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Bioremediation of Environmental Pollutions by Glycosylation with Immobilized Marine Microalga

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Summary

Fluorophenolic compounds are used to agrochemicals and pharmaceuticals, and cause serious environmental contamination. Number of fluorine-containing agricultural chemicals has grown from 4% to approximately 9% of all agrochemicals and has increased in number faster than non-fluorinated agrochemicals over the past 15 years. These compounds are primarily used as herbicides, insecticides, and fungicides, and their residues are released as pollutants into rivers and seas.

This study focused on the metabolism of mono-fluorophenols by cultured and immobilized marine microalga of *Amphidinium crassum*. Biotransformation product was isolated from the cultured cells of *A. crassum*, which had been treated with 2-fluorophenol. Potentially glucosylated product was obtained, and its chemical structure was determined on the basis of their FABMS, ^{1}H and ^{13}C NMR, H-H COSY, C-H COSY, and HMBC spectra as 2-fluorophenyl β-D-glucoside. Substrates, 3- and 4-fluorophenols, were converted into 3- and 4-fluorophenyl β-D-glucosides, respectively. The glucosylation activity of immobilized *A. crassum* cells was enhanced at 2% sodium alginate concentration. Use of immobilized *A. crassum* cells improved the glycosylation activity, and the amount of glycosides was enhanced 2.5 fold in comparison with the case of biotransformation with cultured *A. crassum* cells.

Halophenols containing stable carbon-halogen bond in their structures have been described to be much more resistant to microbial degradation than unsubstituted analogs. From the viewpoint of seawater pollution control, glycosylation of halophenols by immobilized marine microalga is important and environmentally friendly.