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Bioremediation by Using Optical Fibers and Psychrophilic Bacteria

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Abstract

The effects of introducing irradiation by an optical fiber, and of adding psychrophilic bacteria, to the bottom water environments were assessed for supplying oxygen to the anoxic water in stratified season, and for accelerating the microbial activities in the water of low temperature season, respectively. Bottom seawater collected from a eutrophic enclosed inlet usually contained about 2 ug l-1 of chlorophyll a and 10 uM of dissolved inorganic nitrogen. When the in situ bottom waters were incubated in the dark condition, DO concentrations always decreased. However, the DO concentrations increased when water samples collected in the stratified seasons were incubated under light condition of 500 lux, indicating that such low irradiation of 500 lux was often over the critical light intensity and was effective for phytoplankton on stimulating photosynthesis. A bacterial strain CA(20)14 isolated from the Antarctic had the optimal growth temperature of 10 to 15 C. When this psychrophilic bacterium was added to the bottom water-sediment system and incubated at 10 C, the releasing rates of ammonia into water was accelerated as twice as greater than that without adding the strain. From the results of the present study, it was indicated that low activities of bacterial communities in the bottom environments were enhanced by introducing the light into the oxygen-depleted bottom water with optical fiber and supplying oxygen through plankton photosynthesis in the stratified season, and by the addition of some psychrophilic bacteria in the low temperature season. The combination using both optical fiber and psychrophilic bacteria is promising strategies of bioremediation for the eutrophic bottom environments.