Bull. Environ. Contam. Toxicol. (1987) 38:151–153

Bulletin of Environmental Contamination and Toxicology

Toxicity of Ethylene Glycol, Diethylene Glycol, and Propylene Glycol to Human Cells in Culture

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Ethylene glycol is used for antifreeze and in cooling and heating systems etc, diethylene glycol is used in antifreeze for sprinkler systems and water seals for gas tanks etc, and propylene glycol is use for food packaging, as an additive.

Tissue culture toxicity of various alcohols has been reported by Dillingham et al.(1973) who used mouse L cells and Koerker et al.(1976) who used mouse neuroblastoma cells. The toxicity of various polyhydric alcohols(ethylene glycol, diethylene glycol and propylene glycol) has apparently not been determined, under conditions of culture.

We now report the toxicity of ethylene glycol, diethylene glycol and propylene glycol on KB cells and the results are compared with previons data obtained using our cell culture system.

MATERIALS AND METHODS

The following chemicals were used : ethylene glycol, diethylene glycol and propylene glycol(Wako Pure Chemicals. Ind., Ltd., Osaka, Japan). The KB cell line and toxicity test methods used were the same as described(Mochida et al. 1983). A fifty percent inhibitory dose to growth of KB cells(ID50) was used as an index of the toxicity of these compounds.

RESULTS AND DISCUSSION

Fig. 1 shows dose-response curves obtained with ethylene glycol, diethylene glycol and propylene glycol for KB cells. Growth of the KB cells was inhibited with the increasing concentrations of these compounds, as indicated by cell counts.
This inhibition was dose-dependent.

Table 1 shows the ID50 values obtained with these compounds. The ID50 values for ethylene glycol, diethylene glycol and propylene glycol were 0.45 M, 0.18 M and 0.31 M, respectively, for KB cells.

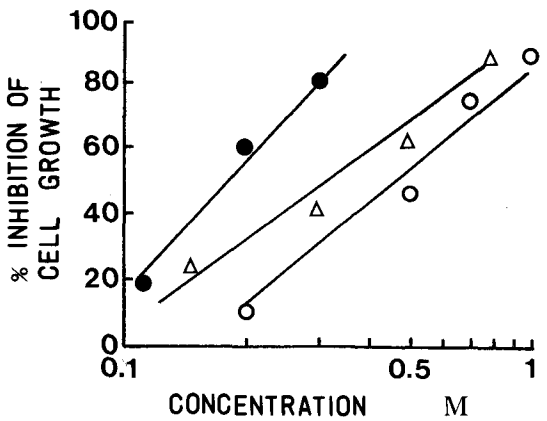

Figure 1. Dose-response curve obtained after 72 h exposure of KB cell cultures to various concentrations of ethylene glycol(O), diethylene glycol(●) and propylene glycol(Δ).

Table 1. Inhibitory doses of ethylene glycol, diethylene glycol and propylene glycol on growth of KB cells.

compounds	ID50 values(M)[a]
ethylene glycol	0.45
diethylene glycol	0.18
propylene glycol	0.31

[a]Concentration of compounds in growth medium that caused a 50% reduction in cell number after 72 h of incubation.

Studies on mouse L cells exposed to ethanol for 72 h showed the ID50 value to be 0.15 M(Dillingham et al. 1973). Our present results show that these compounds (ethylene glycol, diethylene glycol and propylene glycol) are less toxic than ethanol.

Propylene glycol used as a food additive was less toxic than butylated hydroxyanisole, butylated hydroxytoluene, propyl gallate and dl-α-tocopheryl, to KB cells in the same cell culture system(Mochida et al. 1985).

Thus, diethylene glycol is more toxic to KB cells than are ethylene glycol and propylene glycol.

Acknowledgment. We thank M. Ohara for comments on the manuscript.

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Received March 20, 1986; accepted May 1, 1986.