No. 1406

Developments of Facile Sensors of Divalent Heavy Metal Ions in Sea Water Using Algae Biomasses

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Summary

Detection of heavy metals in sea water is one of the important themes in environmental sciences, and developments of sensing materials for detection of heavy metals by low-cost and green processes will be useful to study such a theme. From the points of view, we focus on chlorophylls in algae biomasses, which are largely present in sea water but have not been utilized yet. Chlorophylls are natural photosynthetic pigments and have intense absorption bands in the visible wavelength region. In addition, the positions of absorption bands and the efficiency of photon absorption of chlorophyll molecules can be regulated by modification of their molecular structures. Generally, chlorophyll molecules have central magnesium in the tetrapyrrole macrocycle, and the central metal is responsible for spectral properties of chlorophylls. Therefore, chlorophylls in algae will be one promising materials for functional pigments to detect heavy metals in sea water. In this study, we synthesized methyl pyropheophorbide *a* from natural chlorophyll *a*, which was extracted from a cyanobacterium, and investigated coordination behaviors of divalent metals to methyl pyropheophorbide *a*. As a result, copper ion was selectively inserted into the center of the tetrapyrrole macrocycles of methyl pyropheophorbide *a*, resulting in large spectral changes. Methyl pyropheophorbide *a* was successfully immobilized on the silica-gel plates; its color was clearly changed by incubation in an aqueous solution containing copper ion. These results suggest that chlorophyll derivatives from algae will be useful for developments of facile cupper ion sensors in sea water.