3,4-DICHLOROANILINE, A GROWTH INHIBITOR OF JUVENILE ZEBRAFISH (DANIO RERIO)

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ABSTRACT

Exposure of chemicals to the organisms may interfere with organismal integrity at the biochemical level and ultimately gives rise to adverse effects at the individual level. These effects may result in reductions in ecologically relevant characteristics such as growth, reproduction, and survival. Zebrafish (Danio rerio) has been a well-known vertebrate model in a variety of biological disciplines to assess drug toxicity and safety. Substantial information gathered from developmental and genetic research has placed zebrafish in an attractive position for use as a toxicological model. Numerous studies have confirmed that mammalian and zebrafish toxicity profiles are strikingly similar. In this study, the effect of 3,4-Dichloroaniline (DCA), a metabolite of propanil and diuron (herbicides), and diazinon (insecticide), on the growth rate of juvenile zebrafish (Danio rerio) were assessed. Sixty days old juvenile zebrafish were exposed to various concentrations of DCA ranging from 0.016 to 0.5 mg/L, along with control for 28 days. Study was performed under semi-static condition where media was renewed at every 24 hour intervals. The specific growth rate of fish, exposed to the DCA test concentrations of 0.031, 0.063, 0.125, 0.250, and 0.500 mg DCA/L between days 0 and 14, and 0 and 28, was reduced significantly, as compared with that of the control group. All juvenile fish were normal and no mortality was observed at the concentrations of 0.016, 0.031, 0.063, 0.125, and 0.250 mg DCA/L and in control group. The No Observed Effect Concentration (NOEC) and the Lowest Observed Effect Concentration (LOEC) up to 28 day exposure period of 3, 4-dichloroaniline was found to be 0.063 and 0.125 mg/L, respectively. The EC₅₀ values of 3, 4-dichloroaniline for average specific growth rate between days 0 and 14, 14 and 28, and 0 and 28 were 0.144, 0.178, and 0.257 mg/L, respectively. Based on the results, it can be concluded that 3, 4-dichloroaniline has toxic effect on growth of juvenile zebrafish up to day 28, at the test concentrations of 0.031, 0.063, 0.125, 0.250, and 0.500 mg 3, 4-dichloroaniline/L.

INTRODUCTION

The safety of the fish community is an important concern because fish play a very important role in trophic cascades and as food resource for human beings. Therefore, the effect of different industrial chemicals, plant protection products, biocides, and medicinal products on fish, that may disturb aquatic environment has to be assessed. Zebrafish (Danio rerio) has been a well-known vertebrate model in a variety of biological disciplines to assess drug toxicity and safety. Substantial information gathered from developmental and genetic research has placed zebrafish in an attractive position for use as a toxicological model. In this study, the effects of 3,4-Dichloroaniline (DCA) on the growth rate of juvenile zebrafish (Danio *rerio*) were assessed.

OBJECTIVE

Present study was conducted to determine the toxic effects of 3, 4-dichloroaniline on the growth rate of juvenile zebrafish.

MATERIALS AND METHOD

Test Item

3,4-dichloroaniline (97.6%), Sigma-Aldrich, Switzerland

Test System

Juvenile zebrafish (wild type) were used as test system for the experiment.

EXPERIMENTAL DESIGN

Test System	Juve
Test Media	Wa
Test Procedure	Sen
Control	Test
Test Item	3,4
Test Concentrations	0.0 0.5
Number of Fish	30
Acclimatization	15
Exposure Duration	28
Feed Ration	8%
Observation	Mo Boc
A.I. and Stability Analysis	For test

RESULTS

The specific growth rate of fish exposed to the DCA test concentrations of 0.031, 0.063, 0.125, 0.250, and 0.500 mg DCA/L between days 0 and 14, and 0 and 28, was reduced significantly, as compared with that of the control group. All juvenile fish were normal and no mortality was observed at the concentrations of 0.016, 0.031, 0.063, 0.125, and 0.250 mg DCA/L and in control group. The NOEC and the LOEC up to 28 day exposure period of DCA was found to be 0.063 and 0.125 mg/L, respectively.

TABLE 1: Relationship between Percent Growth Rate and Concentration of 3, 4-Dichloroaniline

Day	EC ₅₀ Value	95% Fiducial Limits (mg/L)		Regression Equation
Duration	(mg/L)	Lower Limit	Upper Limit	(y = a + bx)
0-14	0.144	0.074	0.281	y = 1.692 + 1.533x
14-28	0.178	0.080	0.398	y = 2.002 + 1.332x
0-28	0.257	0.103	0.645	y = 2.466 + 1.051x

Key: y = Probit of mortality, x = Log concentration of 3, 4-Dichloroaniline,a = Intercept, b = Slope

venile zebrafish (1.5 month old)

ater (Mixer of RO water and Tap water at a ratio of 3:1) ni-static

- media (Water)
- -Dichloroaniline
- (control), 0.016, 0.031, 0.063, 0.125, 0.250 and 00 mg/L
- Fish (10 Fish/Replicate)
- days
- days
- [live food (Artemia)]
- ortality and Behavior : every 24 h interval and dy weight : on days 0, 14 and 28
- the highest and lowest concentration at start of the and weekly thereafter



CONCLUSION

Based on the results, it can be concluded that 3, 4-dichloroaniline has toxic effect on growth of juvenile zebrafish up to day 28 at the test concentrations of 0.031, 0.063, 0.125, 0.250, and 0.500 mg 3, 4-dichloroaniline/L.

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Figure 1 : Mean Body Weight on Days 0, 14 and 28 0.125mg/L DCA - Body Weight on Day 28 -Body Weight on Day 14 Figure 2 : Average Specific Growth Rate during 0-14 and 0-28 days



-Average Specific Growth Rate During 0-14 Day -Average Specific Growth Rate During 0-28 Day

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