimized for the production of bioflocculant material (Wen-xinet.al., 2008).

As for the aluminum salts were the highest value for the removal recorded a 95% which shows that the effectiveness of the aluminum ions are at a certain point , and that increasing the concentration of these ions lead to a negative impact in terms of the removal leading to a state of mutability would get again as the increase in the concentration of ions , aluminum means increase the concentration of positive charge (Water Treatment Manual, 2002),A comparison of the flocculating activities of the purified bioflocculant with commercially available inorganic and synthetic flocculants. The bioflocculant revealed a higher flocculation of kaolin clay of 90%, compared with alum which recorded a flocculating activity of 66.82%. (AM Ugbenyen and AI Okoh, 2014) as well as the use of alum in large quantities to increase the concentration of aluminum ions in the treated water , which has negative effects on humans and the liquefaction pipes and water quality (Piyoet.al., 2011).

The results Figure (1) to preparatory stages before the addition of bioflocculant and the use of Jar test either Figure (2) refers to the addition of bioflocculant in jar test shows the extent to which bacterial species.

Figure (1):Effect of bioflocculant on the turbidity the preparation of the models before adding the bioflocculant.

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Figure (2):Effect of bioflocculant on the turbidity the preparation of the models after adding the bioflocculant.

7. CONCULATION

The key conclusions of her research as follows:1- Considered the work of the Bioflocullant compared to alum in water treatment The relatively good efficiency. 2-Production of environmentally friendly materials have no health effects.

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