Radiation Inactivation of Microbes in Fresh Vegetables

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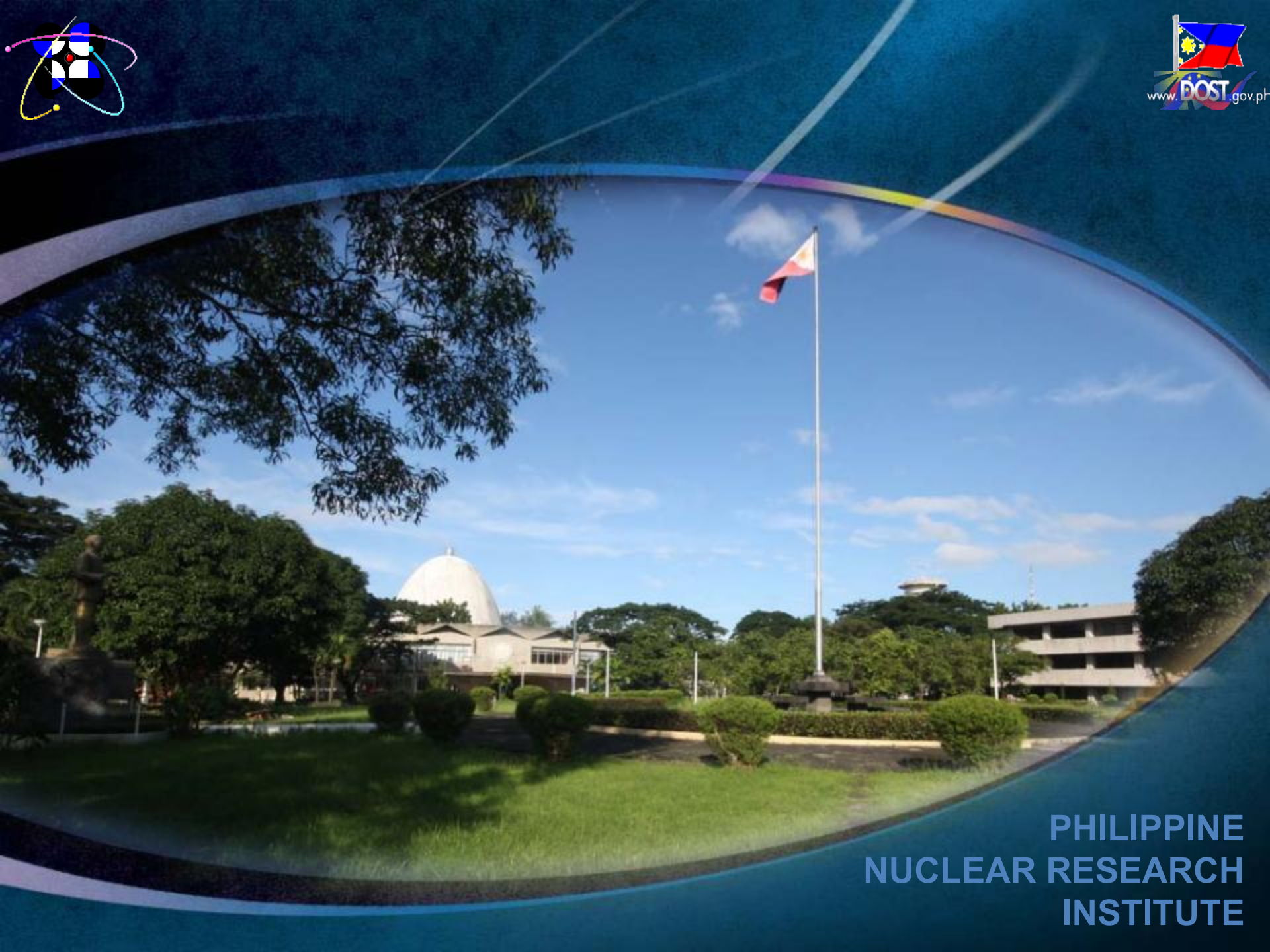
PHILIPPINE
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PNRI Co-60 IRRADIATION FACILITY

Pilot-Scale Irradiation Facility

Semi commercial Facility

- Conversion from a pilot-scale to a semi-commercial scale in 2008
- Current Activity- 87 kCi

PNRI ELECTRON BEAM FACILITY

RATIONALE:

- Role of Fresh vegetables in nutrition and healthy diets is well recognized
- Initiatives to encourage consumers to eat more of these products
- With increasing demands for variety of fresh vegetables has led to increase in national and international trade
- However, recent food safety problems linked to these products i.e. Problems with pathogens

RATIONALE:

- According to the DOH ,Philippines report in 2007, E. Coli was the most common pathogens associated with foodborne outbreaks (10-15%).

