ACUTE AQUATIC TOXICITY OF THREE COREXIT PRODUCTS: AN OVERVIEW

Anita George-Ares and James R. Clark
Exxon Biomedical Sciences, Inc.
Mettlers Road, CN 2350
East Millstone, New Jersey 08875-2350

ABSTRACT: *Corexit 9527, Corexit 9500, and Corexit 9580 have low (LC_{50} or EC_{50} > 100 ppm) to moderate (LC_{50} or $EC_{50} \geq$ 1 to 100 ppm) toxicity to most aquatic organisms in laboratory tests; however, the experimental species, temperature, and exposure duration can significantly affect measurements of toxicity. Field and laboratory studies indicate that 4-hour toxicity test data are more reflective of actual dispersant use conditions.*

Corexit oil spill response products are used worldwide in a number of habitats. As a result, Corexit toxicity data have been generated for a variety of aquatic species tested under various experimental conditions. A wide range of acute toxicity data (LC_{50} and EC_{50} values) has been generated for the dispersants Corexit 9527 and Corexit 9500 and for the shoreline cleaner Corexit 9580. The LC_{50} is the concentration that causes mortality in 50% of test organisms in a specified time period (typically 48 or 96 hours). The EC_{50} is the concentration that causes a specific effect (e.g., decreased growth) in 50% of test organisms in a specified time period. Lower LC_{50} or EC_{50} values indicate greater toxicity. Corexit toxicity data evaluated in this study were drawn largely from unpublished laboratory toxicity reports and from the literature (Fiocco *et al.*, 1991; NRC, 1989; Singer *et al.*, 1990). We evaluated toxicity data for 10 species that were exposed to Corexit 9500, 27 species exposed to Corexit 9527, and 7 species exposed to Corexit 9580.

Results and discussion

The aquatic toxicity of oil spill chemicals is affected by many factors, including exposure conditions, species, and life stage. Data for Corexit 9527 indicate that a wide range of LC_{50} values can be generated for a single species, depending on exposure duration and temperature. Increasing exposure duration generally results in increased dispersant toxicity (lower LC_{50} or EC_{50} values). For example, the invertebrate *Mysidopsis bahia* had LC_{50} values ranging from 19 ppm (96 hours) to greater than 1014 ppm (4 hours). The 4-hour exposure is more reflective of exposures at sea because dilution and dispersion can reduce dispersants to nondetectable concentrations within hours. However, most regulatory agencies require standard 24- to 96-hour aquatic toxicity tests for dispersant use approval. Therefore, dispersants are evaluated using laboratory test results that show greater toxicity than is expected under field conditions.

In general, toxicity test data for fish are highly variable, and susceptibility is affected by species, size, maturity, and many other variables. Fish generally appear to be less sensitive (48- to 96-hour LC_{50} = 140 to 96,500 ppm) to Corexit 9500 and Corexit 9580 than are crustaceans (48- to 96-hour LC_{50} = 21 to 2800 ppm). The silverside fish (*Menidia beryllina*) is an exception, having a sensitivity similar to crustaceans (LC_{50} = 25.2 to 86.9 ppm). Species toxicity trends are not apparent for Corexit 9527. Fish exposed to Corexit 9527 had 48- to 96-hour LC_{50} values ranging from 14.6 to 293 ppm, whereas the values for crustaceans ranged from 2.4 to greater than 10,000 ppm, and for mollusks the range was 1.6 to 2500 ppm. The broad range for all species probably is due in part to variability in laboratory test conditions associated with the large number of tests conducted with this product.

Embryo-larval and early juvenile life stages generally are more sensitive to chemicals than are adults of the same species. Smaller size and less developed metabolic capability may be reasons for the increased sensitivity of early life stages. Data from a variety of dispersants indicate a wide range of EC_{50} values (0.0003 to 1000 ppm) for early life stages of different species (NRC, 1989). Available data indicate that Corexit 9500, Corexit 9527, and Corexit 9580 have moderate toxicity to early life stages of fish, crustaceans, and mollusks (LC_{50} or EC_{50} = 1.6 to 100 ppm).

Decreasing water temperatures in laboratory tests resulted in decreased toxicity (higher LC_{50} values) for Corexit 9527. The scallop, *Argopecten irradians*, had 96-hour LC_{50} values ranging from 200 ppm (20°C) to 2500 ppm (2°C). The grass shrimp, *Palaemonetes pugio*, had 96-hour LC_{50} values of 640 ppm at 27°C and 840 ppm at 17°C. Lower temperatures may result in a decreased uptake of dispersant (NRC, 1989).

Conclusions

Laboratory aquatic toxicity results are highly dependent on test species and experimental conditions, many of which are not representative of field conditions. Consequently, it is essential that spill response coordinators use data that are most relevant to the regional resources requiring protection and most representative of actual exposure conditions (e.g., shorter duration). In addition, decisions to use an oil spill response chemical should not be based solely on its aquatic toxicity. Other factors to consider are data quality, product effectiveness, the toxicity of dispersed oil, dilution and degradation in the environment, potential adverse effects of all response operations, and the recovery potential of habitats and populations.

Biography

Anita George-Ares has been an aquatic toxicologist at Exxon Biomedical Sciences, Inc., for the past 7 years. Her current research focuses on ecotoxicological assessments of chemicals and oil spills.

References

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