

Title: Joint Action of Toxicant Mixtures on Daphnia pulex

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Objective:

The presence of several chemical toxicants in a wastewater or industrial discharge can result in antagonistic and synergistic effects on the biota of the receiving water. Whereas a certain concentration of a given toxicant may or may not be harmful in itself, this same compound, in combination with other chemical toxicants, may result in a toxic response in excess of the additive effects of the individual toxicants present. While some laboratory and field data have shown that lethal responses of fish to mixtures of common toxicants can be predicted largely by a simple additive approach, the evidence for the additive effects of levels of toxicants below their individual "no observed effect" concentration, is inconclusive. Research is therefore needed on the toxicity of mixtures of chemicals at such low concentration levels. The objective of the research, then, is to determine the joint action of toxicant mixtures, at levels approaching either their 48LC50 value or "red book" value, on D. pulex, as the test organism. This information could be incorporated into water quality standards for common toxicants to allow for possible effects of toxicant mixtures.

Procedure:

D. pulex will be exposed to several classes of toxicants, singly and in combination, to determine the possible interactive effects of these toxicants. A concentration-addition model will be used to assess the joint action of the toxicant mixtures. The concentration of each component in the mixture will be expressed as a proportion (p) of the 48LC50 value (concentration of toxicant resulting in 50% mortality after 48 hours of exposure). Concentrations of mixtures of toxicants will be expressed as $\Sigma p48LC50$ or of other quantal responses such as LC10 or LC90. The following interactive responses will then be assessed: antagonistic, less-than-additive joint action, additive joint action, and more than additive joint action. Daphnia 48-hour toxicity tests will be conducted using the methods developed in this laboratory and described in the Technical Report to the MDWPC (in progress). Classes of toxicants to be investigated will include pesticides, metals (such as Al, Cr, Cu, Zn), and selected organic compounds. The study will be specifically directed towards assessing the interactive effects of low levels of toxicants ($p < 0.1$). Additionally, the effects of response time and water quality characteristics (such as hardness and alkalinity) will be investigated. The toxicity of these mixtures will also be assayed

using the Microtox bacterial luminescence analyzer to evaluate this method as a surrogate parameter of the mixtures toxicity.

Expected Results:

Results of the study will be presented in a technical report.

Cost: \$29,000