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Degradation mechanism for phthalic acid esters (PAEs) degrading bacterium

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Di-(2-ethylehxyl) phthalate (DEHP) is the most broadly representative phthalate esters (PAEs) used as a plasticizer and considered an endocrine-disrupting chemical. An efficient DEHP-degrading strain *Rhodococcus ruber* YC-YT1, with salt tolerance (0~12% NaCl), is the first DEHP-degrader isolated from marine plastic debris around coastal saline seawater, which could completely degraded 100 mg/L DEHP within 72 hours. Single factors (pH, temperature, and glucose) analysis and the optimum degradation conditions for the strain were measured by response surface methodology (RSM). According to HPLC-MS analysis, DEHP was transformed by strain YC-YT1 into phthalate (PA) via mono (2-ethylehxyl) phthalate (MEHP), and then PA was used for cell growth. Furthermore, YC-YT1 metabolized initial concentrations of DEHP from 0.5 to 1000 mg/L. Especially, YC-YT1 degraded up to 60% of 0.5 mg/L DEHP. Moreover, compared with previous reports, strain YC-YT1 has the largest substrate spectrum, degrading up to 13 kinds of PAEs as well as diphenyl, PA, benzoic acid, protocatechuic acid (PCA), and 1,2,3,3-tetrachlorobenzene. Strain YC-YT1 could adjust its cell surface hydrophobicity (CSH) in the environment and 79.7~95.9% of DEHP-contaminated soil and water was remedied. These results demonstrate that strain YC-YT1 has vast potential to bioremediate various DEHP-contaminated environments, especially in saline environments. The whole genome sequence of strain YC-YT1 was obtained by the PacBio sequencing platform and submitted to GenBank (CP023712), which contained a circular genome and two plasmids. The genes and gene clusters involved in the degradation of PAEs and aromatic compounds, especially the phthalate dioxygenase genes and ring- cleavage dioxygenase genes, which involved the degradation of diphenyl, PCA, benzoate and phthalate were analyzed by comparative genomics analysis. Two genes (*Dehp1199 and Mehp4077*) encoding DEHP degrading esterases were obtained, condon optimization, expressed and verified. Dehp1199 is a novel alkaline esterase and the enzymological characteristics were analyzed.

Biography

Yanchun Yan has her expertise in bioremediation of environmental pollution and passion in improving the health and wellbeing. Her research team has been focused on the bioremediation for more than twenty years, and they have isolated more than 60 strains of bacteria or fungi capable of degrading pesticides or environmental estrogen chemicals. The degradation characteristics of the strains and a number of genes or gene clusters encoding key enzymes were investigated. These researches provided significant resources of strains and genes for bioremediation, and lay theoretical foundation for the degradation mechanism of pollutants.

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