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MONITORING BEHAVIORAL RESPONSES OF ZEBRAFISH (*Danio rerio*) AS A BIOMARKER FOR IDENTIFYING CADMIUM AND DELTAMETHRIN IN WATER

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Abstract

This study investigated the different behavioral responses of zebrafish (*Danio rerio*) under sudden stress from two types of chemicals (heavy metals and insecticides) and explored the correlations of behavioral responses and several well-known biomarkers. Adult zebrafish were exposed to cadmium (Cd) and deltamethrin for 5 hours. An increase in avoidance speed and turning frequency was first detected behavioral response. The duration of hyperactivity was almost 50 min in the deltamethrin exposure test and only 15 min in the Cd exposure test. A positive linear correlation was detected between variation in speed and brain acetylcholinesterase (AChE) activity in deltamethrin exposure ($p<0.01$, $r^2=0.7103$), while no correlation was detected for Cd exposure ($p>0.05$, $r^2=0.0646$). After 20 min exposure, zebrafish exposed to Cd stayed near the bottom but surfaced more frequently to deltamethrin. Swimming depth increased by 61.98% from 139.92 mm to 226.24 mm in deltamethrin exposure, but decreased by 92.16% from 161.26 mm to 83.92 mm in Cd exposure. Our results suggest that those type-specific characters may attribute to the different mode of action of chemicals studied. The increased malondialdehyde (MDA) level and glutathione (GSH) concentration in tissues showed that toxicity was mainly in the gill following deltamethrin exposure but in the liver following Cd exposure. Speed and turning frequency under both exposures decreased significantly, even lower than the control group, which indicated a possible energy reallocation from locomotion to detoxification processes. Behavioral toxicity classifications provide another tool that may be used to help separate chemicals according to mode of action, which can contribute to the development of a biological early warning system for detecting toxicants at early stages of pollution.

Key words: behavioral response, detoxification system, heavy metals, insecticides, real-time biomonitoring, zebrafish

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