Study the Characteristics, inverse square law and Application of Geiger-Miller Detector in Detection of Milk Purity in Samawa city

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Abstract:
Radiation is naturally present in our environment and exist since the birth of this planet. It comes from outer space (cosmic), the ground (terrestrial), and even from within our own bodies. In physics, the radiation defines as the emission or transmission of energy in the form of waves or particles through space or through a material medium. I have studied its characteristics, its operating region and some laws of radiation which will help us to know more about the counter. Not only we can study the characteristics of Geiger Muller tube but also we can use it in day to day life. In my present study I have studied the characteristics of Geiger Muller tube, Inverse square law and its application as detector in case of milk adulteration. I learned many scientific applications of the G. M. Counter. I tried to study the adulteration in milk in my city Samawa with the help of G. M. Counter. If we generalize the G M Counter and procedure we can detect adulteration in other liquids such as oils, fuels etc.

Keywords: Detecting Radiation, Geiger Muller Instrument, Non-ionizing radiation, Ionizing radiation, Nuclear detectors.

1.0 INTRODUCTION:

In material science, the radiation characterizes as the outflow or transmission of energy as waves or particles through space or through a material medium. It can be created in one of two different ways: by radioactive rot of a shaky iota (radioisotope), or by the connection of a molecule with issue [1]. Radiation is depicted by its sort and energy which are non-ionizing and ionizing radiation relying upon its capacity to ionize matter (Figure 1) [2]. These variables are the direct ionizing radiation relates to the energy testimony in the material by vigorous charged molecule which have Coulomb association with an orbital electron of an objective particle and Indirect ionizing radiation is acknowledged in two stages. To begin with, quick charged particles (electrons and positrons) are delivered in the material because of the photon energy testimony or because of dynamic energy affidavit by neutrons, protons or heavier particles. Second, the delivered charged particles store their energy directly in the material through Coulomb connections between these particles and orbital electrons of a molecule [3].
Non-ionizing radiation has less energy than ionizing radiation; it doesn't have enough energy to deliver particles (to eliminate electrons from iota). Instances of nonionizing radiation is noticeable light, infrared, radio waves, microwaves, and daylight. These are characterized as Extremely Low-recurrence (ELF) waves and are not considered to represent a wellbeing hazard [3].

Ionizing radiation is fit for taking electrons out of their circles around particles, upsetting the electron/proton parity and giving the iota a positive charge. Electrically chargedmolecules and particles are called particles. Ionizing radiation incorporates the radiation that comesfrom both regular and man-made radioactive materials [3].

2.0 Radioactivity:

Radioactivity is the cycle of the unconstrained rot and change of insecure nuclear cores went with the outflow of atomic particles as well as electromagnetic radiation (additionally alluded to as atomic radiation). The parts in this book center around the beginnings and properties of different sorts of atomic radiation and an authentic record of their discovery. In light of the essential idea of the topic in this book, the author felt the needto profit of the prologue to elucidate quickly on the tranquil uses of radioactivity and its properties whereupon we depend sincerely. This presentation will give an exceptionally concise sketch of just a not many instances of uses of radioactivity that improve and advance our lives[6].

3.0 Geiger Muller Instrument:

It was basically a restricted, meager walled metal cylinder with a fine directing wire situated coaxially (Figure 2), where the entire is so orchestrated and encased that lowpressure conditions can relate. A capability of around! 200 V is applied, with the chamber working as
the cathode and the focal wire as the anode. The contacts at AA' are associated with an appropriate electronic enhancer and register. After a grandiose beam or other ionizing radiation goes through the slight metal divider and delivers at least one electrons by ionizing the thin vaporous environment inside the cylinder, these (essential) electrons thusly discharge some more (auxiliary) electrons as they ionize further vaporous particles in their trip to the focal wire. As the electron torrential slide moves toward the anode, always certain particles are delivered close to the focal point of the cylinder shaping a decidedly charged sheath that floats outward to the mass of the chamber around multiple times more gradually than the electrons fly to the anode. At the point when this positive space-charge begins to extend outswards, it changes the conditions precisely as though the distance across of the emphatically charged wire had been expanded. 4 The electric field is consequently diminished adequately to smother the gas release, and the subsequent voltage venture at AA’ is a record of the first beam. When the positive particles arrive at the divider and are killed, a cycle that takes around 10 - 4 seconds, the counter has recouped to get and record another ray[7].

![Figure (2) Geiger Muller[7].](image)

The exemplary plan comprises of a metal cylinder, the Geiger Mueller or GM tube, typically with a glass or mica window toward one side, through which particles enter the gadget. Through the focal point of the cylinder runs a metal wire with a solid positive charge. This fixed cylinder is filled at low weight with a dormant gas, for example, argon[7].

4.0 Main features of a GEIGER-MULLER counter:

- Constant output pulse size, independent of initial ionization.
- A long intensive time to allow entry of each particle. The insensitive time is usually made definite by decreasing the applied voltage with the help of suitable design of external electrical circuit; it is then called the ‘Paralysis Time’.
- Sensitive to the production of even a single ion pair.
• Ability to detect V and other cosmic rays[7].

5.0 General Information of G. M. Tubes:

• G. M. counter cylinders are proposed to identify alpha particles, beta particles, gamma or X-radiation.

• A G. M. Cylinder is gas filled gadget which responds to individual ionizing occasions, along these lines empowering them to be tallied.

• G. M. tube comprise of fundamentally a terminal at a positive potential (anode) encompassed by a metal chamber at a negative potential (cathode). The cathode frames part of the envelope or is encased in a glass envelope. Ionizing occasions are started by quanta or particles entering the cylinder either through the window or through the cathode and slamming into the gas atoms.

