Pathway for Biodegrading Microcystin-YR
by *Sphingopyxis* sp. USTB-05

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Harmful cyanobacterial blooms in waters have become a global environmental problem, this mainly due to the production and release of various microalgal toxins, in which microcystins (MCs) are distributed widely. Here, we focused on the study of a typical form of microcystins called microcystin-YR (MC-YR). It was found that initial 14.8 mg/L of MC-YR could be completely eliminated within 10 hr by the crude enzymes (CEs) of *Sphingopyxis* sp. USTB-05, a promising bacterial strain we isolated and identified in our previous study. During the enzymatic biodegradation of MC-YR with time course, the peaks of two intermediate and two final products were observed on the profiles of HPLC at the wavelengths of 238 nm and 230 nm, respectively. Based on the analysis of *m/z* ratios of MC-YR and its four products by LC-MS/MS, we suggested that at least four enzymes were involved in the biodegradation of MC-YR by *Sphingopyxis* sp. USTB-05. The first enzyme microcystinase converted cyclic MC-YR to linear MC-YR as the first product. Then the second enzyme serine protease was found to cleave the target peptide bond between alanine (Ala) and tyrosine (Tyr) of linearized MC-YR, producing a tetrapeptide and a tripeptide as second products, which were Adda-Glu-Mdha-Ala and Tyr-Masp-Arg, respectively. Next, the third enzyme peptidase converted the tetrapeptide of Adda-Glu-Mdha-Ala to Adda. And the fourth enzyme cleaved the tripeptide of Tyr-Masp-Arg to produce Tyr and dipeptide (Masp-Arg), which has never been reported. These findings will help us better understand the biodegradation pathway of MC-YR by *Sphingopyxis* sp. USTB-05.

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