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Opinion Article

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Effect of carbamazepine on chitobiase release, reproduction, and moulting of daphnia similis

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Description

Carbamazepine (CBZ) one of the most often found pharmaceutical substances in aquatic habitats, has recently been demonstrated to have acute and chronic toxicity in a number of aquatic non-target organisms. The ecotoxicological impacts it exerts on crustacean moulting and reproduction are not well understood yet. The objective of the current study was to assess the crustacean Daphnia similis' acute and long-term toxic reactions to CBZ. At the studied concentrations, CBZ did not produce lethal toxicity after acute exposure (4 days). CBZ did, however, limit chitobiase release and moulting at doses greater than 6.25 g/L, with 96-hour EC50 values of 864.38 and 306.17 g/L, respectively. According to the chronic exposure, there was a substantial decrease in the average number of moults, size of the first brood, average number of offspring per brood, average number of broods per female, and average number of offspring overall per female as CBZ concentrations rose.

Pharmaceuticals And Personal Care Products (PPCPs), a novel class of environmental pollutants, have started to draw attention due to advancements in environmental analytical technology. The majority of PPCPs in the environment have low concentrations, complicated structures, and challenging properties for degradation and accumulation. Despite the low environmental concentrations of PPCPs, long-term pollution may damage aquatic creature's endocrine systems or make them poisonous to reproduction, affect the biochemical processes in aquatic habitats, and have a significant negative impact on the ecosystem. The drug Carbamazepine (CBZ) which is widely used is primarily used to treat epilepsy, arrhythmia, depression, and other conditions. CBZ is released into the environment in a variety of ways and may linger there which causes it to remain in water bodies and have a negative impact on ecosystems. CBZ pollution has been discovered in sewage influent and effluent water surface water and even drinking water in amounts ranging from ng/L to g/L.

Due to its high concentrations in aquatic ecosystems and potential hazard to non-target species, CBZ has drawn increasing attention as an emergent contaminant. Common carp was exposed to CBZ at a median lethal dose (LC50) of 59.70 mg/L for 24 hours, and CBZ caused changes in the activities of Glutamate Oxaloacetate Transaminase (GOT), Glutamate Pyruvate Transaminase (GPT), and Lactate Dehydrogenase (LDH) in several organs. Additionally, it was revealed that CBZ significantly affected the DNA adducts, lipid peroxidation, glutathione S-transferase, glutathione peroxidase, and stable lysosome membrane of the common crab *C. carpio*. Additionally, the Asian clam's syphoning behaviour, biomarkers, hsp mRNA levels, and protein levels in the gills and digestive gland were changed by exposure to environmentally relevant doses of CBZ (Corbicula fluminea). The alterations in the biomarkers imply that oxidative stress is a factor in how CBZ works. Therefore, it's important to CBZ's toxicity to aquatic life. The model species are the only ones for which the harmful effects of CBZ on crustaceans is currently understood. A new exoskeleton is produced during moulting, and the old one is shed to allow the animal to grow and develop. Molting is a useful indicator for determining the toxicity of pollutants in crus-

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taceans with regard to endocrine-disrupting effects.

The amount of moults, survival, and chitobiase activity were assessed following the acute exposure. The main chitinolytic enzyme in the moulting fluid, chitobiase is necessary for the full breakdown of the previous exoskeleton. We address the potential mechanism of CBZ impact on moulting and reproduction in this crab species based on the toxicological findings. The model organism *D. similis* to study the acute and long-term aquatic toxicity of the most often found pharmaceutical chemical (CBZ) at ecologically appropriate doses. According to the findings of the acute toxicity tests, CBZ did not produce lethal toxicity at the tested concentrations. However, even at concentrations as low as 0.03 g/L, CBZ had a considerable impact on the moulting and fertility of *D. similis*. Based on our findings, the time and length of the exposure affect the toxicity of CBZ to *D. similis*. In summary, in *D. similis*, CBZ can impede moulting, delay reproduction, and diminish fertility. Additionally, CBZ functions as an endocrine disruptor in *D. similis*, much like it does in vertebrates, because the release of chitobiase is a sign of possible moulting and reproductive disruption (e.g., fish). Invertebrate populations may experience a wide range of developmental and reproductive outcomes as a result of exposure to CBZ therefore more research on the effects of CBZ on the environment is needed.