



# Immunotoxic effects of 4-nonylphenol on *Clarias gariepinus*: Cytopathological changes in hepatic melanomacrophages

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## Abstract:

Melanomacrophage centres (MMCs) play a key role in the immune response in fish. They are considered sensitive bio-monitoring structures with roles in the assessment of toxicant impacts. The aim of this study was to examine the potential histopathological effect of 4-nonylphenol (4-NP) on hepatic MMCs in *Clarias gariepinus*. To achieve this objective, adult male fish were divided randomly and equally into two groups: a control group and a group that was exposed to 4-NP (dissolved in water at a dose of 0.1 mg/L) for 21 days. The 4-NP-intoxicated hepatic MMCs contained numerous necrotic macrophages. Superoxide dismutase 2 was immuno-expressed in the hepatic MMCs in both groups, with no significant difference. Histomorphometric examination revealed that the sizes and numbers of MMCs were dramatically higher in the livers of 4-NP-exposed *C. gariepinus* than in control fish. Following 4-NP challenge, in the liver, the abundance of lipofuscin and haemosiderin pigments increased, and single-pigmented macrophages, aggregated groups of deformed red blood cells (RBCs) and macrophages were present near blood vessels and hepatic sinusoids. These results reveal that 4-NP exerts immunological effects on hepatic MMCs in *C. gariepinus* and support the utility of MMCs as a cytological biomarker for aquatic exposure to 4-NP.

## Keywords:

4-NP; Catfish; Haemosiderin; Liver; MMCs

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