

Influence of PH on the Lethal Toxicity of Phenol, Para Chlorophenol and Pentachlorophenol to Freshwater Fish *Gambusia Affinis*



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ABSTRACT: Phenol and Phenolic compounds has several sources including industrial wastes, coal , wood distillation, road tars, petroleum refining, chemical and plastics manufacture, domestic sewage discharges, natural sources such as plant material decay and leaching from coal and oil deposits enter natural water system and affect the fish and other aquatic organisms , So the static renewal bioassays were done to study the influence of pH on the lethal toxicity of phenol, para chlorophenol and pentachlorophenol to the freshwater fish *Gambusia affinis*. The studies shows that phenol, para chlorophenol and pentachlorophenol decreased their toxicity as the pH increased to the said fish .The 24,48,72 and 96 hours LC₅₀ values were found to be 48.0,45.0, 43.0 and 41.0 mg/l at pH 6.0 and at pH 7.5 the 24,48,72 and 96 hours LC₅₀ values were 50.0, 48.0, 46.0 and 44.0 mg/l respectively for the fish exposed to phenol, And at pH 6.0 the 24,48,72 and 96 hours LC₅₀ values were 24.0, 21.0, 19.0, 17.0 mg/l and at pH 7.5 the 24, 48, 72 and 96 hours were 30.0, 28.0, 25.0 and 22.0 mg/l respectively for the fish exposed to para chlorophenol .The LC₅₀ values at 24,48,72 and 96 hours at pH 6.0 were 0.12, 0.10, 0.09 and 0.07 mg/l respectively and at pH 7.5 The LC₅₀ values were 1.23, 1.19, 1.15 and 1.11 mg/l respectively for the fish *Gambusia affinis* .

KEY WORDS: Toxicity, pH, *Gambusia affinis*, Phenol, Para-chlorophenol, Pentachlorophenol.

INTRODUCTION

Phenol and phenolic compounds such as para chlorophenol and pentachlorophenol have been released into natural waters from various industrial sources, phenols are used as antiseptics and disinfectants (Meteliev V.V. ,et al., 1983). Phenolic compounds are non specific metabolic inhibitors ,affects nervous system and also acts as hemolyzing agents of erythrocytes (Krajnovic-Ozrectic.M and et al., 1988) pentachlorophenol is used as broad spectrum pesticide , insecticide, fungicide, herbicide and it affects oxidative phosphorylation (Stephen E.D .and G.A Chapman, 1984) , Environmental factor like pH influences various metabolic and physiological process of fish . Studies on the influence of pH on the lethal toxicity of phenol, para chlorophenol and pentachlorophenol to the fresh water fish *Gambusia affinis* were not done elsewhere so the bioassays were carried out..

MATERIALS AND METHODS

The live and healthy freshwater fish *Gambusia affinis* were acclimatized to laboratory condition for ten days in the glass aquarium and fed daily with commercial fish food and the size of the fish selected for the test were 2.8-3.6cms long and weighed 0.28-0.41 gms. Test medium used was one day stored tap water. The test were conducted in triplicate keeping a control. Ten fish were exposed to each concentration of phenol, para chlorophenol and pentachlorophenol separately from 40.0 to 70.0 mg/liters, 20 to 40 mg/liters ,0.01 to 2.0 mg/ liters respectively. Stock solutions were prepared by using analytical grade reagents with acetone as solvent. This required quantity of stock solution of individual type of toxicant was used to have the appropriate concentrations and the solutions were delivered to each glass aquarium to conduct the bioassay test separately. Prior to the commencement of the test feeding to the fish were stopped and were not fed during the test till the end of 96 hours. The medium used for the bioassays were dechlorinated tap water having temperature of 26.5-27.5°C. Dissolved oxygen 6.8-7.2 mg/liter and total hardness was 78-84 mg/liter as CaCO₃ (APHA et al., 1985). The test solutions were renewed every 24 hours for a period of four days. The dose mortality rate obtained for the static bioassay test were plotted on log -probit graph. The LC₅₀ and 95% confidence limits were calculated statistically (Litchfield.J.T.. and F Wilcoxon .1949) The pH of medium was maintained at three different pH of 6.0 and 7.5 0 respectively during the static renewal bioassay till 96 hours for phenol, para chlorophenol and pentachlorophenol separately.

