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Radio-Protector Effect of Red Onion Aqueous Extract when Irradiated by Caesium-137 (β- Radiations).

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Abstract: In this article we discuss how an experiment was actualized to study and check whether red onion extract can absorb β Radiation and act as radio-protector for minor experimental purposes. In this experiment a radioactive β-Radiation source i.e. isotope of Caesium (Caesium 137) was used. GM counter was utilized because of its high efficiency to measure the radioactive (β-radiation) emission. Readings were taken before and after effect of onion extract which gave amazing results by almost absorbing 50 % of the β-Radiations.

Keywords: Ascorbic acid; GM counter; Caesium 137.

1. Introduction

Nuclear technology and radiation science provides important factors in development of human efficiency and act as a significant tool for the economic and industrial growth. Having various uses of radiation science, it was observed that there are also various ill effects of radiation. For example, excess radiation can have severe effect on various organs and tissues causing cancer and various skin diseases. Also damage caused depends on the type of radiation; they can be α-radiations, β-radiations or γ-radiation [3]. Hence, radiation shielding becomes an important factor. As a result, various experiments are conducted on organic and inorganic substances so that they can be used as a protection against harmful radiations.

In this paper Caesium 137 was used as a radiation source. This radiation source emits beta rays for longer time span (Half-life of 30.17 years) which decays to barium 137 and the metastable barium decays to ground state by emitting gamma rays for a very short time span (Half-life of 153 seconds).Beta rays are fast moving free electrons, these beta rays can be deflected by electric field and magnetic field. Beta particles emitted from any material have high velocities and the emitted particles do not have same velocities, which varies from 1% to 99 % that of velocity of light [4].

In this experiment specifically onions were used because of its high content of ascorbic acid [1]. Many studies also suggest that ascorbic acid acts as a Protective agent against harmful radiations [5][6][7].

2.1 Materials

a. Caesium 137

Caesium 137 is a radioactive element having a half-life of 30.17 years. This isotope of Caesium emits both Beta and gamma rays.

Table 1

Symbol	^{137} Cs
Protons	55
Neutrons	82
Half-life	30.17 years
Parent isotope	^{137}Xe(β^-)
Decay products	^{137m}Ba ^{137}Ba
Isotope mass	136.907μ
Spin	$7/2^+$

b. Red onion aqueous extract

In this experiment a pure red onion extract was used. It contains high amount of ascorbic acid which act as DNA protector from radiations [1]. Various studies had also proved that ascorbic acid act as a powerful barrier against harmful radiation, however the radio-protective effect of ascorbic acid completely depends on irradiation rate [2].In this investigation the onion was crushed and squeezed, and pure onion juice without any pulp was extracted for the experiment. However, after

the extraction of the onion juice, it is used within 12 hours for conducting the experiment.

Fig-1: Caesium-137

c. Geiger - Müller counter

GM counter was used for detection of alpha radiation, later various versions were introduced which could measure beta radiation and many other ionizing radiations. GM counter is a very good instrument for radiation detection because of its stable nature of operation [8]. And in this investigation the radiation source was not in high amount so GM counter was highly efficient for the experiment.

Fig- 2:GM Counter

2.2 Methodology

Initially the background readings were taken starting from 350v, 400v, 450v, 500v, 550v, 600v, 650v, 700v respectively; without keeping any source for a time period of 60 sec each. Then readings were taken by keeping the source i.e. Caesium 137 from 350v to 700v respectively for the time period of 60 sec. Red onion extract was used within 12 hours for the experiment; however it was not used directly. A pure cotton cloth having a thickness less than 1mm was utilized to absorb the red onion extract. Then again readings were taken at the same voltages for the time period of 60 sec by placing the cotton cloth (completely absorbed by onion extract and then squeezed) in between the measuring device and the radiation source and were not disturbed during the whole experiment. The distance between the measuring device and the radiation source was 3cm and was not changed during the experiment.

Fig-3: Cotton-cloth

Table 2

Sr. no	Voltage (V)	Time in (sec)	Background count without any source	Radiation count with the source	Radiation count when cotton cloth was kept in between		
1	350	60	22	833	410	438	382
2	400	60	25	846	468	442	421
3	450	60	25	866	439	435	448
4	500	60	21	886	419	452	457
5	550	60	15	898	427	484	439
6	600	60	16	960	454	500	525
7	650	60	32	1202	569	596	570
8	700	60	53	1744	916	973	843

3.1 Conversion from CPM to Becquerel.

In table 2 the readings are taken as count per minute. The following conversion shows how CPM is converted to Becquerel.

CPM = Count per minute.

DPM = Decay per minute.

