

Single and Combined Effects of Diclofenac and Ibuprofen on *Daphnia Magna* and Some Phytoplankton Species

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Abstract : Globally, Diclofenac (DLC) and Ibuprofen (IBU) are the most prescribed drugs due to their antipyretic and analgesic properties. They are, however, highly toxic at elevated doses, with the involvement of an already described oxidative stress pathway. As a result, there is rising concern about the ecological fate of analgesics on non-target organisms such as *Daphnia magna* and Phytoplankton species. Phytoplankton is a crucial component of the aquatic ecosystem that serves as the primary producer at the base of the food chain. However, the increasing presence and levels of micropollutants such as these analgesics can disrupt their community structure, dynamics, and ecosystem functions. This study presents a comprehensive series of the physiology, antioxidant response, immobilization, and risk assessment of Diclofenac and Ibuprofen's effects on *Daphnia magna* and the Phytoplankton community using a laboratory approach. The effect of DLC and IBU at 27.16 µg/L and 20.89 µg/L, respectively, for a single exposure and 22.39 µg/L for combined exposure of DLC and IBU for the experimental setup. The antioxidant response increased with increasing levels of stress. The highest stressor to the organism was 1000 µg/L of DLC and 10,000 µg/L of IBU. Peroxidase and glutathione -S-transferase activity was higher for Diclofenac + Ibuprofen. The study showed 60% and 70% immobilization of the organism at 1000 µg L⁻¹ of DLC and IBU. The two drugs and their combinations adversely impacted Phytoplankton biomass with increased exposure time. However, combining the drugs resulted in more significant adverse effects on physiological and pigment content parameters. The risk assessment calculation for the risk quotient and toxic unit of the analgesic reveals from this study was RQ Diclofenac = 8.41, TU Diclofenac = 3.68, and RQ Ibuprofen = 718.05 and TU Ibuprofen = 487.70. Hence, these findings demonstrate that the current exposure concentrations of Diclofenac and Ibuprofen can immobilize *D. magna*. This study shows the dangers of multiple drugs in the aquatic environment because their combinations could have additive effects on the structure and functions of Phytoplankton and are capable of immobilizing *D. magna*.

Keywords : algae, analgesic drug, *daphnia magna*, toxicity

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