**Technical Information** | **Stepan**

Stepan Company
Northfield, Illinois 60093
Telephone 847 446 7500

# ECOTOXICOLOGY OF DIALKYL DIMETHYL AMMONIUM CHLORIDE (DDAC)

## Applicable to these current Stepan products:

| | | |
|---|---|---|
| BTC® 1010<br>BTC® 818-80%<br>STEPANQUAT™ 8188 | BTC® 1010-80%<br>STEPANQUAT™ 1010-80%<br>STEPANQUAT™ 1010 | BTC® 818<br>STEPANQUAT™ 818 |

Applicable to these inactive Stepan products:

| | | |
|---|---|---|
| BTC® 99 | | |

## Toxicological Information:

| Test/Conditions | Results/Classification | References |
|---|---|---|
| Acute Oral Toxicity<br>(quail) (14 day) | $LD_{50}$ [(1)] = 229 mg/kg<br>(moderately toxic) | Stepan Study No. 91-045A |
| Acute Oral Toxicity<br>(quail) (14 day) (diet) | $LC_{50}$ [(2)] > 5620 ppm<br>(practically non-toxic) | Stepan Study No. 91-046A |
| Acute Oral Toxicity<br>(mallard) (14 day) (diet) | $LC_{50}$ > 5620 ppm<br>(practically non-toxic) | Stepan Study No. 91-044A |
| Acute Aquatic Toxicity<br>(static) (Bluegill sunfish) (96 hr.) | $LC_{50}$ = 0.32 ppm A.I. [(3)]<br>(highly toxic) | Stepan Study No. 90-014A |
| Acute Aquatic Toxicity<br>(static) (Coho salmon) (96 hr.) | $LC_{50}$ = 1 ppm A.I.<br>(moderately toxic) | Stepan Study No. 90-014C |
| Acute Aquatic Toxicity<br>(static) (Daphnids) (48 hr.) | $EC_{50}$ [(4)] = 0.094 ppm A.I.<br>(extremely toxic) | Stepan Study No. 90-014B |
| Acute Aquatic Toxicity<br>(static) (Mysid shrimp) (96 hr.) | $LC_{50}$ = 0.069 ppm A.I.<br>(extremely toxic) | Stepan Study No. 90-014D |

(1) LD = Lethal Dose, (2) LC = Lethal Concentration, (3) A.I. = Active Ingredient, (4) EC = Effective Concentration

**Discussion:**

It should be noted that the above studies reflect acute toxicity of quaternary ammonium compounds (QACs) such as DDAC to aquatic organisms conducted in high quality laboratory water using test methods that do not consider the physical and chemical properties of these molecules in surface water; thus representing an unrealistic scenario. An aquatic safety assessment by Lewis and Wee have shown that when the aquatic studies were conducted in river waters toxicity to aquatic organisms was much reduced. For example the 96 hr. and 48 hr. $LC_{50}$ values for bluegill sunfish and Daphnia magna for QACs determined in laboratory high quality waters ranged from 0.62 to 3.0 mg/l and 0.16 to 1.06 mg/l respectively. The acute toxicities of the same compounds for bluegill sunfish and Daphnia magna in river water ranged from 10 to 24 mg/l and 3.1 mg/l respectively. The 96 hr. $LC_{50}$ value for freshwater alga to these compounds in the laboratory water was 0.23 mg/l. In river water the algistatic concentration for freshwater alga ranged from 0.71 to greater than 4.0 mg/l. These results represent a 3 to greater than 17-fold reduction in toxicity compared to results from the tests using high-quality laboratory water. It is known that quaternaries adsorb to suspended solids and have a tendency to form complexes with anionic moieties (both of which are found in much greater concentrations in river waters). It is believed that these properties are responsible for substantially reducing bioavailability and subsequent toxicity of QACs to aquatic organisms in natural surface waters.

## References:

*Boethling, R.S., 1984, Environmental Fate and Toxicity in Wastewater Treatment of Quaternary Ammonium Surfactants, Water Res. Vol. 18, No. 9, pp. 1061-1076.

*Cross, J., and Singer, E.J., Editors, 1994. Cationic Surfactants: Analytical and Biological Evaluation, Marcel Dekker, Inc., Vol. 53, pp. 95-135.

*Lewis, M.A., and Wee, V. T., (1983) Aquatic Safety Assessment for Cationic Surfactants, Environmental Toxicology and Chemistry, Vol. 2, pp. 105-118.



Last Update: 06/22/2021 Revision Reference: TX021.03

connection with the accuracy, completeness, adequacy or furnishing of such information.