THE OHIO STATE UNIVERSITY

Environmental Science Graduate Program Student Seminar Series

Data quality assessment of aquatic ecotoxicological test data for PFAS

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Abstract

Per- and polyfluoroalkyl substances (PFAS) are a large group of environmentally persistent organic pollutants with diverse physical and chemical characteristics. This group of chemicals has recently drawn great concern due to their ubiquitous presence in aquatic environments and the potential hazard they present to aquatic organisms. While these chemicals have important consumer and industrial applications due to their unique properties of heat, grease, oil, and water resistance, these same properties also make them very stable in the environment and difficult to biodegrade. They thus tend to persist in the environment and may bioaccumulate in humans, plants, and animals, posing ecological and human health hazards. In order to better understand the ecological hazards associated with PFAS, high quality ecotoxicological testing data are required. However, the characteristics of available data have not been assessed in terms of PFAS that have been tested, the types of tests (acute vs chronic), and the adherence of these tests to standardized toxicity testing protocols. The goal of this study was to examine the types and quality of data available from PFAS aquatic toxicity tests. A literature search of the ECOTOX Knowledgebase (US EPA) was conducted to identify relevant published data under the broad category of PFAS and aquatic toxicity testing and a critical review of the testing methods was conducted to determine the strengths and weaknesses of available data. In this review we have summarized methods from eighty papers on PFAS aquatic toxicology from the years 2000 to 2020. An initial summary of information suggests that the most fundamental problem was the lack of verification of exposure dose. Well over quarter of the studies did not measure PFAS exposure concentrations in the test water and even fewer measured PFAS in control or dilution water. Other issues included lack of chemical identification (i.e., not providing a CAS (Chemical Abstract Service) number), not defining or adhering to standard protocols, and lack of reporting of standard environmental physical and chemical characteristics. These shortcomings can have a significant impact on the quality of data available for the determination of aquatic ecological hazards related to PFAS exposure. Our study further proposes the development of a comprehensive QC (Quality Control) checklist which can assist in evaluating the quality of and interpreting toxicity test results.

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