Effect of Dosage of Algae-lysing Bacteria on Algae-dissolving

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Abstract: In order to study the algae-dissolving effect of algae-lysing bacteria S7 on cyan bacteria, the algae-alkali test was carried out on bacteria S7 grown for 24 hours. The algae-alkali bacteria with different volume fractions were added to observe the algae-dissolving effect. The experimental results show that the occurrence of algae action has a lower limit on the volume fraction of bacteria S7, and only when this lower limit is reached or exceeded; there is obvious algae-dissolving phenomenon. When the lower limit is reached, the algae-dissolving phenomenon is delayed or not obvious. When the lower limit is reached, the algae-dissolving phenomenon is delayed or not obvious. The larger the initial volume fraction is, the more obvious the algae-dissolving phenomenon and the shorter the algae-dissolving time are. In order to achieve better algae-removing effect, the dosage ratio of bacterial S7 was determined to be 1:10.

1. Introduction

At present, the eutrophication of lakes and reservoirs in China is serious, and the cyanobacteria blooms frequently occur. Among them, algae-dissolving bacteria have great potential in inhibiting the growth of harmful algae and purifying water bodies[1], algae-dissolving bacteria The effect is also closely related to the concentration of algae. In this study, the algae were studied as algae, and the effects of different volume fractions on the algae-alkali effect were studied.

2. Materials and methods

2.1 Test materials

The selected algae species are Anabaena flos-aquae1092 in cyanobacteria, which is derived from the Algae Collection (FACHB) of the Institute of Hydrobiology, Chinese Academy of Sciences. The bacterial culture was carried out using CT medium. The CT medium formulation is shown in Table 1.

Table 1 Ingredients L of CT medium

Component	Amount	Stock Solution
$Ca(NO_3)_2{\cdot}4H_2O$	1ml/L	15g/100mL dH_2O
KNO_3	1ml/L	10g/100mL dH_2O
$MgSO_4{\cdot}7H_2O$	1ml/L	4g/100mL dH_2O
β-Na_2glycerophosphate	1ml/L	2.5g/100mL dH_2O
PIV(trace mental solution)	1ml/L	Na_2EDTA 0.75g/LdH_2O
		$MnCl_2{\cdot}4H_2O$ 0.041g/L dH_2O
		$ZnCl_2{\cdot}7\ H_2O$ 0.005g/L dH_2O
		$NaMoO_4{\cdot}2H_2O$ 0.004g/L dH_2O
		$FeCl_3{\cdot}6H_2O$ 0.097g/L dH_2O
		$CoCl_2{\cdot}6H_2O$ 0.002g/L dH_2O
TAPs	0.4g/L	/
Vitamine B12	0.1μg/L	/
Biotin	0.1μg/L	
Thiamine HCl	10μg/L	
pH	8.2	

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2.2 Test strain

The test strain was algae-dissolving bacteria S7, which was separated from the Tunxi River, a eutrophic secondary river in the Three Gorges Reservoir area by the research group. Figure 1 is a photograph of colony characteristics and Gram stain of bacteria S7. The bacterial culture was carried out using beef extract peptone medium: beef extract 3 g, peptone 10 g, NaCl 5 g, distilled water 1000 mL, and the pH was adjusted to 7.2.

2.3 Test methods

Choose 6 different bacteria to add volume fractions of 1:100, 1:50, 1:20, 1:12.5, 1:10, 3:20 (Add 1 mL, 2 mL, 5 mL, 8 mL, 10 mL, 15 mL of bacterial solution to 100 mL of faecalis, and the cell concentration is 108 cell/mL.), operated under aseptic conditions, and 3 replicates were prepared for each test group. The culture temperature was 25 ° C, the light intensity was 2000-2500 lux, and the light-dark cycle ratio was 14 h: 10 h. Shake 3 to 5 times a day. The absorbance value was measured at 680 nm every 24 h to test the algae-dissolving effect (because it is a pure algae culture solution, and does not contain other chlorophyll-containing organisms in the natural water body, so the change in absorbance value can well characterize the removal effect of microcystis aeruginosa. .

