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Graphical presentation of attenuation coefficient of different concentration of urea added, in cow's milk samples using energy source CO 60.

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Abstract :

Milk is source of minerals. Milk is an excellent source of calcium and phosphorus. Cow milk content three times calcium than that of wheat and four times than the human milk. So for healthy nation, we need quality of food & milk. But some antisocial elements have been adding some adulterants like water, urea, lactose powder etc. in milk sample. The linear and mass attenuation coefficient plays an important role in agricultural dairy, food technology, science & technology, medicines and forensics etc. In the present work, we measured the linear and mass attenuation coefficient of adulterate milk sample with lactose powder by using gamma source CO^{60} at energies 1.17 MeV and 1.33MeV. The experimental values are in good arrangement and then validate absorption the law.

The results are represented in graphical forms. The experimental values are in good an agreement which validates the gamma absorption law.

Keyword : Linear and mass attenuation coefficient, Scintillation counter, NaI (Tl) detector, gamma sources etc.

Introduction:

The study of interaction of gamma radiations with the materials of common and industrial use, as well as of biological and commercial importance has become major area of interest in the field of radiation science. For a scientific study of interaction of radiation with matter a proper characterization and assessment of penetration and diffusion of gamma rays in the external medium is necessary. The mass attenuation coefficient usually depends upon the energy of radiations and nature of the material. For characterization the penetration and diffusion of gamma radiation in any medium, the roll of attenuation coefficient is very important.

An extensive data on mass attenuation coefficients of gamma rays in compound and mixtures of dosimetric interest have been studied by[1] in the energy range of 1 keV to 20 MeV. An updated version of attenuation coefficients for elements having atomic number from 1-92 and for 48 additional substances have been compiled by other scientists[3-7]. The reports on attenuation coefficients measured by researchers reported [8-24] for different energies for various samples in solid as well as liquid.

In view of the importance of the study of gamma attenuation properties of materials and its various applications in science, technology, agriculture and human health , we have embarked on a study of the absorption properties of buffalo milk sample contains mixture of microelements.

The absorption coefficient of milk is dependent on its content and gamma- ray energy. This work describes a study of content dependence on measurements of attenuation of gamma-radiation at gamma-ray energy 1170 and 1330 keV of mixture of milk and urea samples .

The attenuation of gamma rays expressed as:

$$I = I_o \exp(-\mu x) \qquad \text{........... (1)}$$

Where I_o is the number of particles of radiation counted during a certain time duration without any absorber, I is the number counted during the same time with a thickness *x* of absorber between the source of radiation and the detector, and μ is the linear absorption coefficient. This equation may be cast into the linear form,

$$\log I = \log I_o - \mu x$$

$$\text{i.e.} \quad \mu x = \log (I_o / I)$$

$$\text{i.e.} \ \mu = (1/x) \log(I_o/I) \qquad \text{.......... (2)}$$

The mass absorption coefficient of milk μ_m defined as,

$$\mu = \mu/\rho \qquad \text{............ (3)}$$

Where, μ_m is the mass attenuation coefficient and ρ is the density of sample.

The unit of μ is cm^{-1} and that of μ_m is cm^2/gm.

Materials and Method:

