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DEVELOPMENT OF A WHOLE-CELL SENSING SYSTEM FOR PCBs DETECTION

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Polychlorinated biphenyls (PCBs) are a group of organic chemicals that are persistent when released in the environment. Due to its potential health threat to the human body and the environment, there is a need for a simpler yet sensitive method for quantifying PCBs in environmental samples, including soil and sediments. Here, we report the development of a method for the detection of PCBs based on a whole-cell biosensing system that employs the *bph* operon from *Pseudomonas pseudoalcaligenes* KF707. In our method, the PCB congeners are first dechlorinated to biphenyl and are subsequently detected with the whole-cell biosensing system. Plasmid pSD7000 was constructed with the *lacZ* gene under the control of the *pE* promoter of the *bph* operon from *P. pseudoalcaligenes* KF707. The *bph* operon in the chromosome is regulated by the *bphR1* gene, which further regulates the expression of the whole cluster *bphR1A1A2 (orf3) A3A4BC* by activating the *pE* promoter. Biphenyl is the substrate of BphA, which by subsequent reactions produces 2-hydroxy-6-oxo-6-phenylhexa-2,4-dienoic acid [HOPD]. HOPD, in turn, binds to BphR1, forming the activator complex of the *pE* promoter. When the cells were incubated with biphenyl, HOPD can be produced by the chromosome, and can be bound to BphR1, activating the *pE* promoter in the plasmid. As a result, β -galactosidase is produced and its expression can be related to the concentration of biphenyl. Biphenyl concentration in the range of 10^{-6} - 10^{-4} M could be detected by our sensing system. Consequently, PCBs concentration that is proportional to the biphenyl concentration could also be obtained. The whole-cell sensing system harboring plasmid pSD7000 allows for the detection of the concentration of biphenyl, the dechlorination product of the PCB congeners. As compared to the conventional detection of PCBs in environmental samples, this whole-cell based sensing system shows high efficiency and sensitivity. More studies are underway to improve the detection limit of our system.