

**Aquatic toxicity of Cypermethrin and Cartap
to *Daphnia magna* and *Oryzias latipes***

Younghee Kim, Jinyong Jung, Seungwook Lee and Kyungho Choi

Department of Environmental Health, School of Public Health, Seoul National University, Korea

28, Yunkoon, Chongro, Seoul 110-799 Korea

Background

Cypermethrin is one of the most frequently used pyrethroid pesticides in Korea, and its ecological toxicity is well documented. Environmental concentration of cypermethrin is reported from 0.49 to 100 ppb. Cartap is the first ranked pesticide in annual usage in Korea. These substances cause deformity and developmental retardation in a few non-target species as reported in literature. Synergistic effect is likely when cartap and cypermethrin exist together and warrants investigation.

Method

Cartap (cartap hydrochloride, 99%) and cypermethrin (isomer mixture, 98%) were purchased from Supelco (PA, USA).

Less than 24 hr-old *D. magna* was employed for 96hr acute test. Fertilized *O. latipes* eggs were used for early life stage test. For 96 hr acute test 3-4 mo old *O. latipes* 2.0± 1.0 cm was used.

96 hr acute *D. magna* and *O. latipes* test (US EPA standard) and 96 hr pulsed exposure early life stage test (modified OECD guideline) were conducted.

Result

1. *Daphnia magna* test

Cartap and cypermethrin EC50s rapidly decreased with increasing exposure time, 96 hr EC50 was lower than 48 hr EC50 by the order of two.

2. *Oryzias latipes* test

Acute 96 hr EC50s obtained from cartap and cypermethrin using adult medaka were 353.6 ppb and 30.9 ppb, respectively.

The fertility of eggs of each test group were not statistically significantly different. Egg hatchability decreased in concentration dependent manner, but showed no statistically significant difference ($p > 0.05$).

20% of embryo exposed to the highest concentration of cartap remained non-hatched at the end of the test (20 days after fertilization) Cypermethrin affected normal embryo development at 40 ppb Deformity appeared to be a dominant sublethal effect

Discussion

The 96 hr median effective concentrations of cypermethrin to *D magna* and *O latipes* were found at 0.06 ppb and 30.9 ppb, respectively Cypermethrin EC50s were lower than some of the reported environmental concentrations (0.49 in runoff and 100ppb in overspraying surface water). We also found that cypermethrin caused significant mortality in less than one day-old fertilized eggs at 200 ppb

Cartap did not show severe lethal effect in this study but deformity rates were significantly high at the higher test concentrations. Deformity might cause poor survival of the hatchlings because of incompetence of swimming or feeding. Time to hatch increased in concentration dependent manner

Mixture toxicity of the two pesticides were additive in lethal endpoints with *O. latipes* and in *D. magna* *Daphnia magna* was found to be more sensitive organism in the toxicities of two pesticides.

Short term pulsed exposure to cypermethrin could be concerning issues even though pyrethroids are less persistent in the environment The concentration response curves obtained from cartap and cypermethrin with *D magna* exhibited very sharp slope; short-term exposure assays may not reflect true environmental damages that these two pesticides cause. Short term pulsed exposure of pesticides resulted in decreased hatchability and increased deformity rates with medaka embryos. The results suggest that early life stage exposures to sublethal levels of the pesticides might cause a significant shift in the balance of individual development and potentially structure of ecosystem

Reference

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