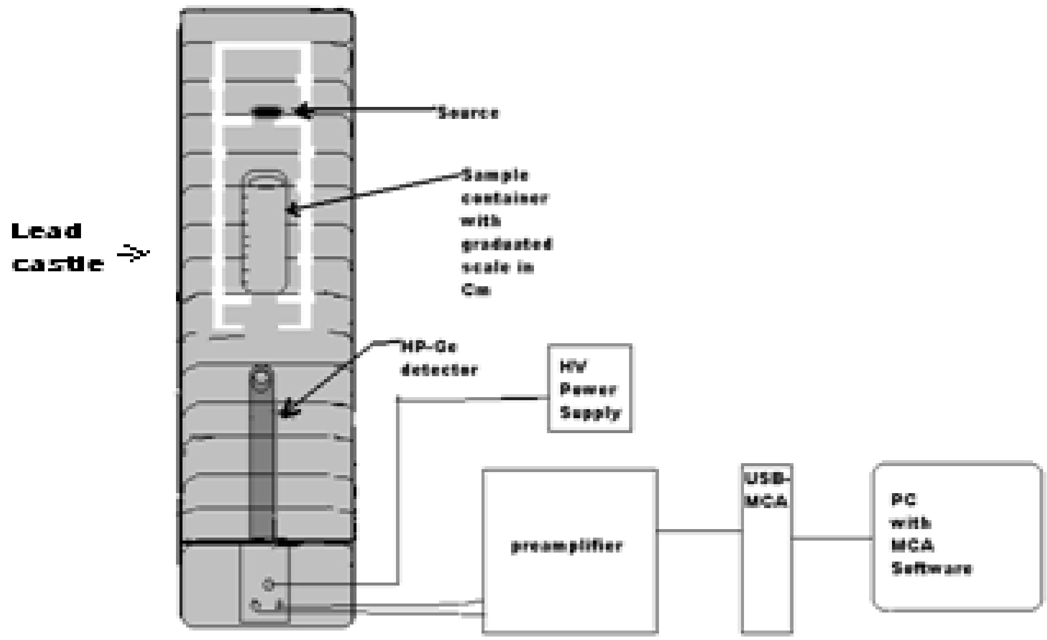
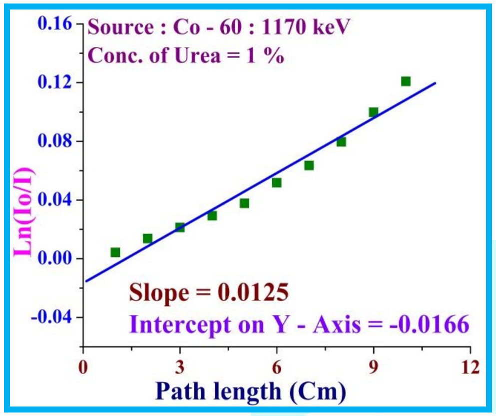
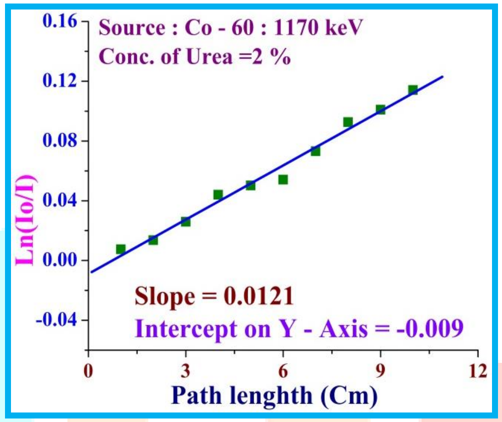


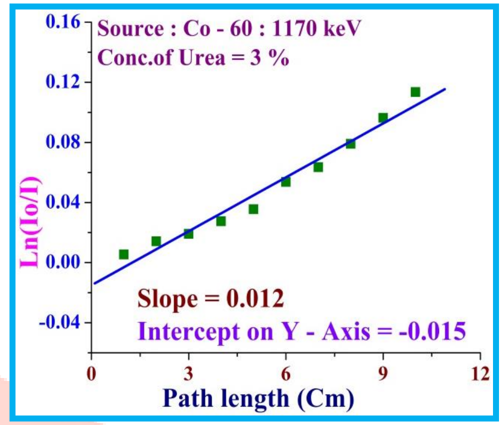
Fig.1: Front view of the experimental set up

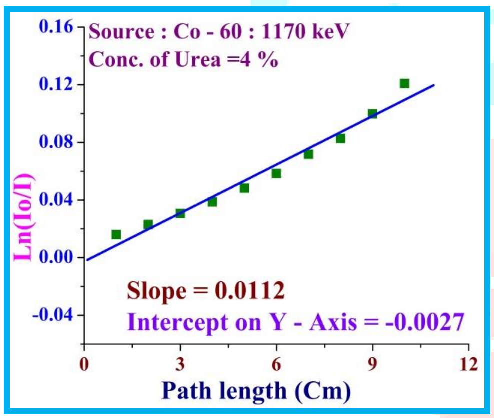
The experimental arrangement is as shown in Figure II. A cylindrical glass container of internal diameter 2.9 cm placed in between detector and sources. The collimated beam of gamma source and cylinder kept in a stand .The assembly was placed in lead castle. The distance between detector and source was 18.3 cm. The transmitted and scattered gamma rays were detected using USB-MCA along with external NaI (Tl) detector. First, the cylinder was kept empty keeping acquisition time 600 sec and readings were taken for gamma rays of a particular energy and noted as I_o. Thereafter, the path length(x) of milk sample varies by path length 1 to 10 cm respectively and readings were taken as I. Same procedure used for each samples with concentrations by adding water in the milk and prepared for 10% ,20%, 30%,……..100%. The NaI (Tl) crystal was used as detector in conjunction with counter circuits. The whole system enclosed in a lead castle. Experimental values of number of particles of radiation without absorber (I_o) per number of particles of radiation counted with absorber (I) were linearly increased with increasing path length in cm as shown in graphs. The slope of the graphs gives the value of the linear absorption coefficient.

