

Chlorpyrifos (CAS no. 2921-88-2)

Tier 1 *in vivo* Test

(1) Results

Fish were exposed to concentrations of 0.145, 1.06 and 6.87 µg/L (measured). No significant differences were observed in mortality, female gonadosomatic index, female hepatosomatic index, secondary sex characteristics, and female hepatic vitellogenin level.

At 1.06 µg/L, a significant increase in male hepatic vitellogenin level was observed.

At 1.06 µg/L and higher, a significant decrease in male gonadosomatic index was observed.

At 6.87 µg/L, abnormal swimming and gross morphology were observed, and a significant decrease in total length, body weight, number of eggs, number of fertile eggs, and fertility rate, and a significant increase in male hepatosomatic index were observed.

(2) Summary

Estrogenic activity of chlorpyrifos has been indicated from literature and Tier 1 *in vitro* tests. In this study, an increase in male hepatic vitellogenin level was observed at sublethal concentrations to suggest estrogenic effect. But this increase was as small as 3.4 times the lower limit of quantification, thus inconclusive to suggest estrogenic or androgenic effects.

The various significant changes observed at 6.87 µg/L were considered to indicate toxicity.

The adverse exposure level of 6.87 µg/L was ca. 70 times as high as the detection limit of environmental water concentration of 0.1 µg/L that was measured in MOE's Environmental Survey and Monitoring of Chemicals in FY1990 (chlorpyrifos was not detected).

The no observed adverse effect level of 1.06 µg/L was ca. 11 times as high as the detection limit of environmental water concentration of 0.1 µg/L for MOE's Environmental Survey and Monitoring of Chemicals in FY1990 (chlorpyrifos was not detected).

Table 1-A Results

Measured concentration ($\mu\text{g/L}$)	Number of tested fish		Total length (mm)		Body weight (mg)		Total length (mm)	
	male	female	male	female	male	female	male	female
Control (nd:<0.02)	12	12	0	0	30.2 \pm 1.9	30.2 \pm 1.5	259 \pm 40	347 \pm 43
Solvent Control (nd)	12	12	0	0	29.4 \pm 1.5	31.1 \pm 1.6	246 \pm 40	350 \pm 60
0.145	12	12	0	8	29.8 \pm 1.4	30.0 \pm 1.4	254 \pm 39	315 \pm 43
1.06	12	12	0	8	29.8 \pm 1.0	30.0 \pm 1.6	272 \pm 31	330 \pm 51
6.87	12	12	0	17	26.8 \pm 1.2**	29.0 \pm 1.6**	182 \pm 26**	300 \pm 52*

Table 1-B Results (continued)

Measured concentration ($\mu\text{g/L}$)	Number of eggs (eggs/female/day)	Number of fertile eggs (eggs/female/day)	Fertility rate (%)	Gonadosomatic Index (%)	
				male	female
Control (nd:<0.02)	21.9 \pm 1.4	20.8 \pm 1.3	94.7 \pm 1.1	0.943 \pm 0.21	11.4 \pm 123
Solvent Control (nd)	23.2 \pm 2.0	21.9 \pm 1.8	94.4 \pm 0.81	0.849 \pm 0.24	9.29 \pm 3.0
0.145	21.6 \pm 1.2	21.0 \pm 0.9	97.1 \pm 1.4	0.802 \pm 0.24	10.5 \pm 1.8
1.06	21.4 \pm 1.2	19.9 \pm 1.9	93.0 \pm 3.1	0.740 \pm 0.25*	10.9 \pm 1.9
6.87	7.03 \pm 0.92**	4.36 \pm 0.73**	20.9 \pm 4.2*	0.492 \pm 0.28**	8.19 \pm 3.7

Table 1-C Results (continued)

Measured concentration ($\mu\text{g/L}$)	Hepatosomatic Index (%)		Vitellogenin (ng/mg liver)		Secondary sex characteristics	
	male	female	male	female	male	female
Control (nd:<0.02)	2.55 \pm 0.29	6.54 \pm 1.4	ND	617 \pm 165	74 \pm 10	0 \pm 0
Solvent Control (nd)	2.37 \pm 0.62	6.82 \pm 1.1	ND	532 \pm 169	73 \pm 10	4 \pm 13
0.145	2.38 \pm 0.54	6.21 \pm 1.2	ND	597 \pm 119	73 \pm 13	0 \pm 0
1.06	2.83 \pm 0.55	7.43 \pm 1.2	1.36 \pm 3.40**	642 \pm 146	70 \pm 16	0 \pm 0
6.87	3.20 \pm 1.0**	5.67 \pm 1.2	ND	492 \pm 321	68 \pm 10	0 \pm 0

Table 1-D Results (continued)

Measured concentration ($\mu\text{g/L}$)	Other observations
Control (nd:<0.02)	Not found
Solvent Control (nd)	Not found
0.145	Not found
1.06	Not found
6.87	abnormal swimming and gross morphology

Data show mean \pm SD (standard deviation)

Statistically significant differences from control group (**p<0.01, *p<0.05)

ND: not detected (below detection limit of vitellogenin: 0.4 ng/mg liver)

(-): not measured

Secondary sex characteristics: number of joint plates with papillary processes