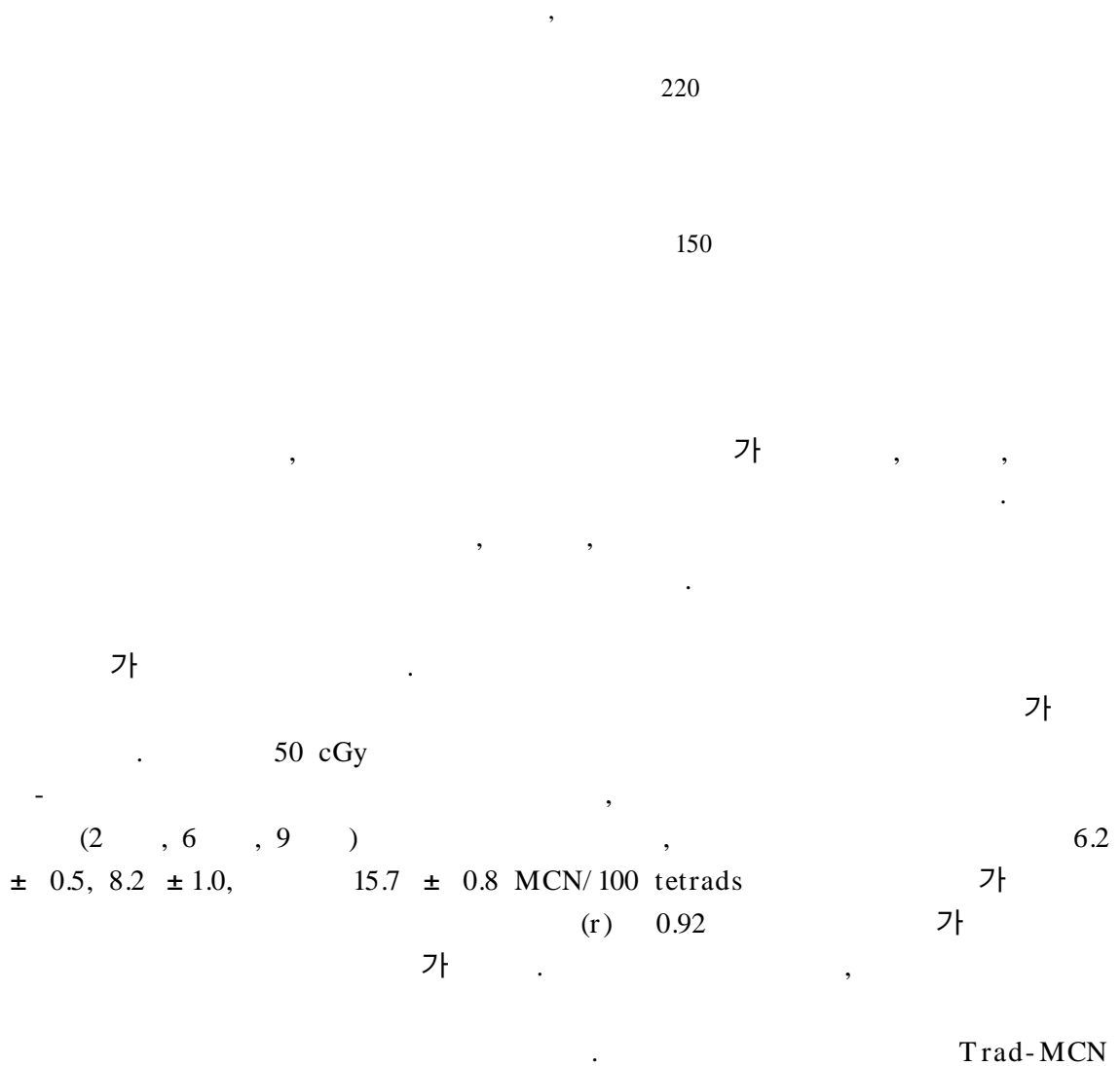


Comparative Study on Biological Effects of Gamma-Radiation and Volatile Organic Compound with the Plant Bioassay



Abstract

This research examined the presence of hazardous materials in chemical workplace field by means of an integrated biological monitoring. The pollen mother cells (PMC) of *Tradescantia* are very sensitive to chemical toxicants or ionizing radiation, and thus can be used as a biological end-point assessing their effect. A parallel series of experiment using five increasing doses of gamma-ray at 10, 20, 30, 40 and 50 cGy was conducted. The MCN frequencies showed a good dose-response relationship in the range of radiation applied and yielded a correlation coefficient of 0.95. On the other hand, the MCN frequency resulted in a good response to exposure time in the workplace field. In case of *in situ* monitoring with the *Tradescantia* micronucleus assay, the frequencies were 6.2 ± 0.5 , 8.2 ± 1.0 , and 15.7 ± 0.8 MCN/100 tetrads for 2, 6, and 9 hours exposure, respectively. Inhalation of the workplace air by workers may result in chronic damage to their health as proven by micronucleus formations in *Tradescantia* pollen mother cells. The combination of chemical/biological monitoring is very effective to evaluate hazardous materials in workplace field and can be alternatively used for screening hazardous materials.