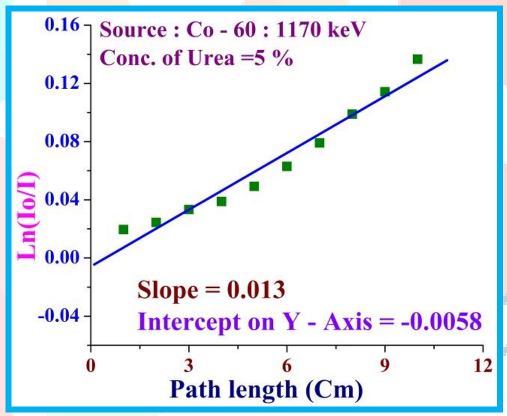
Result And Discussion

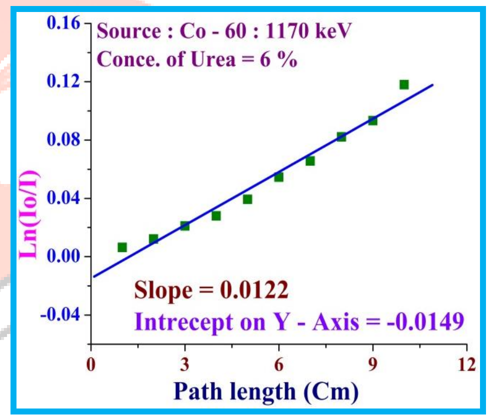


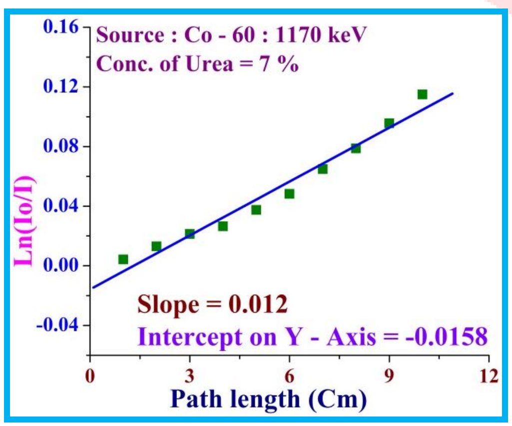


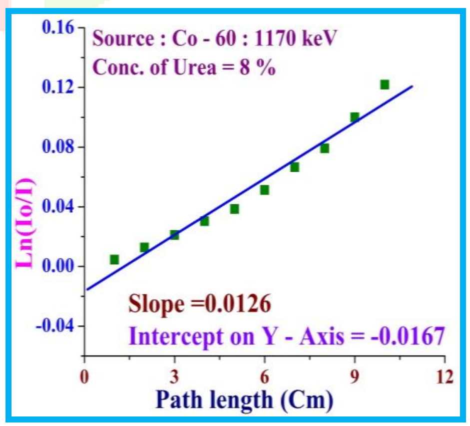


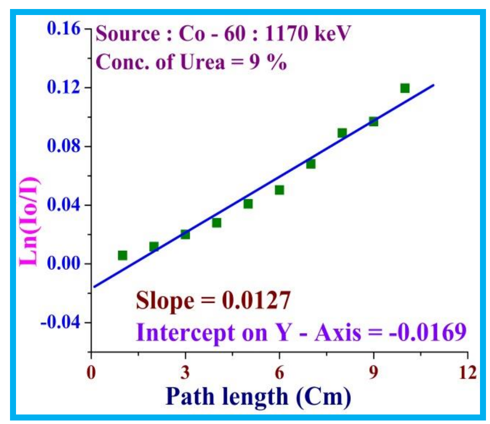


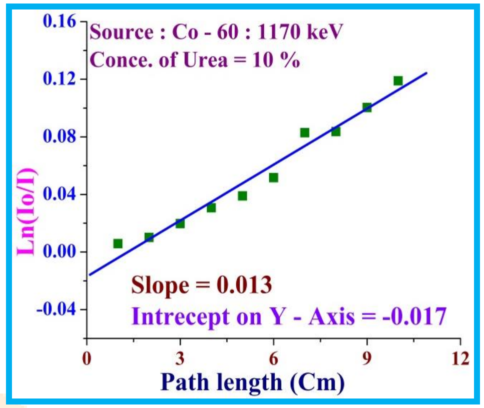


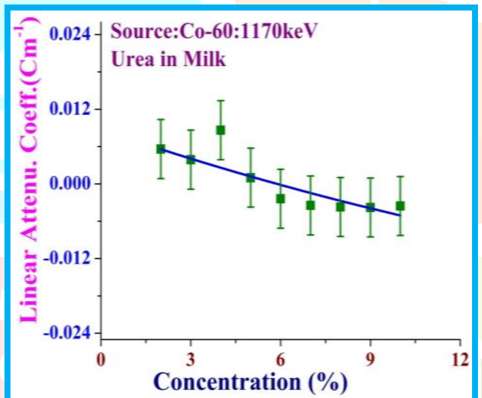


