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DEGRADATION OF MICROCYSTIN-LR BY NATIVE BACTERIA

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Cyanobacteria are a major component in most of eutrophic lakes. Bloom forming cyanobacteria may produce toxins such as hepatotoxic peptides, neurotoxic alkaloids and dermatotoxic phenolic compounds, in addition to lipopolysaccharides. These substances are natural endotoxins released into the water in high concentrations when cell lysis takes place. Microcystins are a group of cyclic heptapeptide hepatotoxins, which are chemically stable over a wide range of temperatures and pH due to their cyclic structure. Microcystin removal by conventional water treatment is beyond the scope of usual treatment methods due to their stability. Microbial degradation of microcystins is one of the major solutions for this situation since it is relatively low in cost. In the present study *Enterobacter sp.* (KM455978) *Enterobacter ludwigii* (KM504128) and *Bacillus cereus* (KM504128) strains which were previously reported as crude oil degraders were used to study their degradation capability of microcystin.

Microcystin-LR (MC-LR) was extracted from water samples taken from Beire Lake. The ability of the isolated bacteria to utilize MC-LR was determined by inoculating 0.5 mL of an overnight starved bacterial suspension (equalized to A590 = 0.35) into separate universal bottles containing 9 mL of filtered sterilized lake water and 0.5 mL of 200 µg mL^{-1} concentration of MC-LR was added to make up the final volume to 10 mL. Triplicate samples were prepared for each bacterial strain and incubated at 25 °C ± 1 °C with constant shaking at 100 rpm. Control samples were prepared without bacterial strains under similar conditions. One milliliter of the sample was taken at 2 day intervals for 14 days. MC-LR concentrations in each sub-sample were measured using High Performance Liquid Chromatography (HPLC).

After 2 days of incubation, significant degradation of microcystin-LR was recorded by *E. ludwigii* and *B.cereus*. In contrast, *Enterobacter* sp. maintained a gradual decrease of MC-LR by day 8 and then started rapid degradation, which ended up achieving 98% degradation after 14 days of incubation. *B. cereus* showed 82% degradation while *E. ludwigii* showed 96% degradation after 14 days. *E. ludwigii* showed the highest degradation rates at second day of incubation (0.77 d^{-1}) whereas the other strains showed lower degradation rates. The degradation rates of *Enterobacter sp.* was more or less constant up to day 10 and thereafter increased significantly up to 0.23 d^{-1} at 14 days of incubation. *B. cereus* showed high degradation rates at the beginning and a pronounced gradual decrease was observed afterwards. *E. ludwigii* showed the highest degradation rate at the beginning and decreased gradually up to day 6 and thereafter remained at a more or less constant rate until day 14 of the incubation. Half life time of MC-LR degradation by each bacterial strain was calculated and the lowest half life time was found for *E. ludwigii* (1.3 days) whereas *Enterobacter* sp. and *B. cereus*, showed 10.5 days and 1.8 days respectively.

The results of the present study revealed that the native bacteria remove a considerable amount of MC-LR by bioremediation which can be used to clean MC-LR contaminations as an environmentally friendly, green and low cost method.

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