• The gas filling comprise of a blend of at least one uncommon gases and an extinguishing operator.

• Quenching is the end of the ionization current heartbeat in a G. M. tube.

• Effective extinguishing in our cylinder is controlled by the blend f the extinguishing gas properties and the estimation of the anode resistor[7].

6.0 Nuclear detectors:

The atomic indicators are the instruments which recognizes radiations and atomic particles, for example, alpha, beta and gamma particles. There are various sorts of indicators. The indicators, for example, ionization chamber and G-M counters use gas, for example, Argon for ionization by these radiations. Thusly, they are called Gas-Filled counters. A strong material, for example, semiconductor or sodium iodide is utilized in counters. These counters are called Solid-state counters. The sparkle counter is a strong state counter in which photons are delivered in the shine gem like sodium iodide when alpha particles are encroached on it. Here are some detectors[8].

7.0 MATERIALS AND METHODS:

7.1 Experiment for Study Characteristic of a G. M. Tube:

Aim – To Study the variation of contrite with applied voltage and thereby determine the plateau, he operating voltage and the slope of the plateau.
Equipment – G. M. Counting system

Procedure –

- I made the connections between counting system to G. M. Detector.
- Placed gamma source facing the end window of the detector, in the source holder of G. M. stand at 2 cm for gamma source.
- Then I start the instrument and set the present time at 30 sec.
  Now for the voltage 300 I took the reading. I done the same procedure for diff voltages.

Table 1, Study of the Characteristics of G. M. Counter Readings for gamma source:

| Sr No. | Voltage (V) | Counts N | Background Counts, Nb | Corrected count \(N_c = N - Nb\) |
|--------|-------------|----------|-----------------------|----------------------------------|
| 1      | 300         | 183      | 14                    | 165                              |
| 2      | 330         | 176      | 10                    | 166                              |
| 3      | 360         | 174      | 13                    | 161                              |
| 4      | 390         | 164      | 9                     | 164                              |
| 5      | 420         | 170      | 10                    | 169                              |
| 6      | 450         | 199      | 7                     | 180                              |
| 7      | 480         | 201      | 9                     | 180                              |
| 8      | 510         | 179      | 4                     | 178                              |
| 9      | 540         | 209      | 9                     | 195                              |
| 10     | 570         | 216      | 8                     | 205                              |
| 11     | 600         | 247      | 14                    | 233                              |
| 12     | 630         | 318      | 7                     | 311                              |
figure 3. Relation between count and voltage (Characteristics Geiger Muller)

7.2 Study of Application of G M Counter as Milk Adulteration Detector in Samawa city:

Source = CS (Gamma Source)
Present Time (t) = 30 sec.
Source Distance = 3.5 cm
Milk Container Distance = 2 cm
Adulteration = Starch

Table 2, Study of Application of G M Counter as Milk Adulteration Detector in Samawa city:

| S. No. | Adulteration (%) | Background Count (Nb) | Count (N) | Corrected Count |
|-------|------------------|-----------------------|-----------|-----------------|
| 1     | 0                | 5                     | 151       | 146             |
| 2     | 1                | 5                     | 148       | 143             |
| 3     | 2                | 5                     | 154       | 149             |
| 4     | 3                | 5                     | 143       | 138             |
| 5     | 4                | 7                     | 151       | 144             |
| 6     | 5                | 8                     | 160       | 152             |
| 7     | 10               | 9                     | 148       | 139             |
| 8     | 15               | 8                     | 163       | 155             |
| 9     | 20               | 6                     | 146       | 140             |
7.3 Study of the inverse square law:

Observations – source gamma source Cs

Present time = 60 sec
Working voltage = 436V
Background count = 11

Table 3, Study of the inverse square law:

| Sr no | distance | counts N | net count R=N/60 | product C=R*d² |
|-------|----------|----------|-----------------|---------------|
| 1     | 2        | 3607     | 60.12           | 240.47        |
| 2     | 2.5      | 2357     | 39.28           | 245.52        |
| 3     | 3        | 1615     | 26.92           | 242.25        |
| 4     | 3.5      | 1210     | 20.17           | 247.04        |
| 5     | 4        | 921      | 15.35           | 245.60        |
| 6     | 4.5      | 732      | 12.20           | 247.05        |
| 7     | 5        | 601      | 10.02           | 250.42        |
| 8     | 5.5      | 470      | 7.83            | 236.96        |
| 9     | 6        | 438      | 7.30            | 262.80        |
8.0 Results and Conclusion:

- I got level between voltages 300 V and 540 V.
- From the principal try I found that working voltage of G M Counter is 436 V.
- From the second test I got all around characterized chart, henceforth the backwards square law of radiation is fulfilled and mean result of the net rate and separation square is 243.
- Third try demonstrated that tallies through corrupted milk are not quite the same as that of unadulterated milk 15% starch contained milk. Include changes in the range +8 to -8 from the tallies of that of unadulterated milk's check.
- From my perception I found that G M Counter is a decent instrument for identifying radiation. It could be utilized for different purposes. It is utilized in disease therapy for distinguishing phase of malignancy, additionally utilized in different enterprises.
- I examined backwards square laws. The backwards Square Law is very satisfying. I discovered that cheating is in the city of Samawa, where there are a few organizations or a few manufacturing plants where there is a level of water in the milk, and I might want to deal with the equivalent in future. In the event that we sum up the technique, we can identify debasement in various fluids like oils, fills and so on.

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