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Removal of *Cochlodinium polykrikoides* using a novel material produced from sediment - A field study

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ABSTRACT : *The present study was conducted in three fields at Namhae to examine the removal efficiency of organic free, heavy metal immobilized sediment on Cochlodinium polykrikoidesand and on sea water quality. The present study results concluded that removal efficiency was depends on the initial number of red tide cells. There was no drastic change in the sea water quality after sediment spray. For the comparison of effectiveness of betonite, zeolite and lime were mixed with sediment did not show any marked difference in removal. Finally, the present study evaluated 50g/m^2 sediment is sufficient to remove 100% cells density, even though various environmental factors are interfering the mechanism.*

KEY WORDS : *Harmful algal blooms; Red tide; Cochlodinium polykrikoides sediment; cell density; field study; sea water quality*

1. Introduction

Cochlodinium polykrikoides is one of the most frequently appearing harmful dinoflagellate responsible for fish kills and it occurs annually in coastal water of korea, causing significant damage. The alleged economic loss in Korea caused by the *C. polykrikoides* bloom is increased every year. Until now various materials can be used to control harmful algal blooms however, these materials are not suitable on field due to a number of disadvantages especially requirement of high load, changes of water quality, effect of marine community and not eco-friendly.

2. Objective

To investigate the effects and practicability of dredged sediment collected from Busan port dumping site to remove *C. polykrikoides* algal blooms carried out in field experiments at Namhae, Korea. Almost no research was carried out the field experiment using dredged sediment on the open system. Therefore, the present study report the *C. polykrikoides* removal efficiency of organic free, metal immobilized dredged sediment in field as well as bentonite, zeolite and lime were mixed with sediment in different combination to compare the removal efficiency.

3. Materials and Methods

In the present study was conducted in 3 sites at Namhae, South Gyeongsang Province, South Korea. Based on sediment heavy metal concentration, analytical grade of potassium dihydrogenphosphate (KH2PO4) was used as a source of phosphate for metal immobilization of sediment before spray to field. Bentonite, zeolite and lime each were mixed with field 1 sediment, zeolite and lime in field 2 sediment and lime only in field 3 sediment for the comparison of effectiveness of cell removal. The suspensions were sprayed on the surface of the field using a pump and nozzle. At each station characteristics of sea water were recorded at surface, middle and bottom layers before and after (10 and 30 min) sediment spray. Meanwhile water samples were collected and fixed with lugal solutions for enumeration of red tide cells.

4. Results and Discussion

The present study results showed that the addition of

sediment to *C. Polykrikoides*, surface water containing 3250 cells/ml in 1st field, 2250 cells/ml in 2nd field and 1625 cells/ml in 3rd field, removed 88%, 77% and 100%, respectively. In the case of middle layer *C. Polykrikoides* decreased by 94% in 1st field, 80% in 2nd field and 100% in 3rd field after 30 sediment spray. Cell density in bottom layer was very less when compared to surface and middle layer at all fields. Moreover, at field 1 and 3, 50% of the algal blooms were removed from the bottom layer and 80% in 2nd field after 30 min sediment spray. There was no significant alterations observed in water parameters like pH, conductivity, salinity, trace elements, TSS, VSS, TS, VS and nutrient like nitrate. Figure 1 showed the effectiveness of cell removal by 3 kinds of sediments in 3 fields. Here effectiveness of initial cell density removed by 1 g of sediment was calculated after 10 min and 30 min sediment spray. Here the effectiveness of removal was increased linearly with increasing cell density after 30 min sediment spray. This figure concluded that the removal efficiency was depents on the initial cell density.

