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共代谢条件下光合细菌对2-氯苯酚的生物降解

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Biodegradation of *o*-chlorophenol by photosynthetic bacteria under co-metabolism.

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摘要

光合细菌PSB-1D不能利用2-氯苯酚(2-CP)作为唯一的碳源和能源.选用苹果酸、丙酸钠、乙酸钠、柠檬酸钠、苯酚、葡萄糖和可溶性淀粉等7种不同碳源作为光合细菌PSB-1D降解2-CP的共代谢基质，考察了在黑暗好氧培养条件下，不同共代谢基质对PSB-1D生长及降解2-CP效果的影响.结果表明：葡萄糖能够很好地促进PSB-1D的大量繁殖，提高降解效果，缩短降解周期，为最佳共代谢基质.对葡萄糖的投加浓度进行了优化，当葡萄糖的投加浓度为3 g·L^{-1}时，菌株PSB-1D培养168 h后的菌体生长浓度ΔD_{560}为1.749，2-CP的半衰期为3.9 d，降解速率常数为0.00864 h^{-1}.采用SDS-PAGE对微生物全细胞蛋白质进行分析发现，在共代谢过程中当菌株PSB-1D利用葡萄糖作为底物提供能源和碳源时，可诱导产生2-CP特异性降解酶.

关键词： 光合细菌 2-氯苯酚 共代谢 生物降解 降解动力学

Abstract:

Photosynthetic bacterial strain PSB-1D cannot utilize *o*-chlorophenol (2-CP) as the sole carbon source for energy. In this paper, different carbon sources (malic acid, sodium propionate, sodium acetate, sodium citrate, phenol, glucose, and soluble starch) were taken as the co-metabolism substrates to study their effects on PSB-1D growth and 2-CP degradation under the condition of aerobic culture in darkness. Among the substrates, glucose was most efficient, which promoted the reproduction of PSB-1D,enhanced the 2-CP degradation efficiency, and shortened the degradation period. The optimization experiment of added concentration of glucose showed that when the added glucose concentration was 3g·L^{-1}, the PSB-1D cell concentration ΔD_{560} after 168 h culture was 1.749, the half-time of 2-CP was shortened to 3.9 d, and the degradation rate constant was increased to 0.00864 h^{-1}. The SDS-PAGE analysis on the total microbial cellular protein showed that taking glucose as the co-metabolism substrate, PSB-1D could induce a specific 2-CP-degrading enzyme.

Key words: photosynthetic bacteria *o*-chlorophenol co-metabolism biodegradation degradation kinetics

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