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Ecological Risk Assessment of Diclofenac (DLC) on Growth, Biochemical Composition, and Antioxidant response of Microcystis aeruginosa (Cyanobacteria) Strains and Chlorella sorokiniana (Chlorophyta)

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Abstract : Pharmaceuticals are one of the most rapidly rising environmental pollutants, with widespread and increasing usage in human and veterinary medicine, hospitals, and communities, all of which are key pathways of pharmaceutical entry into the environment. Diclofenac is a commonly used nonsteroidal anti-inflammatory drug (NSAID) used to treat painful and inflammatory disorders. Analgesic's ecological concerns for non-target organisms such as algae and cyanobacteria are raising substantial concern. Diclofenac's impact on algae and cyanobacteria strains is poorly understood. The purpose of this research was to look into the risk quotients (RQ) and physiological effects of DLC on Microcystis aeruginosa EAWAG 198, Microcystis aeruginosa LE3, and Chlorella sorokiniana UTEX 2714. The RQ of the analgesic to the examined organisms differed in this investigation, revealing Microcystis aeruginosa LE3 > C. sorokiniana UTEX 2714 > Microcystis aeruginosa EAWAG 198 were found to have different RQs to the tested organisms. DLC was more toxic to Microcystis strains than to algae, according to the EC50 values calculated. Diclofenac inhibited growth and decreased chlorophyll-a content in the exposed cultures significantly ($p<0.05$). The increase in intracellular hydrogen peroxide (H2 O2), Malondialdehyde (MDA), glutathione S-transferase (GST) activity, and lipid peroxidation of the exposed cultures at 96 hours was significant ($p<0.05$), indicating that DLC was responsible for the observed oxidative stress patterns. DLC treatment enhanced the total lipid, carbohydrate, and protein content of Chlorella sorokiniana UTEX 2714. Our findings suggest that increased DLC concentrations in aquatic ecosystems can have a major impact on population dynamics and other phytoplankton species.

Keywords : diclofenac, microcystis, plant physiology, risk assessment
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