- In the recent paper published(2014), Philippine comprehensive assessment of prevalence of bacterial pathogens in fresh vegetables used in salad preparation resulted to:
  - 300 samples tested in open markets(n=5) and supermarkets(n=5), 16.7% tested positive for thermotolerant E.coli
  - E. Coli range from 0.30 to 4.03 log10 cfu/g

- Therefore, efforts to resolve food safety problems linked to fresh foods such as fresh vegetables are important and timely.

OBJECTIVES:

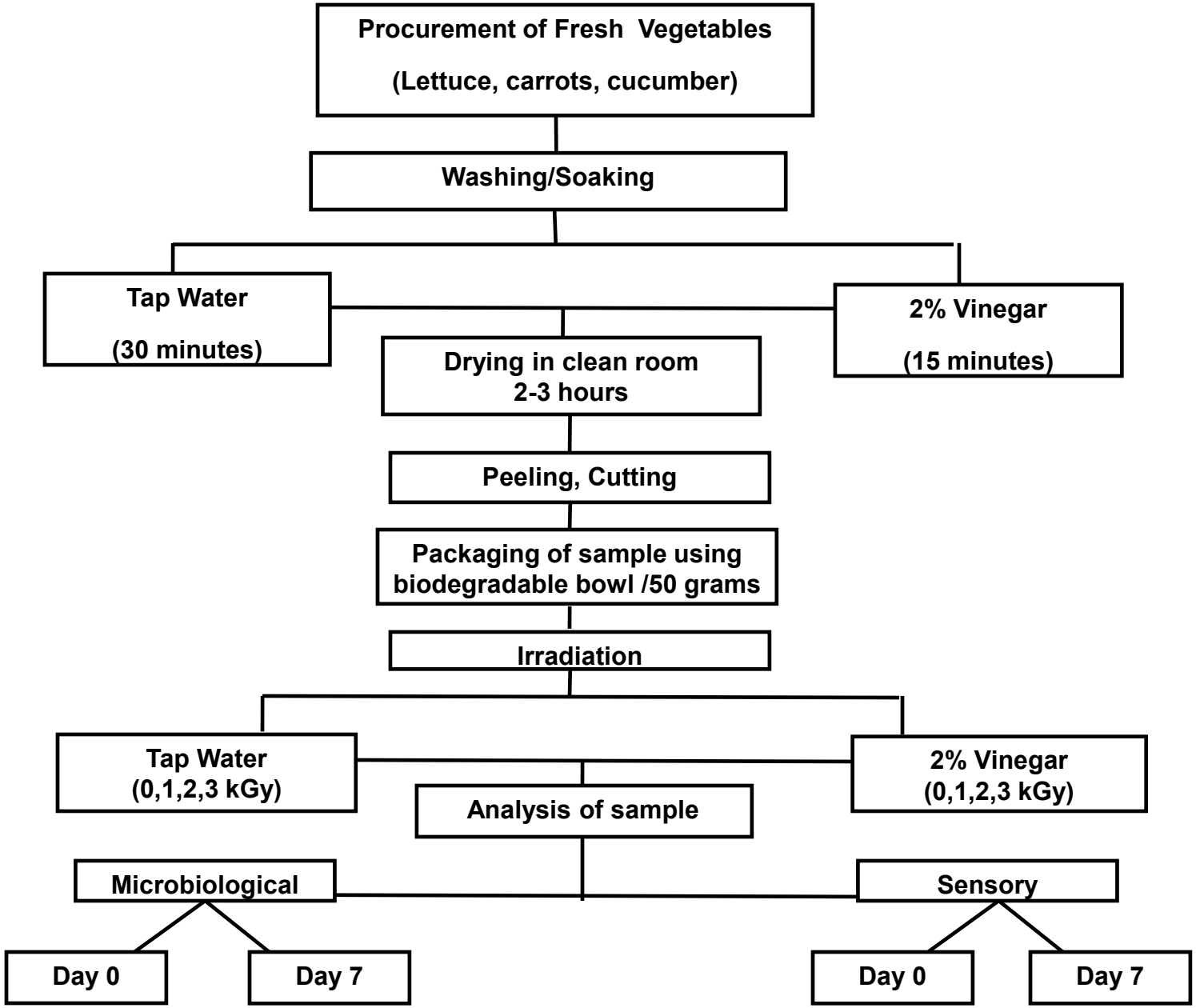
1. To evaluate the combined effects of pre-treatment and irradiation on the microbial quality of fresh vegetables