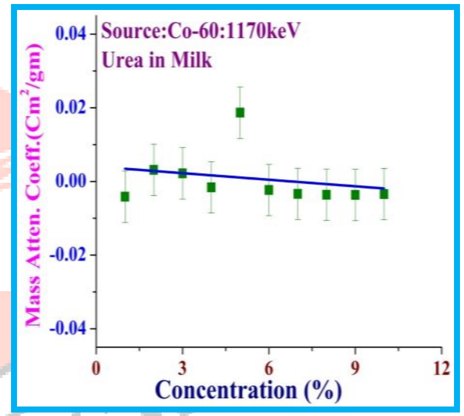


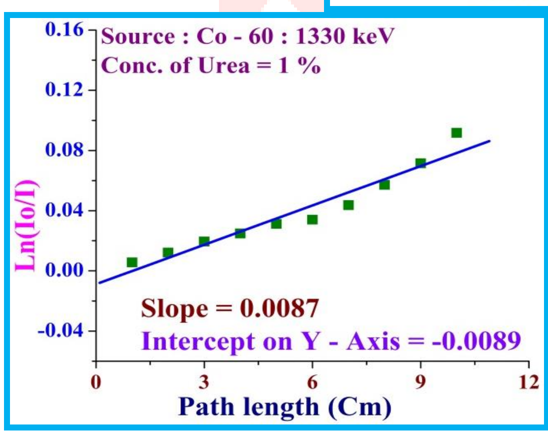


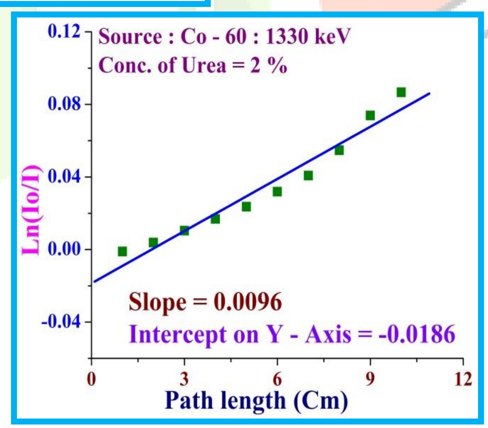


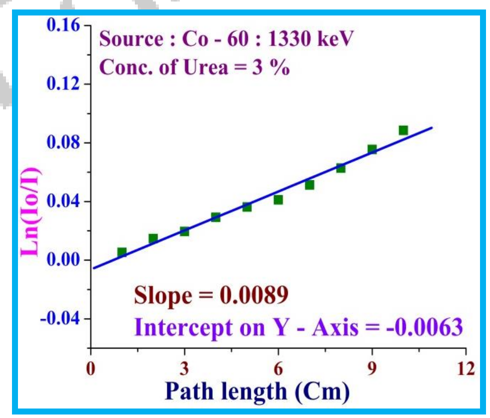

Source : Co - 60 : 1170 keV
Conce. of Urea = 10 %
Ln(Io/I)
Slope = 0.013
Intrecept on Y - Axis = -0.017
Path length (Cm)

