

Effects of aluminium on *Clarias gariepinus* physiology, gills histology and cholinesterase in vivo and in vitro

ABSTRACT

The gill is the site of acid-base balance, ionic regulation, gas exchange, and nitrogenous waste excretion by fish. The physiological, histopathological and enzymatic alterations from *Clarias gariepinus* gills were examined to assess the effects induced in gill tissues within 96 h exposure to waterborne $\text{Al}_2(\text{SO}_4)_3$ with different concentrations (25 to 300 mg/L). The exposure of *C. gariepinus* to aluminium showed deleterious effects to normal fish behaviours and varying degrees of gill damage when visualised under inverted light microscopy (stained with haematoxylin-eosin), scanning electron microscopy and transmission electron microscopy. The mortality rate was observed increasing with increased Al concentration showing noticeably disrupted lamellae, irregular nucleus shape and increasing area of vacuolation in treated fish gills associated with $\text{Al}_2(\text{SO}_4)_3$ exposure concentration. Furthermore, electron microscopic X-ray microanalysis of fish gills exposed to sublethal Al revealed Al accumulated on the surface of the gill lamella. Al toxicity also gave inhibitory effects on cholinesterase (ChE) extracted from the fish gills with 90.0% inhibition at 300 mg/L Al highest concentration exposure (in vivo), whereas the Al metal ion inhibited 50% of ChE activity at 4.12 mg/L (IC_{50}).

Keyword: Aluminium toxicity; Cholinesterase; *Clarias gariepinus*; Gills; Morphology; Physiology