2. To determine the D10 value of E. Coli ATCC 25922 inoculated in fresh vegetables.

3. To determine the effectiveness of irradiation on the sensory and nutritional qualities of the products

Methodology

1. Flow chart of combined dipping and irradiation of fresh vegetables



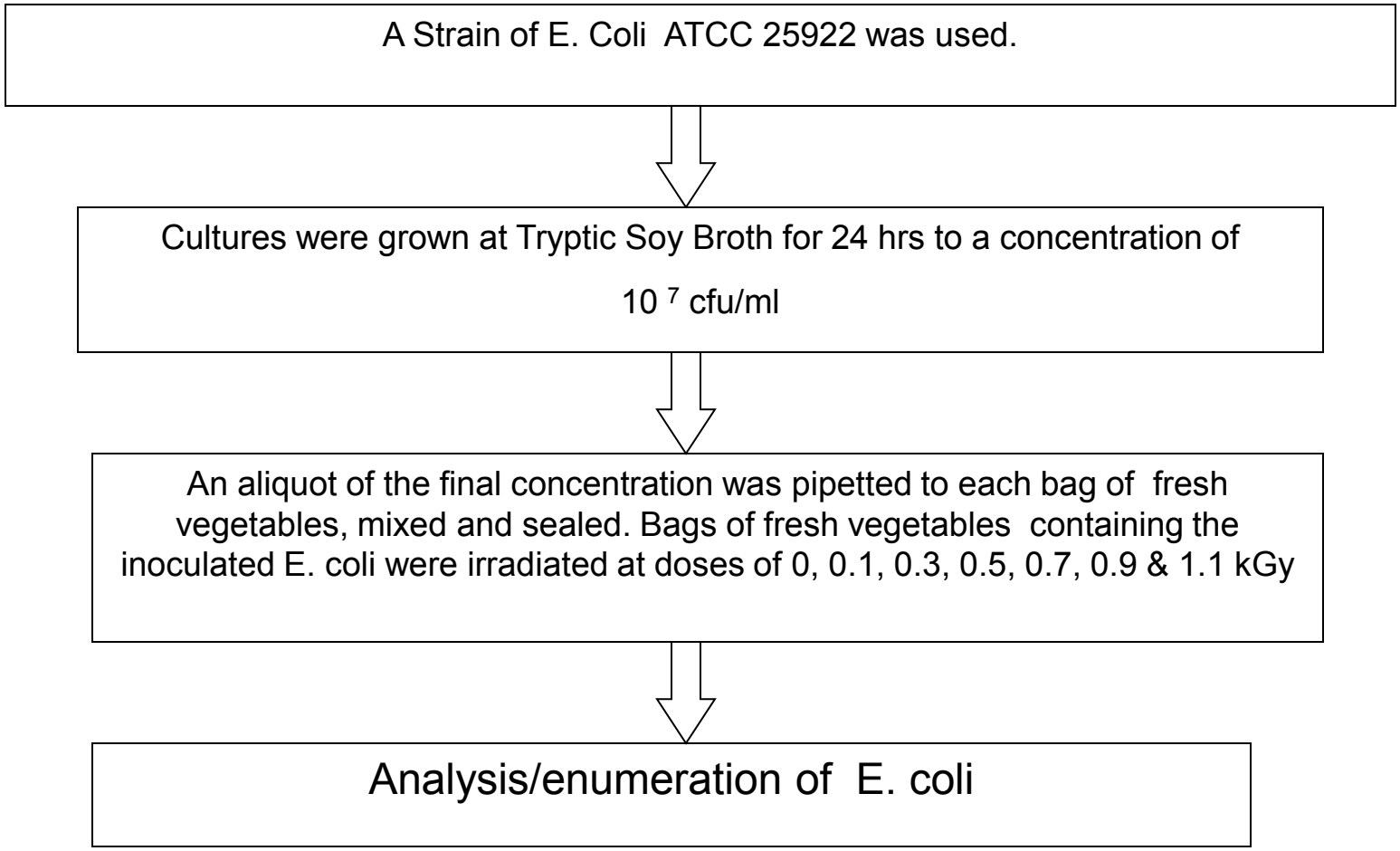
2. Irradiation of pre-cut fresh vegetable prior to inoculation

