Biodegradation of microcystin-LR by an amino acid-degrading anaerobic bacterium

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**ABSTRACT**

Recent studies have proved that microcystins (MCs) can be degraded by sediment under anaerobic conditions, suggesting that anaerobic biodegradation is an important pathway to remove MCs in water treatment. In this study, the potential for biodegradation of microcystin-LR (MCLR) by an amino acid-degrading anaerobic bacterium ALA-1 was investigated. Under mesophilic conditions (20, 25 and 30°C), MCLR was dropped from 4 mg/L to below the detection limit in 10 d without lag phase. While at cold temperatures (10 and 15°C), MCLR degraded completely in 14 and 19 d with a delay time reaching 6 and 8 d, respectively. Under alkaline conditions (pH 8.0, 9.0), MCLR was degraded completely within 10 d without a lag phase. While MCLR was degraded completely within 12 d under neutral condition (pH 7.0). A lag time of 8 and 20 d was needed prior to the onset of MCLR degradation under two slightly acidic conditions (pH 6.0, 5.0), respectively, and MCLR was completely consumed until day 22 and day 38. In addition, extra carbon or nitrogen sources had no significant effect on the degradation ability of ALA-1. Linearized MCLR (m/z 1,013.3729, C₄₉H₇₇N₁₀O₁₃), tetrapeptide (m/z 616.1208, C₃₂H₄₈N₄O₈) and Adda (m/z 332.0186, C₂₀H₃₀N₂O₃), commonly known as aerobic biodegradation products of MCLR, were detected as the intermediate products. The mlrA gene homologue, known for its degradation potential of MCLR, was absent in strain ALA-1, implying that other enzymes which were not encoded by the mlrA gene cluster might have been involved in metabolizing MCLR in the present study.

**Keywords:** Anaerobic bacterium; Microcystin-LR; Biodegradation products; Enzymatic degradation; mlrA gene

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