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Studies on the efficient degradation of phthalic acid esters by *Gordonia alkanivorans* YC-RL2 and *Mycobacterium* sp. YC-RL4

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Phthalic acid esters (PAEs) are widely used as plasticizers to improve the flexibility of plastic products. The PAEs are carcinogenic, estrogenic and extremely difficult to be degraded under natural condition. The isolated strains *Gordonia alkanivorans* YC-RL2 and *Mycobacterium* sp. YC-RL4 were capable of degrading PAEs effectively, including dimethyl phthalate (DMP), diethyl phthalate (DEP), dibutyl phthalate (DBP), dicyclohexyl phthalate (DCHP), and di-(2-ethylhexyl) phthalate (DEHP). The optimal temperature and pH for DEHP degrading was 30°C and 8.0. Based on metabolites detected by HPLC-MS, the degradation pathway of DEHP was deduced where the strains transformed DEHP into benzoic acid (BA) via phthalic acid (PA) and mono (2-ethylhexyl) phthalate (MEHP). The alpha/beta hydrolase (DphM1) responsible for PAEs hydrolysis was identified from genomic library of YC-RL4. This enzyme had identity of 30%-40% with the known PAEs esterase, such as EstSP1, EstS1, EstG, M673 PAEs hydrolase, DphB and M11 PAEs hydrolase. DphM1 could hydrolyze all of 13 kinds of PAEs tested, especially ones with bulky side chain. The optimal catalytic condition of DphM1 towards PAEs was 30°C and pH8.0. Kinetic analysis showed that DphM1 preferred to DMP, DEP and DCHP with high catalytic efficiency, and also could degrade recalcitrant substance DEHP, DOP and BBP, which was the vantage of DphM1 compared to counterparts reported. Based on the result of molecular docking, DphM1 and DMP could interact perfectly with binding energy of -69.125/mol. Some hydrophilic amino acid such as His148, Ser210, Asp209 and His336 might contribute to binding substrate or catalysis. A series of mutants will be constructed to evaluate the function of putative active residues.

Recent Publications

1. Ruth Nahurira (2017) Degradation of di(2-ethylhexyl) phthalate by a novel *Gordonia alkanivorans* strain YC-RL2. Current Microbiology 74(3):309-319.
2. Fan Shuanghu (2018) Excellent Degradation performance of a versatile phthalic acid esters-degrading bacterium and catalytic mechanism of monoalkyl phthalate hydrolase. International Journal of Molecular Sciences 19(9):2803.
3. Ruth Nahurira (2018) Biochemical and structural characterization of a monoethylhexyl phthalate hydrolase from *Gordonia alkanivorans* strain YC-RL2. Acta Microbiologica Sinica 58(2):303-313.
4. Ruth Nahurira (2019) *In silico* genome analysis reveals the metabolic versatility and biotechnology potential of a halotorelant phthalic acid esters degrading *Gordonia alkanivorans* strain YC RL2. AMB Express 9(1):21.

Biography

Yan Yanchun is a Professor and Doctoral Supervisor; She was granted Special government allowances of the State Council; She works in the Graduate School of Chinese Academy of Agricultural Sciences. Over last 20 years, she has completed seven national and provincial projects, obtained seven national invention patents and provincial awards for scientific and technological achievements. She has published more than 100 papers in influential academic journals in her research field, including 51 SCI papers and 1 monograph. Her team has been focused on bioremediation of environmental pollution for 20 years. More than 60 strains of bacteria or fungi capable of degrading pesticides or environmental estrogen chemicals have been isolated.

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