3. Experimental results

It can be seen from the figure that in the algae-alkali test, the bacterial volume fraction (1:100, 1:50, 1:20, 1:12.5, 1:10, 3:20) is different, and the algae-dissolving effect is better. The large effect, the initial average OD value of the algae solution in the test was 0.66, and when the bacterial addition volume fraction was 1:100 (1 mL per 100 mL of algae liquid), the algae-dissolving effect was not exhibited. When the volume fraction of bacteria added was 1:50 (2 mL per 100 mL of algae), the algicidal effect was observed on the 5th day, the OD value decreased to 0.51; the OD value on the 7th day was 0.46; However, when the bacterial addition volume fraction is 1:20 (5 mL per 100 mL of algae liquid), the algae-dissolving effect is exhibited at the beginning of the 3rd day, the OD is reduced to 0.43, and the algae-dissolving effect is very obvious on the 5th day, The value decreased to 0.34, and the OD value of the 7d was 0.27. When the bacterial addition volume fraction was 1:12.5 (8 mL per 100 mL of algae), algae was formed on the 1st (24h), OD The drop is 0.53, the OD drops to 0.24 on the 5th day, and the OD value on the 7th day is 0.18. As can be seen from the figure, the added volume fraction of bacteria solution is positively correlated with the algolytic effect. Through analysis, it can be seen that there is a lower limit for the added volume fraction of algolytic effect of algae-lysing bacteria S7: When the volume fraction of bacteria was greater than 1:50 (i.e., 2mL bacteria were added into analgal solution of anabaenia anabinosa per 100mL), bacterial S7 showed algolysis on the 5th day. Only when the lower limit is reached or exceeded can the algolysis be obvious. When it is lower than the lower limit, the alginolysis is delayed or not obvious. The larger the proportion is, the more obvious the alginolysis is and the shorter the alginolysis time is.

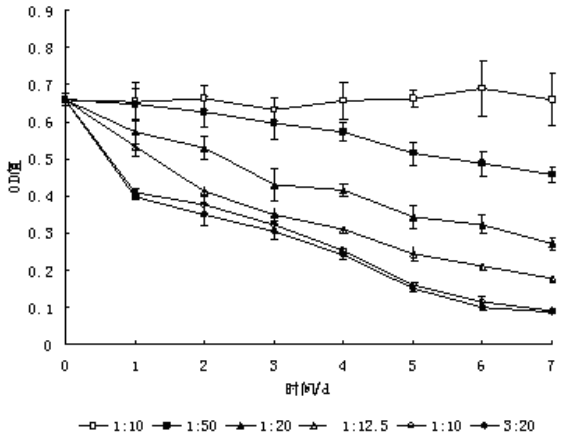

Fig. 1 Algicidal effect of different Volume Fraction of bacteria S7

Studies have shown that the growth curve of algal lysogenic bacteria of different species and genera is greatly different, and the growth rate of bacteria and bacteria in different growth periods also have an impact on the algal lysis. Algolysis is also related to the concentration of algolytic microorganisms. Bacterial algolysis requires a certain initial concentration to obtain an ideal algolysis effect, when the algolysis is delayed or not obvious below the lower limit of this concentration. As reported [2], Mycobacterium can reduce the biomass of Nostoc, but the initial concentration of bacteria must reach 5 × 106 cells / mL. Below this concentration, there is no algae-reducing effect in oligotrophic medium. The ability to dissolve algae in the enriched medium is delayed, and the higher the initial concentration, the faster the algae-dissolving effect. The higher the initial concentration, the faster the algolysis effect is. 5 times 104cell/mL requires 4d, and 5 times 103cell/mL requires 8d. 5 times 102 cells /mL requires 12 days. Peng chao [3] showed that when M6 and M13 were 104 ~ 105cell/mL and M8 were 104 ~ 106cell/mL, alginolysis was not obvious and the alginolysis time was prolonged. When M6 and M13 were 105 ~ 1010cell/mL and 106 ~ 1010cell/mL and M8 were 106 ~ 1010cell/mL, alginolysis was obvious, and the higher the initial concentration was, the more prominent the alginolysis effect was. The lower concentration limit of the three alginolytic bacteria was: M6 was 105cell/mL, M8 was 106cell/mL, and M13 was 105cell/mL. The reason of this difference is related to the different species and ways of lysis of algal bacteria.

The results showed that there was a lower limit on the volume fraction of the algae-activating action of bacteria S7: when the volume fraction of bacteria was greater than 1:50 (ie, when 2 mL of bacteria were added per 100 mL of the algae solution), Bacteria S7 showed algae-dissolving effect on the 5th day; when the volume fraction of bacteria was 1:20, it showed obvious algae-dissolving effect on the 3rd day; when the volume fraction of bacteria was 1:12.5, it showed obvious algae-dissolving at 24h effect. In order to achieve better algae-dissolving effect, this experiment chose to set the ratio of bacterial S7 to 1:10.

4. Conclusions

The test results indicate that the occurrence of algae action has a lower limit on the volume fraction of bacteria S7, and only when this lower limit is reached or exceeded, there is obvious algae-dissolving phenomenon. When the lower limit is reached, the algae-dissolving phenomenon is delayed or not obvious. The larger the initial volume fraction is, the more obvious the algae-dissolving phenomenon and the shorter the algae-dissolving time are. Bacterium S7 was grown for 24h for algae-breaking test. When the volume fraction of bacteria was 1:50 (that is, when 2 mL of bacteria was added per 100 mL of the algae solution), the bacteria S7 showed algae-dissolving effect on the 5th day; when the volume of the bacteria When the score is 1:20, it shows obvious algae-dissolving effect on the 3rd day; when the volume fraction of bacteria is 1:12.5, it shows obvious algae-dissolving effect at 24h. In order to achieve better algae-dissolving effect, the bacterial S7 is cast. The addition ratio is determined to be 1:10.

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