Study shows common water pollutants cause heart damage in fish

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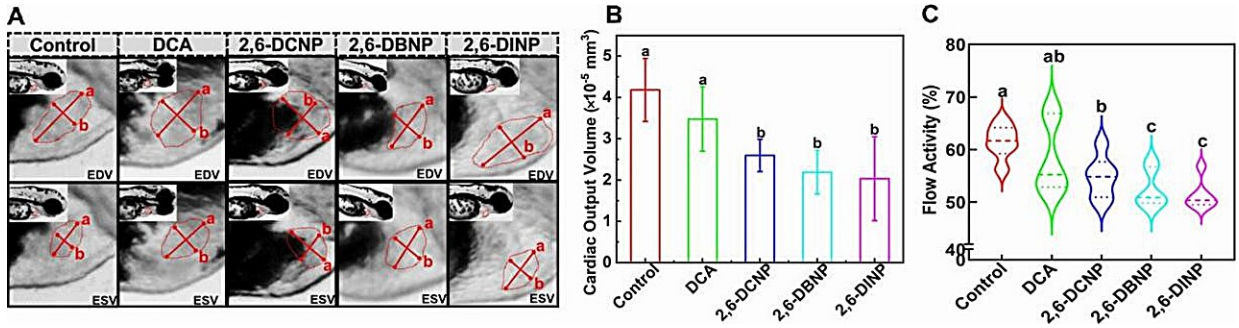

Impacts of 2,6-DHNPs and DCA exposures on the cardiac output (A and B) at 48 hours post-fertilization (hpf) and blood flow (C) at 72 hpf. Credit: *Eco-Environment & Health* (2024). DOI: 10.1016/j.eehl.2024.02.004

Recent findings highlight the persistence of dihalogenated nitrophenols (2,6-DHNPs) in drinking water, resisting standard treatments like sedimentation, filtration, and boiling. The research demonstrates the severe cardiotoxic effects of these contaminants on zebrafish embryos at concentrations as low as 19 μg/L, indicating potential health risks for humans.

2,6-DHNPs, a group of disinfection byproducts (DBPs), are raising alarm bells for public health. These bad actors in the water world are tougher and more toxic than many other pollutants, making it hard for typical water cleaning methods to get rid of them.

They pack a powerful punch, being significantly more harmful to marine life and cells than similar pollutants. Found in places like sewage, swimming pools, and our drinking taps, 2,6-DHNPs are everywhere, signaling a pressing need for better ways to clean our water and keep us safe.

A new study, published in *Eco-Environment & Health* has uncovered the severe cardiotoxic impacts 2,6-DHNPs have on zebrafish embryos, serving as a model for potential human health risks.

2,6-DHNPs, a group of DBPs resistant to traditional water purification methods like boiling and filtration. These DBPs pose a significant risk, showing a toxicity level 248 times higher than the known regulated DBPs, dichloroacetic acid, in zebrafish embryos. Using zebrafish as a biological model due to their genetic similarity to humans the study meticulously detailed how these emerging contaminants wreak havoc on cardiac health.

The zebrafish embryos exposed to 2,6-DHNPs suffered from severe heart damage characterized by increased production of harmful reactive oxygen species, cell death (apoptosis), and disrupted heart development.

The study revealed that 2,6-DCNP and 2,6-DBNP, two types of DBPs, exhibited significant resistance to removal in drinking water treatment plants. Boiling and filtration were found to be the most effective household water treatment methods, reducing 2,6-DCNP and 2,6-DBNP levels by 47% and 52%, respectively.

Exposure to 2,6-DHNPs caused heart failure in zebrafish embryos through increased production of harmful reactive oxygen species (ROS) and delayed heart development. Notably, the antioxidant N-acetyl-L-cysteine was able to mitigate the cardiotoxic effects induced by 2,6-DHNPs.

Dr. Hongjie Sun, a leading researcher in the study, stated, "The cardiotoxic potential of 2,6-DHNPs at low concentrations significantly challenges our current understanding of water safety and highlights the need for urgent reassessment of drinking water treatment methods."

Dr. Peng Gao, the corresponding author, added, "Our findings underscore the importance of evaluating the health impacts of disinfection byproducts that may form during water treatment and being resistant to household treatment. We need to prioritize the development of advanced water purification technologies to remove these pollutants and safeguard public health effectively."

This research underscores a critical environmental and public health issue: the contaminants that survive water treatment processes can lead to severe health outcomes in exposed organisms, hinting at the possible public health risks faced by these persistent waterborne chemicals.

More information: Hongjie Sun et al, Dihalogenated nitrophenols in drinking water: Prevalence, resistance to household treatment, and cardiotoxic impact on zebrafish embryo, *Eco-Environment & Health* (2024). DOI: 10.1016/j.eehl.2024.02.004

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