
RECENT RESEARCH ACTIVITIES

Screening and identification of useful enzymes from biphenyl/PCB-degrading bacteria that metabolize lignin-derived aromatic compounds

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A variety of microorganisms play a significant role in the mineralization of plant lignin. The lignin-derived aromatic compounds are further degraded by soil bacteria. So far, a number of biphenyl/polychlorinated biphenyls (PCB)-degrading bacteria have been isolated from various environmental samples and characterized in terms of biochemical and genetic aspects [1]. Recently, the genome analyses of ten biphenyl/PCB-degrading bacteria, isolated from biphenyl-contaminated soil in Kitakyushu, Japan, were performed [2-3]. Interestingly, some of these biphenyl/PCB-degrading bacteria grew well on lignin-derived aromatic compounds as the sole sources of carbon and energy, as well as xenobiotic compounds like PCB. This finding implies that biphenyl/PCB-degrading bacteria may be a type of terminal lignin-degrading bacterium.

To globally screen and identify expressed proteins involved in the metabolism of lignin-derived aromatic compounds from these biphenyl/PCB-degrading bacteria, a proteomic approach is needed. On the other hand, I have already optimized a fluorescence two-dimensional difference gel electrophoresis (2D-DIGE) method for a white-rot fungus surrounded by polysaccharide sheath [4]. Therefore, I tried to modify this method for biphenyl/PCB-degrading bacteria and to perform 2D-DIGE using intracellular proteins prepared from *Pseudomonas furukawaii* (formerly *P. pseudoalcaligenes*) KF707 [5]—one of the best-characterized biphenyl/PCB-degrading bacteria—grown in the presence and absence of biphenyl. As a result, I successfully detected the difference in protein expression under the two culture conditions and also identified up-regulated, constantly expressed, and down-regulated proteins by peptide mass finger printing. These results show that using proteomic and genomic approaches, I can efficiently screen and identify candidate proteins and genes involved in the metabolism of lignin-derived aromatic compounds from biphenyl/PCB-degrading bacteria. These approaches can also lead to the production of useful aromatic compounds from wood biomass.

References

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