WATER QUALITY AND DINOFLAGELLATE BLOOM IN COASTAL WATERS OF THE SOUTH CHINA SEA

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Introduction

Red tide refers to the rusty red colouration of the seawater due to the pigmented *peridinium* content of dinoflagellate cells. In contrast to normal phytoplankton bloom, red tides are predictable and occur once or twice yearly with regularity, often markedly monospecific in nature (> 90% of total cell count belong to a single species). Red tides occur in distinct patches as opposed to ordinary blooms which are more diffuse. A study was undertaken of the primary productivity, chlorophyll biomass, water quality and other related parameters of fish ponds along the coastal water of South China Sea, where an intensive fish culture activity is presently located. The incidence of plankton bloom and information on various water quality parameters were especially noted.

Materials and Methods

The study was carried out in brackish-water fish ponds in Terengganu (1996 to 1998). Fish ponds are presently used as an intensive culture activity, obtaining its water source from lagoons or moat waters facing the South China Sea. Subsurface samples (0.5 m depth) were taken in carboys at all stations and transported to the laboratory for analyses. Photosynthetic measurements were carried out using the modified method of Byran et al. (1976). Determination of ammonia, total dissolved phosphorus and particulate phosphorus in natural waters were determined. Lipid was extracted twice from samples with chloroform methanol and water (1:2:0:8 by volume) (Kates, 1972). Lipid material was methylated with 14% boron trifluoride methanol (w/v) (Morrison and Smith, 1991). Fatty acid methyl esters FAME were injected at 60°C onto a single column *Hewlett Packard* (HP, 5980 series II) gas chromatography unit (Shamsudin, 1992).

Results and Discussion

Red tide of dinoflagellate was observed in brackish water fish ponds along the coast coast of the South China Sea. The nearby coastal lagoon water facing the South China Sea is the source of water for fish pond culture activities of sea bass during the study period. An examination of water quality in fish ponds during the study period indicated that both the organic and inorganic nutrients were high during the pre-wet monsoon period. The source of the nutrients in coastal water was believed to be derived from the agro-based industrial effluents, fertilisers from paddy fields and untreated animal wastes. This coincided with the peak production of dinoflagellate in the water column. The cell count ranges from 8.3 to 60.4 x 10.4 x 10^4 / *l* during the bloom peak period and the bloom species were compared entirely of non-toxic dinoflagellates with *Protoperidinium quinquecorne* occurring > 90% of the total cell count. However, both cultured and indigenous fish species were seen to suffer from oxygen asphyxiation (suffocation due to lack of oxygen). Two species of Ciliophora, *Tintinnopsis* and *Favella*, were observed to graze on these dinoflagellates at the end of the bloom period. These dinoflagellate cells showed high content of PUFAs (polyunsaturated fatty acids especially eicosapentaenoic acid EPA, decosohexaenoic acid DHA) which are potentially rich supplementary feeds for fish. The fish ponds are usually situated in a low-lying region and it is a convenient depository ground or outlet for water-based effluents (industrial, agriculture, untreated human and animal wastes and siltation due to erosion from land developments). The neighbouring region around the study area is presently undergoing heavy paddy plantation and crop fertilisation. The most common microplankton species encountered during the study period included those of diatom (Bacillariophyceae), dinoflagellate (Dinophyceae), blue-green algae (Cyanophyceae) and Ciliphora.

Conclusions

Plankton bloom occurred during the study periods when the mean cell count had already reached a peak value of 60.4 x 10^4 cell / *l*. During the bloom, dinoflagellates were the most predominant algae, comprising species of *Ceratium, Peridinium, Protoperidinium, Gonyaulax, Dinophysis, Ornithocercus* and *Gymnodinium*. The most dominant dinoflagellate during the bloom comprised of the non-toxic species of *Protoperidinium quinquecorne* (> 90% of total cell count) with a smaller proportion of *Protoperidinium brochii* and *Protoperidinium excentricum*. Considerable amounts (6-11% of the total fatty acid) of the polyunsaturated fatty acid 18:3w3 (linolenic acid) were present in the dinoflagellate. However, high amounts of 20:5w3 (eicosapentanoic acid) and 22:6w3 (docosahexaenoic acid) were present with variable but usually high amounts of 22:4w6 acids. Lipid content were three to five times higher than chlorophyll *a*.

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