Sealing of fresh vegetables

Placing dosimeters (Gaufchromic) outside the sample pouches

Irradiation of pre-cut fresh vegetables

3. Inoculation of E. Coli in fresh vegetable



4. Sensory Evaluation of non-irradiated and irradiated pre-cut fresh vegetables

- Carried out by 6 panelists from day 0 & 7.
- Quality of mixed vegetables measured using parameters as color, odor aroma texture and overall acceptability
- Scoring method on scale of 1 -9 points, 1= poor-9 =best
- Data analyzed using mean average scores of 6 panelists.



Results

Table 1. Microbiological quality of non-irradiated & irradiated pre-cut fresh vegetables

Radiation Dose (kGy)	CFU/g		
	APC	Total Coliform	E. Coli
0	9.0×10^5	340	< 250
1	< 250	< 10	ND
3	< 10	< 10	ND
5	< 10	< 10	ND

Table 2. Microbiological assessment of non-irradiated and irradiated (soaked in tap water) pre-cut fresh vegetables at 0 and 7 days storage at chilled condition (3-4°C)

NO.OF DAYS	DOSE (kGy)	TAP WATER		
		AEROBIC PLATE COUNT (cfu/g)	TOTAL COLIFORM (cfu/g)	E. Coli (cfu/g)
	0	9.8×10^5	340	ND
Day 0	1	<250	<10	ND
	2	<10	<10	ND
	3	<10	<10	ND
	0	5.0×10^5	<250	ND
Day 7	1	<250	<10	ND
	2	<10	<10	ND
	3	<10	<10	ND