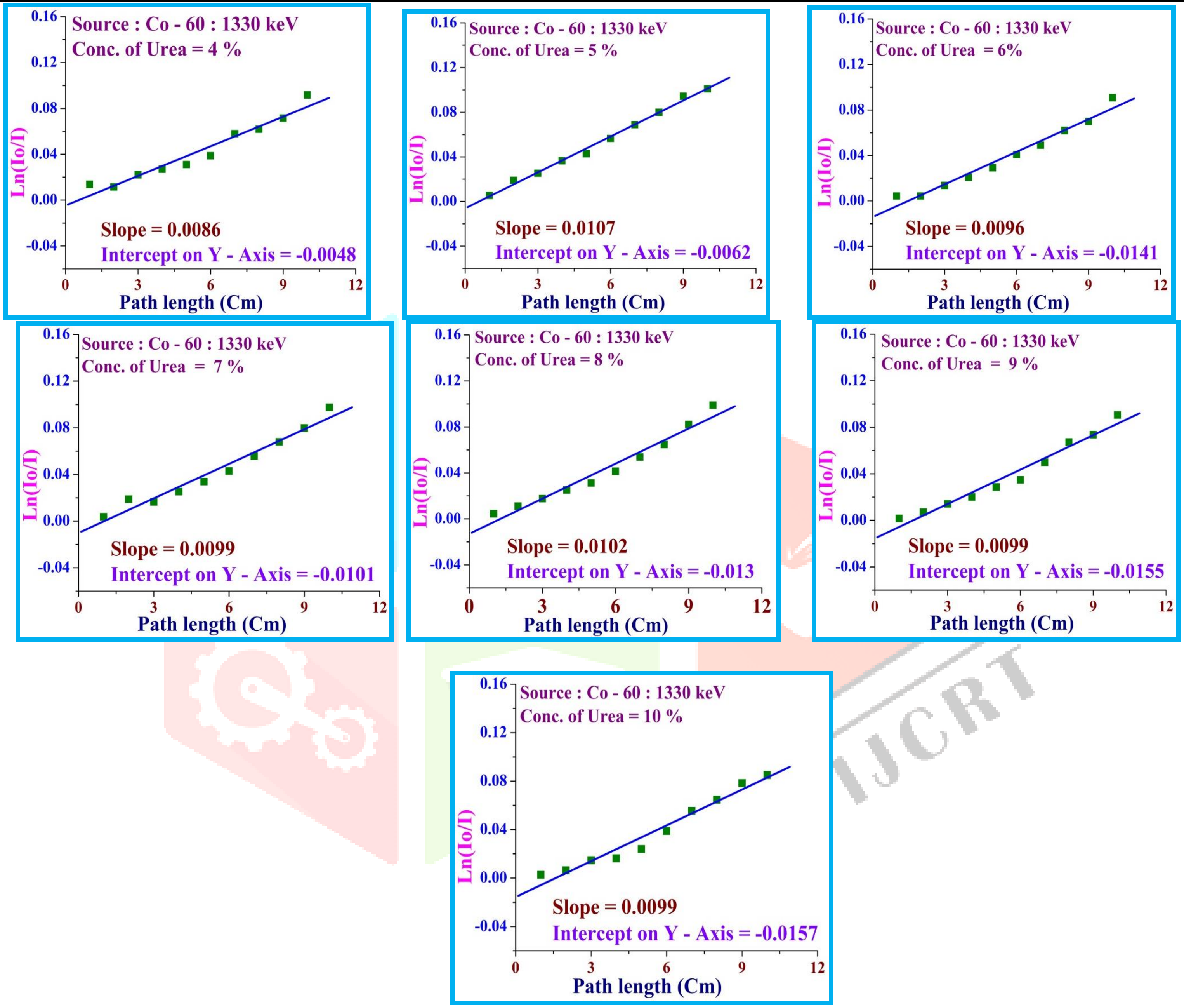

Source:Co-60:1170keV
Urea in Milk
Linear Attenu. Coeff.(Cm-1)
Concentration (%)

