

ACUTE AND DEVELOPMENTAL TOXICITY OF

BISPHENOL A TO *Daphnia magna*

Gabsoo Hwang, Kangjoo Kim

School of Civil and Environmental Engineering, Kunsan National University, San 68, Miryong-dong, Kunsan, Jeonbuk, 573-701, Korea, gshwang@kunsan.ac.kr

Abstract

Aquatic ecotoxicity of bisphenol A, a well known endocrine disrupter in mammals, was studied using lab. reared *Daphnia magna* as a test organism. The static acute 48 h LC₅₀ of bisphenol A was 12.9mg/L and 110-hr LC₅₀ values of bisphenol A for daphnid embryos of different ages after deposition into the brood chamber increase with ages in the range of 1.55mg/L-8.91mg/L. Bisphenol A showed the ability to inhibit embryonic development. The lethal response and developmental inhibition all showed good concentration-response relationship.

Key words: bisphenol A, aquatic ecotoxicity, *Daphnia magna*, embryonic development

Background

Industrial and municipal wastewater can cause the serious damage or disruption to aquatic ecosystems. Bisphenol A is an industrial chemical used in the manufacture of polycarbonate plastics, epoxy resins and other products. This compound has been known to interact with the mammalian estrogen receptor as an agonist and elicit the disruption of endocrine-related processes.

For bisphenol A, different levels of 48 h LC₅₀(3,900-20,000ug/l) in *Daphnia magna* as an acute ecotoxicity index have been reported. In the present study, intensive acute toxicity tests were conducted to eliminate this ambiguousness. Also, developmental toxicity of bisphenol A was assessed in *Daphnia magna* to assess its ecotoxicity in an effort to discern whether this compound may elicit endocrine-related toxicity in an invertebrate species

Method

Daphnids were cultured and experimentally maintained in formulated media reconstituted with 192 mg/L $\text{CaSO}_4\text{H}_2\text{O}$, 192 mg/L NaHCO_3 , 120 mg/L MgSO_4 , 8.0 mg/L KCl, 1.0 mg/L selenium and 1.0 mg/L vitamin B12. To assess the acute toxicity of bisphenol A in *Daphnia magna*, the 48 h EC_{50} for daphnid neonates (<24 h old) and 110 h LC_{50} for daphnid embryos of different ages were determined. For the assessment of developmental toxicity, embryos of the same age (after appearance in the brood chamber) were removed from untreated maternal daphnids. Embryos were individually assigned to wells of 96-well microtiter plates along with 200 μL of medium containing various concentrations of bisphenol A. Embryos were incubated at 20°C under a 16 hr photoperiod and were examined microscopically.

Results and discussion

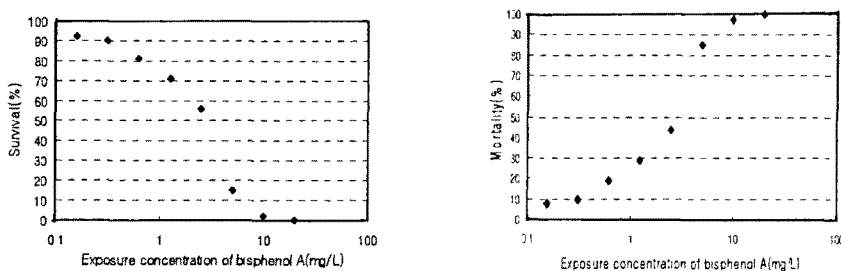


Fig. 1. The concentration-response curve for survival and mortality in early daphnid embryo (age of 6-7.5hr) exposed to bisphenol A. Response was checked 72hrs after exposure.

Table 1. Comparison of published 48 h EC_{50} s in *Daphnia magna* for bisphenol A

Reported value of 48 h EC_{50} (mg/L)	Author(year of publication)
3.9	Stephenson, R.R.(1983)
10	Alexander, H.C. et al.(1988)
20	Hendriks, A.J. et al.(1994)
12.9	This study

- The static acute 48 h LC_{50} of bisphenol A was 12.9(12.76-13.04)mg/L.

- Bisphenol A showed the ability to interfere with embryonic development, suggesting its antiestrogenic activity.
- Daphnid embryotoxicity tests can be one of useful tools available for the assessment of ecotoxicity of various chemicals in the aquatic environment.

Reference

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