Beta ray counting efficiency of GM counter is 100%,

And;

&, 1 Becquerel = **DPM/60**

Therefore,

1 Becquerel = DPS

Since, counting efficiency of GM counter is 100 percent for beta particles,

Counting efficiency = 100

Therefore,

% counting efficiency = 1 ------ (1)

&,

% counting efficiency = **CPM/DPM** ----- (2)

Therefore, from equation 1 & 2 we get

1 = **CPM/DPM**

Therefore,

CPM = DPM ------- (3)

&, 1 Becquerel = **DPM/60** ------ (4)

Therefore, from equation 3 & 4 we get the following equation.

1 Becquerel = $CPM/60$ ---- (5)

By using equation (5) reading has been concluded, which are elaborated in table 3.

Table 3

The below readings are in Becquerel (Bq).

Sr. no	Voltage (V)	Time in (sec)	Background count without any source (Bq)	Radiation count with the source (Bq)	Radiation count when cotton cloth was kept in between (Bq)			Average of all 3 readings (Bq)
1	350	60	0.366	13.880	6.830	7.300	6.366	6.832
2	400	60	0.416	14.100	7.800	7.366	7.016	7.394
3	450	60	0.416	14.430	7.316	7.250	7.466	7.344
4	500	60	0.350	14.760	6.980	7.533	7.616	7.376
5	550	60	0.250	14.960	7.110	8.066	7.316	7.497
6	600	60	0.266	16.000	7.560	8.330	8.750	8.203
7	650	60	0.533	20.030	9.480	9.930	9.500	9.636
8	700	60	0.883	29.060	15.26	16.216	14.05	15.175

Following graph represents comparison between before and after effect of cotton cloth & red onion extract.

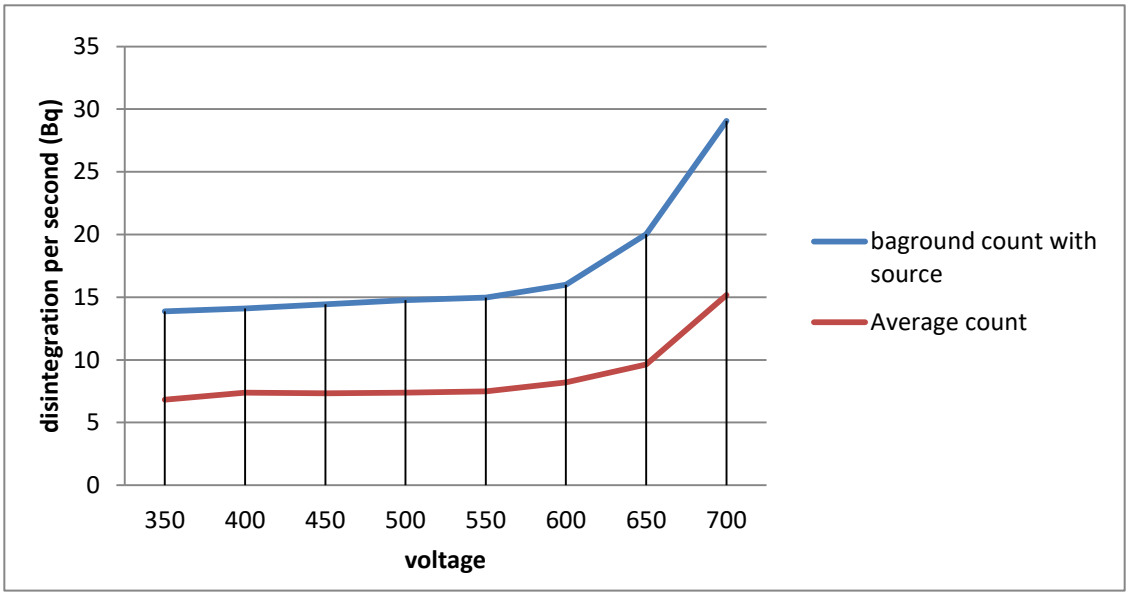

Chart-1: Comparison of before and after effect of onion extract

The above graph represents the comparison in between voltage verses disintegration per second, also it shows the before and after effect of red onion extract. In this the average count is the average of all the three readings taken when the cotton cloth was placed in between the source and the measuring device. Background count with Source is the count taken without any effect of red onion extract i.e. without placing the cotton cloth between the source and the measuring device. When we compare both the readings as per the Graph-1 we can clearly see that almost 50% of Beta-radiations were absorbed by the cotton cloth (Soaked in red onion extract), and the major role for the absorption of the radiation is played by the presence of ascorbic acid.

4. Conclusion

Hence, the results suggest that the presence of ascorbic acid in red onion aqueous extract act as radio-protector agent against harmful beta radiations. Various studies has also elaborated that the presence of ascorbic acid also helps as a protective agent against damage caused by the harmful gamma radiations.

Also, red onion aqueous extract can be used for radio-protection for minor experimental purposes specifically which may include low amount of radioactive source and any radioactive emissions, it may not reduce the complete impact of radiation but almost 50% of radiations may be reduce due the use of this aqueous extract.

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