1.

70 %
가
[1].
[2].
1970
(*Tradescantia* Micronucleus Assay Method; Trad-MCN)
Trad-MCN 가
[3], 가

[4]. ,
 ,
 ,
 (acentric fragment) (sticky
 chromosome complex)가 4 (tetrads)
 , count Trad-MCN assay
 [3]. Trad-MCN
 .
 가 가
 4
 , 1 2 가 .
 Trad-MCN 가 가
 Trad-MCN 가 가 [6].
 가
 [6].
 가

2.

:
Tradescantia 4430 .
 20 (>200) (growth chamber) 24

(Toluene) :

400 mg Tenax TA가

2 , 6 9 .
 24 , .

: ⁶⁰Co (150 TBq, Panoramic Irradiator,
 Atomic Energy of Canada Ltd.) , (cuttings)가

가 0 50 cGy .
 30 cGy .
 가 Hougland's solution No.2 6
 : , [4].
 가 10 , 4
 100 300

3.

- (dose-response relationship)

가 ,
 가 , 50 cGy
 MCN 가 - MCN
 가 0 50 cGy
 가 (Fig. 1).
 (1)

$$F_{MCN} = 1.97D + 4.05, \quad (r^2 = 0.95) \quad \text{-----} \quad (1)$$

$$F_{MCN} = \quad \quad \quad (\text{MCN}/100 \text{ tetrads})$$

$$D = \quad \quad \quad (\text{cGy}).$$

$$r^2=0.95 \quad 0 \quad 50 \text{ cGy}$$

4 MCN/100 tetrads

[7].

(Toluene)

9
 1368 $\mu\text{g}/\text{m}^3$
 96%
 가 1368 $\mu\text{g}/\text{m}^3$ (2)
 , 6 , 9) , 6.2 \pm 0.5,
 8.2 \pm 1.0, 15.7 \pm 0.8 MCN/ 100 tetrads 가
 (r) 0.92 가
 가 . 가

(Fig. 2).

$$F_{\text{MCN}} = 1.31C + 2.53, \quad (r^2 = 0.84) \quad \text{-----} \quad (2)$$

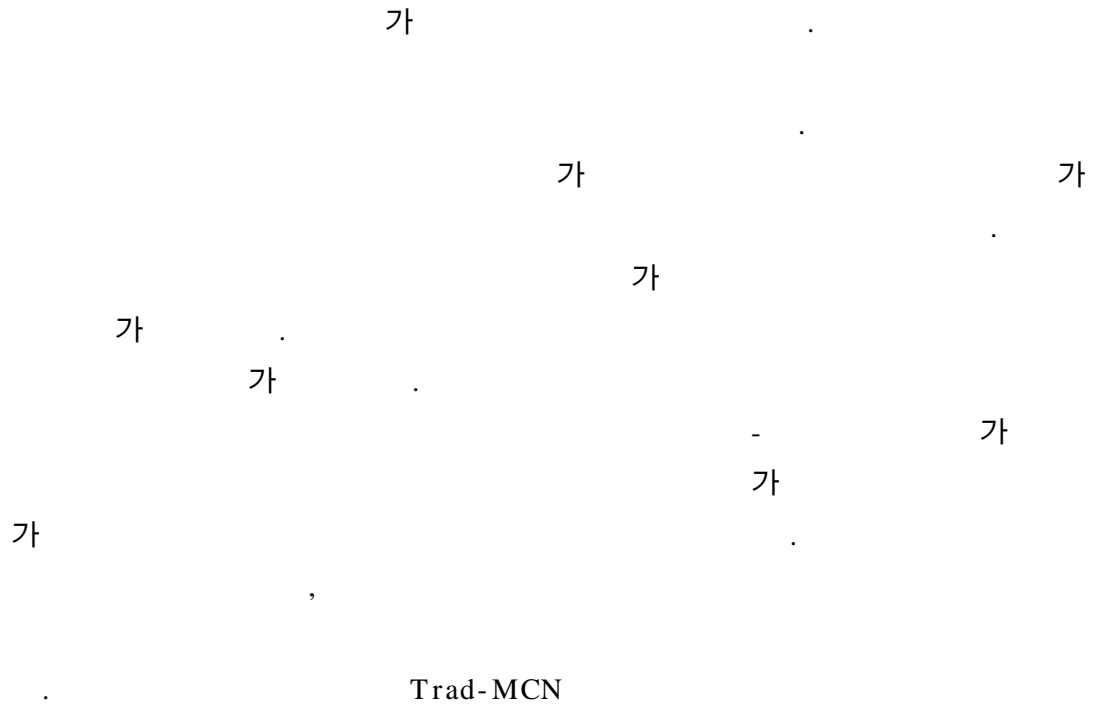
F_{MCN} = (MCN/ 100 tetrads)
 C = (hr).