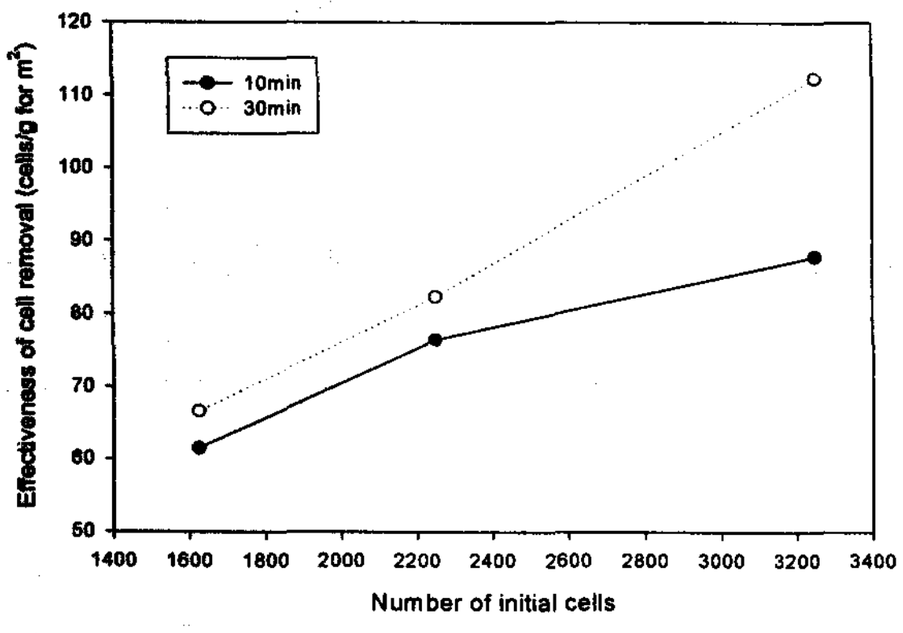

Figure 1. Relationship between the effectiveness of a material on the C. *polykrikoides* removal with its initial density in the surface layer of the sea

This finding showed that the bentonite, zeolite and lime didn't make any different on removal efficiency. This study evaluated that sediment concentration approximately 30g/m^2 was removed 3000cells/ml even sediment mixed with betonite, zeolite and lime in field 1 or zeolite and lime in field 2 or lime only infield 3. Finally, the quantity of 50 g/m^2 sediment may be higher removal efficiency on *C. polykrikoides*, even though various factors like higher cell density, size of the sediment, settling velocity, wind speed and coagulation speed were interfere the mechanism.

5. Conclusions

1) Present study field test indicate that sediment have a higher capacity to remove the red tide cell. 2) 100% of the red tide cells removed by 24.4g/m2 of sediment with if the cell density less than 1600 cells/ml on surface layer. 3) Nearly 80% of the cells removed by sediment when the cell density exceed over 1600 cells/ml upto 3600 cells/ml. 4) Effectiveness of cell removal showed that there was no marked difference when bentonite, zeolite and lime were added to sediment. 5) Effectiveness cell removal showed if the concentration of sediment is 50g/m^2, may be it remove higher capacity of red tide cells, even though various environmental factors interfere the mechanism. 6) Finally this field experiment proved that sediment has the high removal efficiency, rapidity, cost effectiveness and potentially low environmental impacts.

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References

Anderson, D.M., 1997. Turning back the harmful red tide. Nature 388, 513-514.

Bricelj, V.M., Malouf, R.E. 1984. Influence of algal and suspended sediment concentrations on the feeding physiology of the hard clam Mercenaria mercenaria. Mar. Biol. 84, 155 - 165.

Choi, H.G., Kim, P.J., Lee, W.C., Yoon, S.J., Kim H.G., Lee, H.J. 1998. Removal efficiency of Cochlodinium polykrikoides by yellow loess, J. Korean Fish, soc, 31, 109-113.

Fukami, K., Nishijima, T., Murata, H., Doi, S., Hata, Y., 1991. Distribution of bacteria influential on the development and the decay of Gymnodinium nagasakiense red tide and their effects on algal growth. Bull. Jpn. Soc. Sci. Fish. 57, 2321 - 2326.