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Determination of Adulteration in Milk Samples by using Geiger Muller Counter

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Abstract: The present research focuses on the adulteration in milk, samples of fresh cow milk; sealed cow milk and milk powder have been collected to this study .The adulteration made by using water and urea as adulterant substances milk collected to detect the various milk adulterants, Geiger Muller have been used to determine the adulteration. The result showed that change in count when water or urea or milk powder is added in milk. By conclusion, the GM counter can be used for the detection of adulteration in milk.

Key words: Milk, adulteration, Geiger Muller, urea, adulteration, determine

INTRODUCTION

Milk is an essential commodity and the most perfect food for daily life (Gahlawat *et al*., 2012; Kartheek *et al*., 2011). It is a source of calcium, protein minerals, carbohydrates, fat and vitamins (Nirwal *et al*., 2013; Ayub *et al*., 2007) .The quality of food and milk is so, important but some antisocial elements have been adding some adulterant is like urea, starch, ammonium, sulphate, salt, water and milk powder to increase their profit margin, volume and viscosity of milk (Soomro *et al*., 2014). Various preservatives like some antibiotic and formalin are also added in milk to increase shelf life (Afzal *et al*., 2011). These adulterants decrease the nutritive value of milk and causing very serious health related problems (Gupta and Gupta, 2008). Adulterated food is dangerous for human health as it may contain various chemicals. There are many ways to determine the adulation in milk, the use of interaction between radiation with materials of common and industrial uses (Udagani and Ramesh, 2014). The diffusion and penetration of gamma rays in the external medium is necessary for a scientific study of interaction of radiation with matter for various applications in science, agriculture, technology and human health (Chaudhari and Girase, 2013). This study was subjected to investigate the adulteration of milk by using Geiger Muller counter GM.

MATERIALS AND METHODS

A/milk samples: Samples of fresh cow milk, sealed cow milk and milk powder have been collected to this study, the adulteration made by using water and urea as adulterant substances milk collected to detect the various milk adulterants B/G M Counter and radioactive source Caesium 137 (Cs 137) have been used to study the adulteration of milk.

RESULTS AND DISCUSSION

A/operating voltage of GM: Analysis and computations estimated from the tabulated readings (Fig. 1-3). V1 = Starting voltage of plateau = 360 V, V2 = Upper threshold of the plateau = 570 V. Plateau length = V2-V1 = (570-360) = 210 V. Operating voltage:

$$V0 = (V2+V1)/0.5 = (364+604)/2 = 484\,V$$

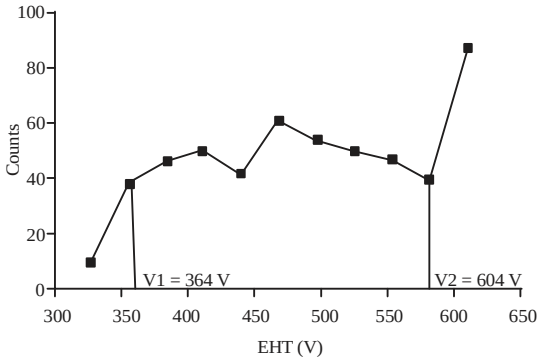

Fig. 1: Plot of counts vs. EHT (Counts 30 sec)

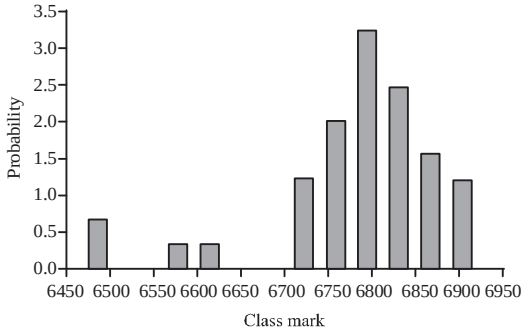

Fig. 2: Histogram of the submitted samples (Probability)

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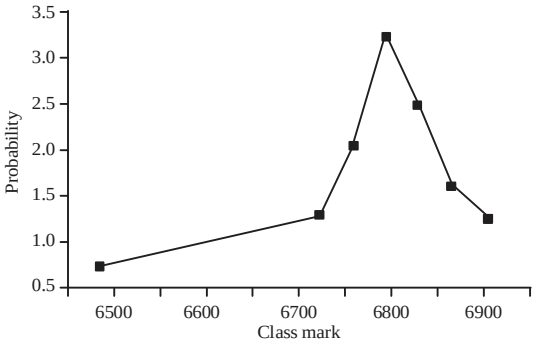

Fig. 3: Gaussian distribution curve of the submitted samples (Probability)

