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Rhodococcus sp. ED55 – a bacterial strain with ability to degrade endocrine disrupting chemicals and potential for bioaugmentation

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Abstract

The occurrence of Endocrine disrupting chemicals (EDCs) in the environment is a topic of concern. It is commonly accepted that the major source of EDCs to the environment is wastewater treatment plants (WWTPs') effluents, due to the inefficiency of WWTPs to remove this kind of pollutants [1]. A bacterial strain – *Rhodococcus* sp. ED55 was isolated from the sediments of a discharge point of a WWTP in Coloane, Macau, for its ability to degrade EDCs. The bacterium was able to biodegrade 17 β -estradiol (E2), 17 α -ethinylestradiol (EE2), bisphenol-A (BPA) and bisphenol-S (BPS) at different extents. Strain ED55 was able to completely degrade the supplied amount of E2 in few hours, both in synthetic medium and in real wastewater from a municipal WWTP (Parada, Maia – Portugal). Estrone (E1), 4OH-E1 and 4OH-E2 were identified as intermediate degradation metabolites and the metabolic pathway is under elucidation. Bioaugmentation with *Rhodococcus* sp. ED 55 significantly improved the natural attenuation of the compound in municipal wastewater in batch assays. The acute test with luminescent marine bacterium *Vibrio fischeri* revealed elimination of the toxicity of the treated effluent and the standardized yeast estrogenic (S-YES) assay with the recombinant strain of *Saccharomyces cerevisiae* revealed decrease of estrogenic activity of samples. *Rhodococcus* sp. ED55 was applied in a strategy of an AGS sequencing batch reactor adapted to salinity [2], which was operated for treating a synthetic saline wastewater containing E2, EE2 and BPA. E2 was no longer detected in the bulk liquid after 10 min of aerobic reaction throughout reactor operation, suggesting that this compound was quickly removed by biodegradation. EE2 adsorption/desorption to the aerobic granules was observed. Removal of BPA significantly increased after bioaugmentation with *Rhodococcus* sp. ED55, showing that biodegradation was the governing removal mechanism. COD removal was not significantly affected by EDCs shock loads. *Rhodococcus* sp. ED55 can potentially be applied in bioaugmentation strategies for ameliorating treatment of wastewater contaminated with EDCs.

Keywords

Endocrine disrupting chemicals; *Rhodococcus* sp. ED55; bioaugmentation; wastewater; Aerobic granular sludge.

References

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