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OPTIMIZATION OF MICROCYSTIN-LR DEGRADATION RATES OF ISOLATED FRESHWATER BACTERIAL STRAINS

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Microcystin-LR (MC-LR) is the dominant type of cyanotoxin present in Sri Lankan freshwater bodies. The present study optimizes the MC-LR degradation rates of *Bacillus cereus*, *Rahnella aquatilis* and *Stenotrophomonas maltophilia* previously isolated by authors as degraders of MC-LR. Optimization was done for different temperatures, nitrate and phosphate concentrations. 0.5 µL of overnight grown, starved and suspension equalized (A 590 nm = 0.35) bacterial cultures were introduced into filter sterile lake water containing MC-LR at a final concentration of 5 mg L^{-1}. The flasks were incubated at 18 °C, 28 °C and 32 °C for 14 days at 100 rpm. Sample aliquots of 0.5 mL were removed every two days, freeze dried and analyzed using High Performance Liquid Chromatography (HPLC). The same procedure was followed to study the effect of nitrate (0.01 mg L^{-1}) and phosphate concentrations (0.005 mg L^{-1}) on degradation. Nitrate levels varied from 0.1 - 2.5mg L^{-1} and phosphate levels varied between 0.005 to 0.05 mg L^{-1}. Each experimental and control samples were carried out in triplicate.

Maximum MC-LR degradation by all three bacterial strains were exhibited at 32 °C (*B. cereus*- 2.65 ± 0.03 µg day^{-1}, *R. aquatilis* - 2.38 ± 0.19 µg day^{-1}, *S. maltophilia* - 2.77 ± 0.04 µg day^{-1}) whereas MC-LR degradation of all three strains were inhibited at 18 °C. MC-LR degradation rate of *B. cereus* and *R. aquatilis* increased from 0.43 ± 0.05 µg day^{-1} to 0.94 ± 0.15 µg day^{-1} and from 0.38 ± 0.01 µg day^{-1} to 0.56 ± 0.17 µg day^{-1}, respectively when phosphate levels were increased from 0.005 to 0.01 mg L^{-1} while phosphate concentrations higher than 0.01 mg L^{-1} resulted in a decrease in MC-LR degradation of both strains. *S. maltophilia* showed the highest MC-LR degradation rate of 0.34 ± 0.01 µg day^{-1} at 0.02 mg L^{-1} of total phosphate and total phosphate concentrations higher than 0.02 mg L^{-1} showed a decrease in MC-LR degradation. Moreover, a rapid degradation of MC-LR was recorded by all three strains, with the increase of nitrate concentration in the medium from 0.1 mg L^{-1} to 0.4 mg L^{-1}. Maximum degradation rates of 3.98 ± 0.15 µg day^{-1} and 3.68 ± 0.18 µg day^{-1} were showed by *B. cereus* and *S. maltophilia* at 0.4 mg L^{-1} of nitrates, whereas *R. aquatilis* showed a maximum rate of 3.31±0.05 µg day^{-1} at 0.5 mg L^{-1} of nitrate. Therefore, all three bacterial strains could be employed as a biofilm to remove MC-LR at 32 °C, 0.01 mg L^{-1} of total phosphate and at 0.4 mg L^{-1} of nitrates.

Keywords: Optimization, *Bacillus cereus*, *Rahnella aquatilis*, *Stenotrophomonas maltophilia*, temperature, nitrate, phosphate

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