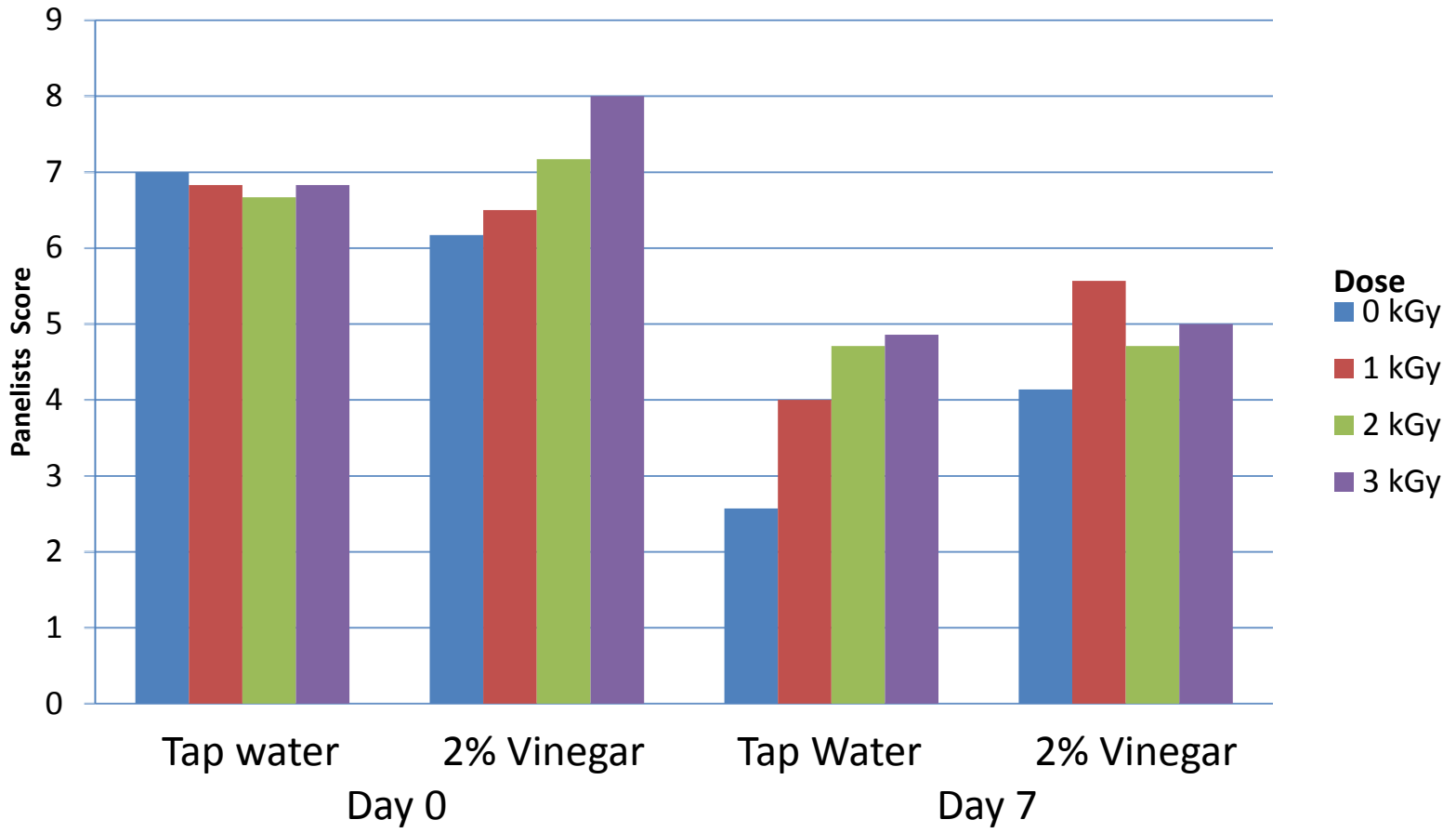
ND= Not detected

Table 3. Microbiological assessment of Irradiated and Non-irradiated (in 2% Vinegar) pre-cut fresh vegetables at 0 to 7 days storage at chilled conditions (3-4°C)

NO.OF DAYS	DOSE (kGy)	2% VINEGAR		
		AEROBIC PLATE COUNT (cfu/g)	TOTAL COLIFORM (cfu/g)	E. Coli (cfu/g)
	0	7.8×10^6	220	ND
Day 0	1	<250	<10	ND
	2	<250	<10	ND
	3	<10	<10	ND
	0	TNTC	<10	ND
Day 7	1	<250	<10	ND
	2	<10	<10	ND
	3	<10	<10	ND

ND= Not detected TNTC: too numerous to count

Overall Acceptability of Pre-cut Fresh Vegetables with pre -treatment of (Tap Water and 2% Vinegar) at different radiation doses