$r^2=0.84$ 0 9 hr
 가
 (background rate) 2.53 MCN/ 100 tetrads
 2.9 \pm 0.4 MCN/ 100
 tetrads , [8].

가 (Table 1).

24 25 cGy
 8
 100 ppm
 0.36 ppm
 biomonitoring

4.



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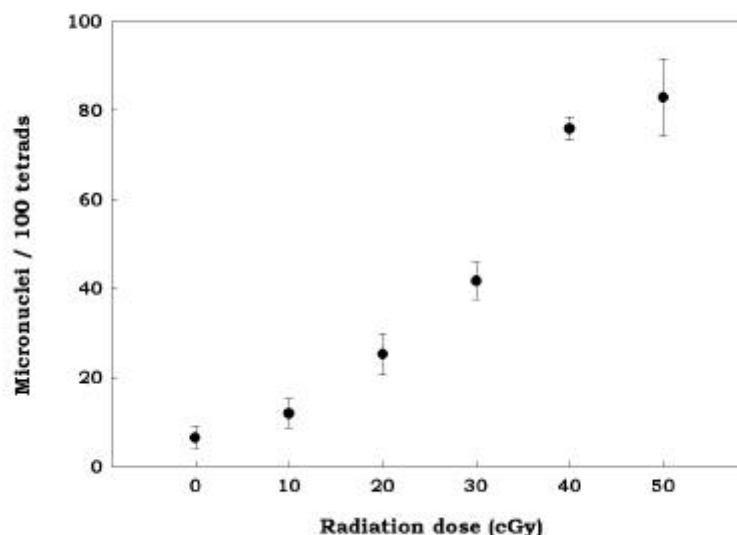


Figure 1. Micronucleus frequencies induced by radiation in pollenmother cells of T-4430.

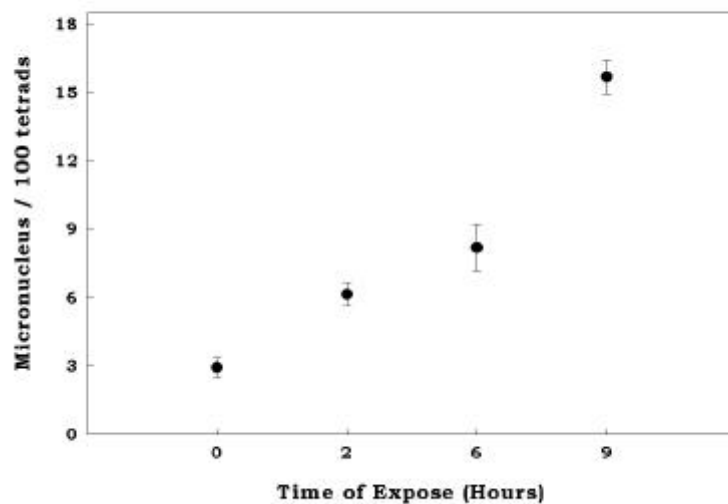


Figure 2. Micronucleus frequencies induced by toluene exposure in pollen mother cells of T-4430.

Table. 1. Radiation dose and toluene exposure time for inducing the same frequencies of micronuclei in *Tradescantia* pollen mother cells

Toluene exposure time (hr)	Micronucleus frequencies (MCN/ 100 tetrads)	Radiation dose equivalent to toluene exposure time (cGy)	Remarks
2	5.2	0.6	
6	10.3	3.0	
9	14.3	5.2	
12	18.3	7.2	
24	40.0	18.0	