

Toxicity Assessment of Tetrachloroethylene, Trichloroethylene and 1,1,1-trichloroethane Using Human and Monkey Cells

Kyo Mochida and Koichi Saito

Shimane Prefectural Institute of Public Health and Environmental Science,
Nishihamasada-machi, Matsue 690-01, Japan

Tetrachloroethylene, 1,1,1-trichloroethane and trichloroethylene are solvents commonly used in dry cleaning, metal degrading and chemical manufacture. These organohalides has been found in ground water (Giger and Molnar-Kubica 1978), drinking water and blood plasma (Dowty et al. 1975) and mother's milk (Pellizzari et al. 1982). While the significance of these findings is not clear, there may be a potential hazard to health.

We now report the toxicity of tetrachloroethylene, trichloroethylene and 1,1,1-trichloroethane to human and monkey cells.

MATERIALS AND METHODS

The following chemicals were used : trichloroethylene, tetrachloroethylene and 1,1,1-trichloroethane (Wako Pure Chemical. Ind., Ltd., Osaka, Japan).

The cell lines (KB cells and African green monkey (AGMK) cells) and toxicity test methods used were the same as described previously (Mochida and Yamasaki 1984). A fifty percent inhibitory dose to growth of cells (ID₅₀) was used as an index of the toxicity of these compounds.

RESULTS AND DISCUSSION

Figure 1 shows some typical dose-response curves obtained with tetrachloroethylene, trichloroethylene and 1,1,1-trichloroethane for KB cells and AGMK cells. After 72 h of incubation, KB cells showed the same dose-dependent inhibition of growth as the AGMK cells.

Table 1 shows the ID₅₀ values obtained with these compounds. The ID₅₀ values of these compounds ranged from 140 to 630 µg/ml and there was no clear distinction in sensitivity between KB and AGMK cells.

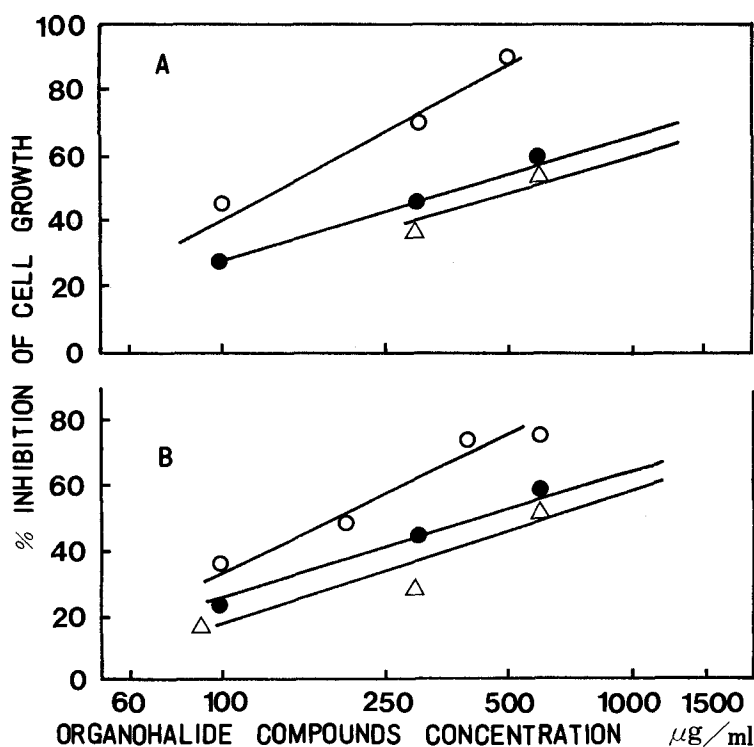


Figure 1. Dose-response curves obtained after 72 h exposure of mammalian cells in culture to various concentrations of organohalide compounds. The compounds were tetrachloroethylene(○), 1,1,1-trichloroethane(●) and trichloroethylene(△). AGMK cells(A) and KB cells(B).

Table 1. Inhibitory effects of organohalide compounds on growth cultured mammalian cells.

compounds	ID50 ($\mu\text{g/ml}$) ¹	
	KB cells ²	AGMK cells ³
tetrachloroethylene	195	140
1,1,1-trichloroethane	420	380
trichloroethylene	630	550

1 Concentration of organohalide compound in growth medium that caused a 50% reduction in cell number after 72 h of incubation.

2 KB cells : Human established cell line.

3 AGMK cells : African green monkey kidney.

Elias et al.(1981) found similar ID50 values with mouse L cells to 1,1,1-trichloroethane. We found that 1,1,1-trichloroethane had about 5 times the toxicity of trichloromethane, to both lines of cells in the same cell culture system(Mochida and Yamasaki 1984).

Tetrachloroethylene seems to be more toxic than trichloroethylene and 1,1,1-trichloroethane to KB and AGMK cells.

REFERENCES

- Dowty B, Carlisle D, Laseter JL, Storer J (1975) Halogenated hydrocarbons in New Orleans drinking water and blood plasma. *Science* 187:75-77
- Elias Z, Hartemann P, Chau N (1981) Etude de la cytotoxicité du chloroforme, du dichloro-1,2-éthane, du trichloro-1,1,1-éthane et de l'hexachlorobutadiène sur les cellules L de souris. *Toxicol Eur Res* 3:293-298
- Giger W, Molnar-Kubica E (1978) Tetrachloroethylene in contaminated ground and drinking waters. *Bull Environ Contam Toxicol* 19:475-480
- Mochida K, Yamasaki M (1984) Toxicity of halomethanes to cultured human and monkey cells. *Bull Environ Contam Toxicol* 33:253-256
- Pellizzari ED, Hartwell TD, Harris BSH, Waddell RD, Whitaker DA, Erickson MD (1982) Purgeable organic compounds in mother's milk. *Bull Environ Contam Toxicol* 28:322-328

Received November 30, 1984; accepted January 8, 1985