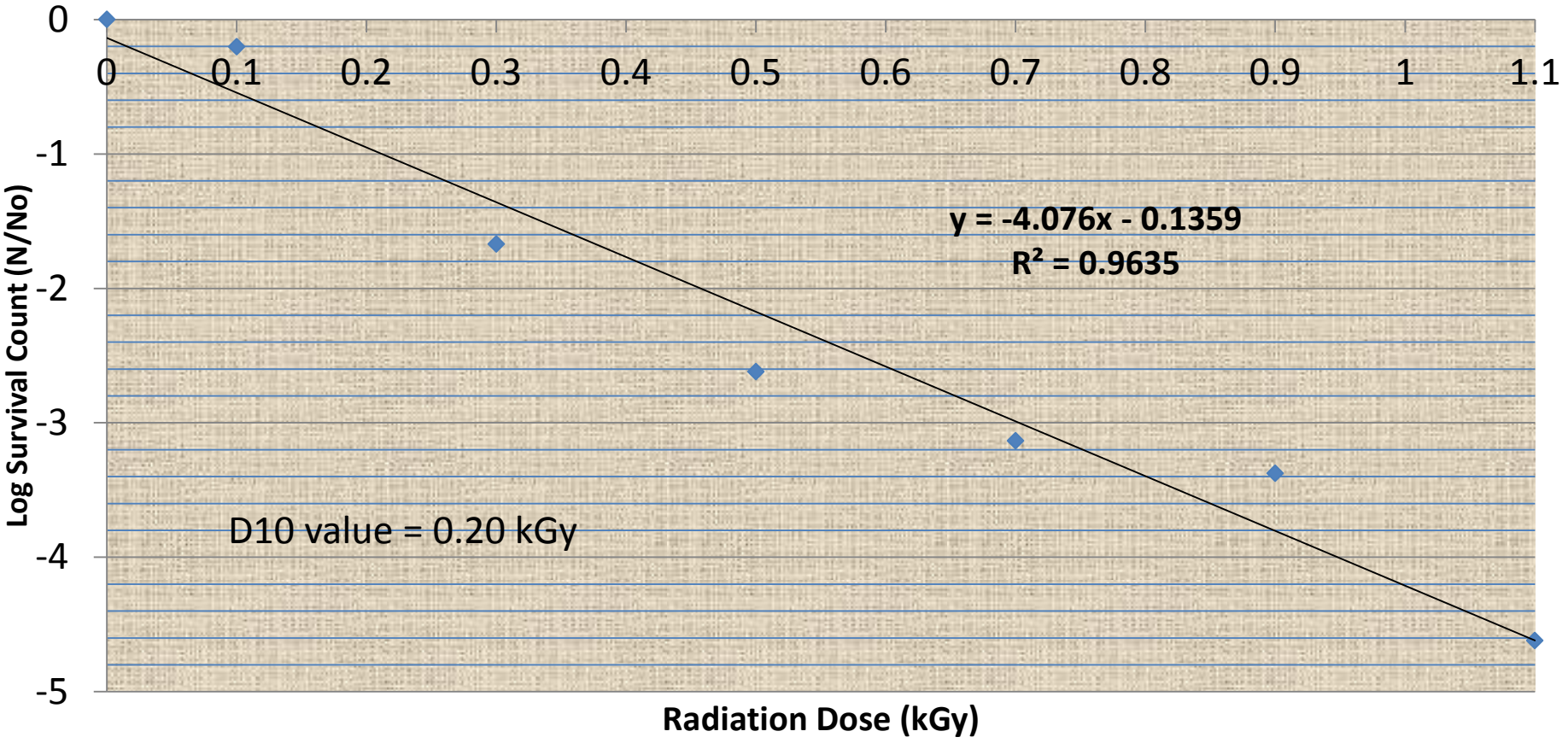


Nutritional Analysis of Irradiated and Non-irradiated fresh vegetables

Nutrients	Radiation Dose (kGy)		
	0	1.5	3
Vitamin A (mg/kg)	2.26	1.07	1.90
Vitamin C (mg/kg)	1.22	3.80	ND

ND-Not Detected
Methods used: HPLC

Fig. 1. Survival curve of E.coli ATCC 25922 inoculated in pre-cut fresh vegetables



CONCLUSION:

- Comparable microbial counts ranging from 10^5 to 10^6 cfu/g were obtained for fresh vegetables soaked in tap water for 30 minutes and in 2% vinegar for 15 minutes up to 7 days storage at chilled conditions. Soaking in water and vinegar prior to irradiation did not alter the high microbial counts of the products.

- Using a minimum dose of 1kGy , a remarkable reduction of 3- 5 log cycles in the total aerobic counts was obtained. Similarly, at this dose level coliform counts were below the detectable counts.

CONCLUSION:

- A D10 value of 0.20 kGy was determined for *E.coli* ATCC 25922 inoculated in fresh vegetables indicating sensitivity of these pathogen to low dose radiation.

- Overall acceptability of irradiated fresh vegetables are higher than non-irradiated lots at 7 days storage period.

- That irradiation is a feasible alternative treatment to improve microbial safety and quality of fresh vegetables.



MABUHAY PHILIPPINES