

Responses of Invertebrates and Fish to Alkyl Sulfate and Alkyl Ethoxylate Sulfate Anionic Surfactants During Chronic Exposure

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Anionic surfactants are used in high volumes by the consumer products industry in laundry, dishwashing, shampoo, toothpaste, and cosmetic products (Fendinger *et al.* 1994). A desirable facet of these ingredients are rapid biodegradation which reduces exposure in the environment following waste treatment and prevents accumulation in aquatic and terrestrial compartments (Larson 1991). While this aspect of surfactant chemistry is an environmental benefit it leads to difficulties in executing ecotoxicity tests. Microbially mediated reductions in test concentrations argue for flow-through testing with analytical verification of exposure concentration.

This manuscript describes results from flow through chronic toxicity tests using non-standard species. Choice of organisms were based on availability and regional ecological importance. Results from these and other traditional single species tests were used to assess the applicability of statistical and uncertainty factor extrapolation techniques to predict effects at the ecosystem level (Aldenberg and Slob 1991; OECD 1992) determined during comprehensive stream mesocosm exposures to the same surfactants (Belanger *et al.* In Press; Belanger *et al.* 1994).

MATERIALS AND METHODS

The anionic surfactants dodecyl alkyl sulfate (AS or sodium dodecyl sulfate, CAS NO. 151-21-3) and alkyl ethoxylate sulfate (AES, CAS NO. 68585-34-2) were used in these studies. AS was obtained as 99% pure from Sigma Chemical Company (St. Louis, Missouri). Purity and structure were confirmed by fast atom bombardment-mass spectrometry (FAB-MS) and infra-red spectrometry (IR). Concentrations of AS in toxicity test waters were determined by the gas chromatographic method of Fendinger *et al.* (1994). AES was specially synthesized at Procter & Gamble by sulfating a 50:50 mixture of C₁₄ and C₁₅ linear alcohol ethoxylates. The structure of the AES was confirmed by nuclear magnetic resonance (NMR) and liquid chromatography/mass spectrometry (LC/MS) and had an average 2.17 ethoxylates per mole. The final test material and LC/MS methods for determining AES concentrations in toxicity

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