

CONFERENCE PROCEEDING

Genotoxicity and Cytotoxicity Study of E-Cigarettes Using *Vigna Radiata* (Mung Bean) as Plant Bioassay

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ABSTRACT

The purpose of this study was to examine the genotoxicity and cytotoxicity of flavourless and flavoured e-cigarettes liquid (50% propylene glycol:50% vegetable glycerine, with no nicotine salt) by using mung bean as a plant bioassay. Healthy seeds of mung bean were exposed to flavoured and flavourless e-cigarette liquid with concentrations of 0%, 10%, 15% and 25% (v/v). The genotoxic and cytogenetic impacts of the applied flavour and concentrations were assessed using mung bean as a plant bioassay, based on microscopic and macroscopic observations, which expressed as mitotic index, chromosomal abnormalities percentage, survival percentage, germination percentage, germination rate, plant growth rate, plant height, and root growth rate. Overall, flavoured and flavourless e-liquids reduced the survival percentage, germination percentage, germination rate, plant growth rate, plant height, and root growth rate of mung bean. However, observation shows flavoured e-liquid severely affects the mean plant growth rate, plant height and root growth rate compared to flavourless e-liquid. The treatment of both flavoured and flavourless e-liquids reduced mitotic index (MI). Percentage of chromosomal aberration was also increased in the dividing cells of mung bean root tips regardless of the type of flavours. Chromosome clumping and C-mitosis were the most common abnormalities found, and chromosomal bridge was the highest aberration at anaphase meanwhile anaphase stickiness was occasionally observed in the mung bean root tip dividing cells. growth. It is concluded that the morphological differences observed are probably due to the result of cytology and genomic disturbances caused by the treatment induced to the mung bean seeds.

Keywords: *Vigna radiata*, mung beans, e-cigarette, plant bioassay

INTRODUCTION

Globally, the usage of e-cigarette has risen greatly. The flavoured e-cigarette liquid entices many people, especially adolescents to start using e-cigarettes. However, the compounds contained in the flavoured e-cigarette liquid might not be safe when inhale since there is a lack of studies on the genotoxicity and cytotoxicity of e-cigarettes based on the flavour. Furthermore, previous research found that inhalation of buttery flavoured e-liquid (diacetyl) causes bronchiolitis obliterans (Kreiss *et al.*, 2002). Therefore, this study aimed to determine the genotoxicity and cytotoxicity of flavourless and flavoured e-cigarettes liquid by using the mung bean as a plant bioassay.

MATERIALS AND METHODS/ METHODOLOGY

The exposure of mung beans to the e-liquids

For both flavourless and flavoured e-liquid, four groups of 30 mung bean seeds were prepared. The control group was only treated with distilled water, 0% (v/v). The

remaining three groups were treated with e-liquid of different concentrations, 10%, 15% and 25% (v/v) respectively. In each treatment, the mung bean seeds were soaked for 24 and 48 hours.

The macroscopic and microscopic observations

The measurement of macroscopic parameters was taken daily for 10 days for survival percentage, germination rate, germination percentage, plant growth rate, plant height and root growth rate. For microscopic parameters, the mitotic index and percentage of chromosomal aberrations during the cell division were determined.

RESULTS AND DISCUSSION

The observation of macroscopic and microscopic parameters

The exposure to flavoured and flavourless e-liquid affect all of the parameters tested as they significantly affected the survival percentage, germination percentage, germination rate, plant growth rate, plant height, and root growth rate of mung bean with the increment of exposure time.

The mitotic index was significantly reduced by both flavoured and flavourless e-cigarette liquids at 24 and 48 hours consequently, reducing plant growth rate and plant height. Based on Sharma and Vig (2012), the results of the present study suggest that both flavoured and flavourless e-cigarette liquids can be considered in the lethal range since the mitotic index is reduced by 50% and less. Meanwhile, the chromosomal aberrations observed in the meristem cells of mung beans in each treatment was significantly high. The presence of mutagen might change the enzyme activity which lead to chromosomal damage, and physiological abnormalities which then reduced the plant survival (Kumari *et al.*, 2016; Sato & Gaul, 1967).

Table 1. Mean±SE of macroscopic and microscopic parameters following the exposure of e-liquids

	Treatment (v/v)						
	Control 0%	10%	Flavoured 15% 25%		10%	Flavourless 15% 25%	
	Survival percentage (%)						
24 (h)	100	53.33	30	20	50	43.33	60
48 (h)	100	33.33	16.67	6.67	66.67	10	40
	Germination percentage (%)						
24 (h)	100	70	46.67	33.33	66.67	63.33	73.33
48 (h)	100	73	50	13	80	50	57
	Germination rate (unit/day)						
24 (h)	1.00	0.38	0.26	0.30	0.44	0.61	0.60
48 (h)	1.00	1.00	0.68	0.50	0.80	1.00	0.47
	Plant growth rate (cm)						
24 (h)	0.93±0.05 ^a	0.18±0.05 ^b	0.13±0.05 ^c	0.93±0.05 ^{bc}	0.10±0.05 ^b	0.17±0.05 ^b	0.13±0.05 ^b
48 (h)	0.93±0.05 ^a	0.11±0.05 ^b	0.10±0.05 ^b	0.00±0.05 ^b	0.30±0.05 ^b	0.02±0.05 ^c	0.17±0.05 ^b
	Plant height (cm)						
24 (h)	10.53±0.55 ^a	2.47±0.55 ^b	0.59±0.55 ^c	1.49±0.55 ^{bc}	1.20±0.55 ^b	1.82±0.55 ^b	1.35±0.55 ^b
48 (h)	10.53±0.54 ^a	1.56±0.54 ^b	1.13±0.54 ^{bc}	0.00±0.54 ^b	3.31±0.54 ^b	0.43±0.54 ^c	2.00±0.54 ^b
	Root growth rate (cm)						
24 (h)	0.81±0.07 ^a	0.51±0.07 ^b	0.35±0.07 ^{bc}	0.22±0.07 ^c	0.91±0.07 ^a	0.83±0.07 ^a	0.32±0.07 ^b
48 (h)	0.81±0.04 ^a	0.24±0.04 ^b	0.07±0.04 ^c	0.01±0.04 ^c	0.18±0.04 ^b	0.12±0.04 ^b	0.12±0.04 ^b
	Mitotic index (%)						
24 (h)	10.95±0.60 ^a	2.62±0.69 ^b	2.37±0.47 ^b	3.00±0.49 ^b	2.07±1.08 ^b	1.53±1.53 ^b	3.16±1.53 ^b
48 (h)	10.95±0.66 ^a	4.12±0.66 ^b	23.24±0.90 ^b	1.74±1.69 ^b	3.86±0.75 ^b	3.60±0.75 ^b	3.93±1.40 ^b
	Chromosomal Aberration (%)						
24 (h)	0.00±13.64 ^a	71.30±16.40 ^b	85.62±13.64 ^b	69.51±11.93 ^b	96.86±9.65 ^b	92.31±13.64 ^b	98.89±15.56 ^b
48 (h)	0.00±9.31 ^a	60.69±8.67 ^b	45.56±7.32 ^b	55.56±19.38 ^b	70.67±5.67 ^b	75.36±7.51 ^b	74.88±6.13 ^b

CONCLUSION

The results of the present study indicated the potential occurrence of cytotoxic and genotoxic agents in the e-cigarette liquid regardless of the flavour types. Therefore, mung bean can be used as a reliable and cheap tool of genotoxicity screening.

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