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The potential relationship between neurobehavioral toxicity and visual dysfunction of BDE-209 on zebrafish larvae: a pilot study

Bin Zhang^{1,2}, Ting Xu^{2,3*}, Daqiang Yin^{2,3*} and Sheng Wei²

Abstract

Background: Although listed in the Stockholm Convention, commercial Decabromodiphenyl ether (c-DecaBDE) is still being produced in many factories and used as a kind of flame retardants primarily in plastic polymers and textiles. Widespread use offered many exposure ways of its major ingredient, BDE-209, to humans and the environment. Most current studies of BDE-209 focused on the health effects and toxicity of thyroid disruption, oxidative stress, neurotoxicity, and reproductive function, but seldom spread light on the relationship between neurobehavioral toxicity and visual dysfunction. Using zebrafish larvae model, we hope to uncover the potential relationship between the neurobehavioral and visual effects after exposure to BDE-209.

Results: BDE-209 exposure could not induce the changes of locomotion and path angle in 5 days post fertilization (dpf) larvae; however, 5 µg/L BDE-209 exposure caused locomotor hyperactivity and more responsive turns at 7 dpf. The social activity of 50 µg/L exposure group was significantly higher than the control group at 6 dpf. Besides, 5 and 50 µg/L exposure caused the upregulation and downregulation of four cone opsin genes, respectively. The expression of rhodopsin gene was not influenced by both concentration exposures.

Conclusion: The neurobehavioral effects induced by 5 µg/L BDE-209 exposure were consistent with the upregulation of four cone opsins in 7 dpf larvae. The low concentration of BDE-209 exposure caused the hyperactivity and more responsive turns of larvae possibly contributing to the disruption on the cone opsin expressions of larvae. Our results would provide the mechanism cue of neurobehavioral toxicity after BDE-209 exposure and call for more attention on the ecotoxicology studies of BDE-209.

Keywords: BDE-209, Neurobehavior, Vision, Zebrafish

Background

Commercial Decabromodiphenyl ether (commercial mixture, c-decaBDE) was listed as a new member of persistent organic pollutants (POPs) under the Stockholm Convention in 2017 amendment because of its

environmental persistence, high potential for bioaccumulation and biomagnification, long-distance transport capacity, and adverse effects; after commercial Pentabromodiphenyl ether (c-PentaBDE) and commercial Octabromodiphenyl ether (c-OctaBDE) have been banned in 2009 amendment (<http://chem.pops.int/TheConvention/ThePOPs>). However, c-decaBDE is still being produced in many factories and used as a kind of flame retardants primarily in plastic polymers and textiles [1]. Widespread use and slow degradation offered many exposure ways of BDE-209, the main constituent in c-decaBDE and

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Neurobehavioral Toxicity Analysis And Interpretation

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Neurobehavioral Toxicity Bernard Weiss,1994-06-30 In establishing how certain chemicals can cause behavioural disorders the process of neurotoxicity risk assessment poses significant challenges to every discipline within neuroscience In this volume leaders from industrial academic and government settings share insights on behavioural measurement in neurotoxicity risk assessment and address the critical scientific issues arising from the expanding role of neurobehavioral toxicology in public policy development The authors set out to provide a comprehensive and authoritative review of current methods in the analysis and interpretation of neurobehavioural toxicology Coverage begins with a discussion of criteria for determining neurotoxic potential The next section examines neurobehavioural evaluations in developmental neurotoxicity Subsequent sections focus on activity and observational data and applications of schedule controlled operant behaviour in toxicity testing The contributors address controversies surrounding the suitability and interpretation of procedures designed for neurotoxicological assessments Some case studies are also included

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neuroprotection and genomic approaches The 35 papers and 10 posters are taken from the Sixth International Conference on Neuroprotective Agents held in September 2002 in South Carolina *National Toxicology Program : Annual Plan* United States. Public Health Service,1994 *Guidelines for the Care and Use of Mammals in Neuroscience and Behavioral Research* Committee on Guidelines for the Use of Animals in Neuroscience and Behavioral Research,2003 Provides advice for common situations in neuroscience and behavioral research that can pose difficulties It treats the development evaluation and implementation of animal use protocols as a decision making process not just a decision It encourages the use of professional judgement and careful interpretation of regulations and guidelines to develop performance standards that ensure animal well being and high quality research This book will be an indispensable resource for researchers veterinarians and institutional animal care and use committees **Casarett & Doull's Toxicology** Curtis D. Klaassen,2007-12-11 The most complete trusted reference text covering the full span of medical toxicology Market Students toxicologists and pharmacologists Focuses on the principles concepts and modes of thought that are the foundation of the discipline New to this edition updated throughout to reflect new understanding of cell death and drug metabolism new content on chemical terrorism many new contributors **CSA Neurosciences Abstracts** ,1995 **Comprehensive Toxicology: Reproductive and endocrine toxicology** I. Glenn Sipes,1997 This volume in the Comprehensive Toxicology series demonstrates how the use of extremely powerful molecular and cell biology techniques has stimulated the growth of toxicology as a scientific discipline The field of toxicology has evolved from its earlier days of in vivo and descriptive studies to focusing on mechanisms Frequently mechanisms require an examination at the cellular and molecular level Molecular toxicology has opened the door to comprehending the basic mechanisms of how toxicants show their effects The volume is a comprehensive integrated profile of the molecular effects of toxicants and the molecular mechanisms involved in producing cellular and tissue injury

Neurobehavioral Toxicity Analysis And Interpretation Book Review: Unveiling the Power of Words

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