

Poster Communication 63

Danio rerio Responses to 3,4-Dichloroaniline Under Different Thermal Regimes

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Abstract

Background: The aromatic amine 3,4-dichloroaniline (3,4-DCA) is a degradation product of several phenylurea herbicides, including diuron and linuron, and is frequently detected in freshwater environments [1,2]. It is currently being considered for potential inclusion in the 5th Watch List of the Water Framework Directive, mainly due to uncertainties regarding its predicted no-effect concentration (PNEC). 3,4-DCA has been linked to adverse effects in non-target aquatic organisms [2]. Rising temperatures may modulate contaminant toxicity by altering organismal physiology, metabolic rates, and chemical interactions, highlighting the importance of assessing their combined effects [3]. **Objective:** This study aimed to evaluate how elevated temperature, aligned with IPCC climate projections, affects the chronic sub-individual toxicity of 3,4-DCA in *Danio rerio*. **Methods:** Juvenile *D. rerio* were exposed for 28 days to environmentally relevant concentrations of 3,4-DCA ($\leq 30 \mu\text{g/L}$) under two temperature regimes representing standard testing conditions and a projected warming scenario (25 and 30 °C). Sub-individual responses were assessed using a multi-biomarker approach targeting antioxidant and detoxification pathways, energy metabolism, neurotoxicity, and genotoxicity. **Results:** Temperature strongly modulated 3,4-DCA toxicity. Combined exposure disrupted antioxidant capacity increased oxidative stress and altered energy metabolism. Elevated temperature also affected antioxidant defenses, detoxification activity, and cellular energy allocation. At 30 °C, significant effects of 3,4-DCA were observed, including oxidative stress (5.93–8.89 $\mu\text{g/L}$), energy imbalance (5.93 $\mu\text{g/L}$), and genotoxicity ($\geq 30 \mu\text{g/L}$). **Conclusions:** Chronic exposure to 3,4-DCA disrupts cellular defense mechanisms and metabolic processes in zebrafish, particularly at elevated temperatures. Although organisms activated compensatory antioxidant and metabolic responses, these mechanisms were insufficient to fully counteract the oxidative and metabolic disturbances induced by the combined stressors. This suggests increased energetic demands associated with maintaining detoxification and cellular homeostasis under warm conditions. Overall, these findings suggest that warming conditions may intensify the biological stress imposed by 3,4-DCA, highlighting the importance of considering temperature as a relevant factor when evaluating the ecological risks of contaminants in freshwater systems.

Keywords: Freshwater contamination; Aromatic amine; Zebrafish; Climate change; Biomarkers

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