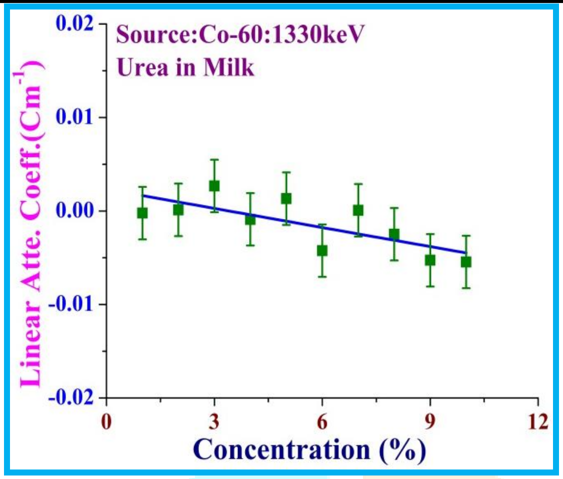

Source:Co-60:1170keV
Urea in Milk
Mass Atten. Coeff.(Cm2/gm)
Concentration (%)

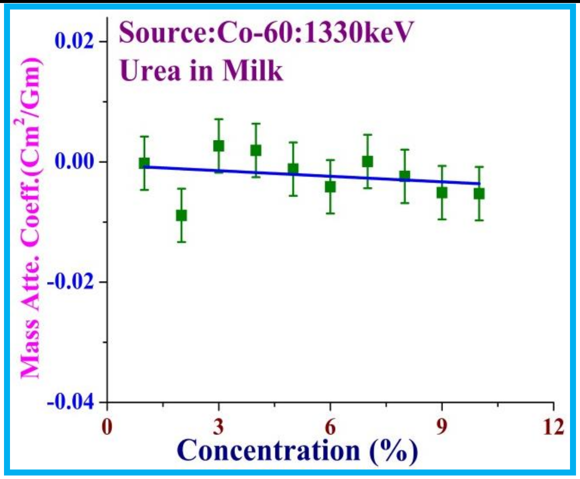

Source : Co - 60 : 1330 keV
Conc. of Urea = 1 %
Ln(Io/I)
Slope = 0.0087
Intercept on Y - Axis = -0.0089
Path length (Cm)


Source : Co - 60 : 1330 keV
Conc. of Urea = 2 %
Ln(Io/I)
Slope = 0.0096
Intercept on Y - Axis = -0.0186
Path length (Cm)


Source : Co - 60 : 1330 keV
Conc. of Urea = 3 %
Ln(Io/I)
Slope = 0.0089
Intercept on Y - Axis = -0.0063
Path length (Cm)


Source : Co - 60 : 1330 keV
Conc. of Urea = 4 %
Slope = 0.0086
Intercept on Y - Axis = -0.0048
Source : Co - 60 : 1330 keV
Conc. of Urea = 5 %
Slope = 0.0107
Intercept on Y - Axis = -0.0062
Source : Co - 60 : 1330 keV
Conc. of Urea = 6%
Slope = 0.0096
Intercept on Y - Axis = -0.0141
Source : Co - 60 : 1330 keV
Conc. of Urea = 7 %
Slope = 0.0099
Intercept on Y - Axis = -0.0101
Source : Co - 60 : 1330 keV
Conc. of Urea = 8 %
Slope = 0.0102
Intercept on Y - Axis = -0.013
Source : Co - 60 : 1330 keV
Conc. of Urea = 9 %
Slope = 0.0099
Intercept on Y - Axis = -0.0155
Source : Co - 60 : 1330 keV
Conc. of Urea = 10 %
Slope = 0.0099
Intercept on Y - Axis = -0.0157
Ln(Io/I)
Path length (Cm)





Conclusion:

We studied the linear and mass attenuation coefficient of cow's milk sample with different concentrations urea adding and milk at the gamma ray energies 1170 and 1330 with narrowed beam. The result shows that as concentration of milk and urea sample increases, mass attenuation coefficient decreases. Gamma dissociation law is valid for the milk sample. The other research work is in progress.

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