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RESULTS AND DISCUSSIONS

Soon after the fish was introduced into various concentrations of phenol, Para chlorophenol and pentachlorophenol showed erratic and rapid movement at higher concentrations and then they slowed down their movement, surfacing and gulping of atmospheric oxygen were also seen, blood clots near the gill regions was visible, excessive mucous across gill region for the fish exposed to para chlorophenol and pentachlorophenol was seen at lower pH, Pale coloration of the fish at the time of death was observed exposed to the higher concentrations to phenol, para chlorophenol and pentachlorophenol.

Toxicity of phenols related to pH were studied by Sarikoski and Vilukshela., 1982, decreased pH increased the toxicity of phenol the fish. The 96 h LC₅₀ values for Kharda, Singi and Patra were 9.1, 13.0, and 2.5 mg/l, at pH 6.0, and at 7.3 were 32.7, 39.4, 12.5mg/l and pH 8.8 were 49.2,54.1 and 29.2 respectively for the three fishes exposed to phenol (Dalela et al., 1980). For pentachlorophenol the 24 hours LC₅₀ was 0.028ppm at pH 5.5, at pH 6.5 was 0.044 ppm and at pH 7.5 was 0.208ppm at pH 8.5 the 24 hours LC₅₀ value was 0.40ppm and at pH 9.5 was 3.126ppm for *Cyprinus carpio* respectively (Khangarot et al., 1985)

The studies shows that phenol, para chlorophenol and pentachlorophenol decreased their toxicity as the pH increased to the *Gambusia affinis*. The 24,48,72 and 96 hours LC₅₀ values were found to be 48.0,45.0, 43.0 and 41.0 mg/l at pH 6.0 and at pH 7.5 the 24,48,72 and 96 hours LC₅₀ values were 50.0, 48.0, 46.0 and 44.0 mg/l and at pH 9.0 the LC₅₀ values were 60.0, 58.0, 56.0 and 54.0 mg/l respectively for the fish exposed to phenol (Table 1), And at pH 6.0 the 24,48,72 and 96 hours LC₅₀ values were 24.0, 21.0, 19.0 and 17.0 mg/l and at pH 7.5 the 24, 48, 72 and 96 hours were 30.0, 28.0, 25.0 and 22.0 mg/l respectively for the fish exposed to para chlorophenol (Table 2). The LC₅₀ values at 24,48,72 and 96 hours at pH 6.0 were 0.12, 0.10, 0.09 and 0.07 mg/l and at pH 7.5 the were 1.23, 1.19, 1.15 and 1.11 mg/l for the fish *Gambusia affinis* exposed to pentachlorophenol respectively (Table 3).

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Table 1: LC₅₀ Values and 95 percent confidence limit for the fish *Gambusia affinis* exposed to Phenol.at two different pH

pH	24 hours	48 hours	72 hours	96 hours
6.0	48.0 (47.19-48.81)	45.0 (44.29-45.72)	43.0 (42.49-43.51)	41.0 (40.67-41.32)
7.5	50.0 (47.80-52.30)	48.0 (47.01-49.00)	46.0 (44.48-47.56)	44.0 (42.88-45.14)

Table 2: LC₅₀ Values and 95 percent confidence limit for the fish *Gambusia affinis* exposed to Para chlorophenol.at two different pH

pH	24 hours	48 hours	72 hours	96 hours
6.0	24.0 (22.51-25.58)	21.0 (19.84-22.21)	19.0 (18.11-19.93)	17.0 (16.44-17.57)
7.5	30.0(28.35-31.74)	28.0 (26.76-29.28)	25.0 (24.10-25.92)	22.0 (21.27-27.37)

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Table 3: LC₅₀ Values and 95 percent confidence limit for the fish *Gambusia affinis* exposed to Pentachlorophenol at two different pH

pH	24 hours	48 hours	72 hours	96 hours
6.0	0.12 (0.10-0.13)	0.10 (0.09-0.10)	0.09 (0.08-0.09)	0.07 (0.06-0.07)
7.5	1.23 (1.20-1.25)	1.19 (1.16-1.21)	1.15 (1.12-1.17)	1.11 (1.09-1.12)