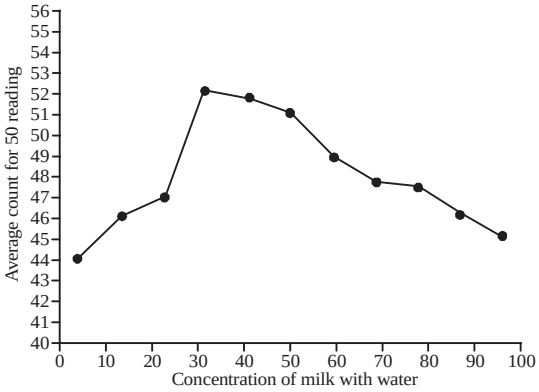

Fig. 4: Average count for different percentage of milk (B counts for different concentrations of water and milk)

The slope of the plateau is given by slope:

$$(\text{Percentage}) = ((\text{N2-N1})/\text{N1})\times (100/(\text{V2-V1}))\times$$

$$100 = ((33\text{-}21)/21\times(100/210)\times 100 = 27.20\%$$

Where:

N1 and N2 : Are the count rates at the lower and the upper limits of the plateau

V1 and V2 : Are the corresponding voltage (Fig. 4)

To study the statistical decay nature of radioactive substance by using GM tube: Eqution:

$$\overline{N} = \frac{\sum_i N_i F_i}{\sum F_i}$$

$$\sigma = \sqrt{\frac{\sum_i \left(N_i - \overline{N}\right)^2 F_i}{\sum F_i - 1}}$$

Parameters used:

V_A : Cathode-anode voltage in GM tube

t_p : paralysis time of the counter

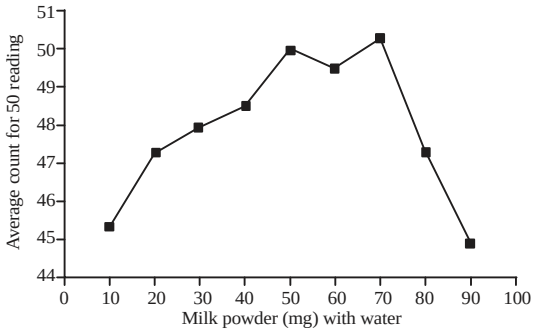

Fig. 5: Average count for different percentage of milk powder with water (Average for 50 count)

Variables used:

T : Chose time interval

N : Observed count in Time T

Nb : No.of background counts in Time T

No. : N-Nb

Nc : Corrected No. of counts in Time T

Nc : $(N_0/I\text{-}Btp)$

Where:

B : Average No. of particles emitted in Time T

N : Total No. of readings

N : Mean No. of count s in Time T for all reading

N : (N1+N2+N3+----------Nn)/n

Ni : Mean of ith class interval

6 : Standards deviation

A : Area of the histogram = n×N = Total No. reading x class interval

Gaussian function: GM counter is used to count the radiation emitting from radioactive source. If any other materials come in between source and detector, then the number of count changes (Fig. 5). When any other material is added in different concentrations of milk and is placed between source and detector then following observations is noticed Fig. 6. When water is added in the milk, then the number of count absorbed by milk reduces and hence, No. of count received by the detector are more up to 30% adulteration of milk, then it shows decline trend Fig. 7. At 30% No. of counts are saturated but if we add water in the milk powder, the maximum counts received by the detector at 50 and 70% of the adulteration this is because of water in the milk powder. In case of urea added with fresh milk, initially the No. of count detected by the detector shows decline trend and No. of count will be maximum at 60% of adulteration. In case of milk in pouch, maximum count at 40% of adulteration.

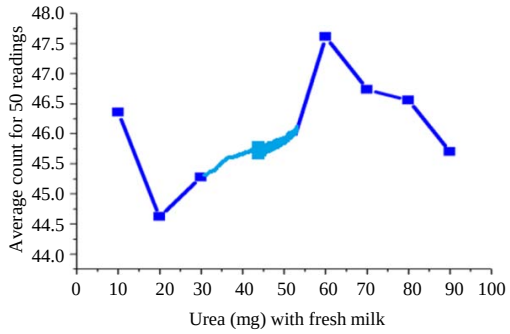

Fig. 6: Average count for different percentage of urea with fresh milk (Average count for 50 readings)

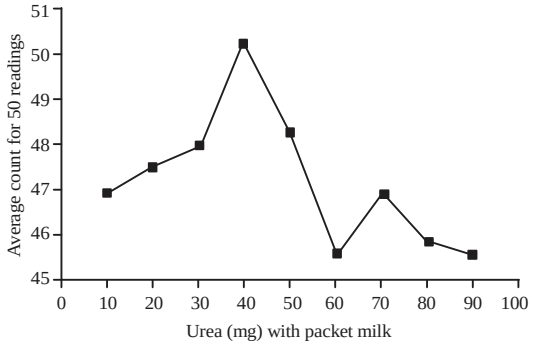

Fig. 7: Average count for different percentage of urea with sealed cow milk (Average count for 50 readings)

CONCLUSION

This indicates that as water or urea or milk powder is added in the milk, there are changes in counts by the detector. These observations are preliminary test, therefore, GM counter can be used for the detection of adulteration in milk.

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