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ATTENUATION COEFFICIENT OF CANE SUGAR OF MILK SAMPLES USING GAMMA SOURCE

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Abstract

Attenuation coefficient is very important parameter in forensic science, industry, agriculture, defence etc. The attenuation coefficient of milk samples with cane sugar using different concentration at gamma ray energy 122 keV studied. The results are good agreement and valid absorption law.

Key words: *Gamma source, Cane sugar, milk, gamma ray spectrometer, NaI detector.*

INTRODUCTION

The knowledge 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.

The reports on attenuation coefficients measured by researcher's reported[1-18] 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 cane sugar in milk samples.

The absorption of gamma rays is expressed as:

$$N=N_o \exp(-\mu x) \quad (1)$$

Where N_o is the number of particles of radiation counted during a certain time duration without any absorber, N 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.

The mass absorption coefficient of milk, μ_m defined as,

$$\mu_m = \mu/\rho \qquad (2)$$

Where, μ_m is the mass absorption coefficient and ρ is the density of milk sample. The unit of μ is cm^{-1} and that of μ_m is cm^2/g.

Experimental arrangement:

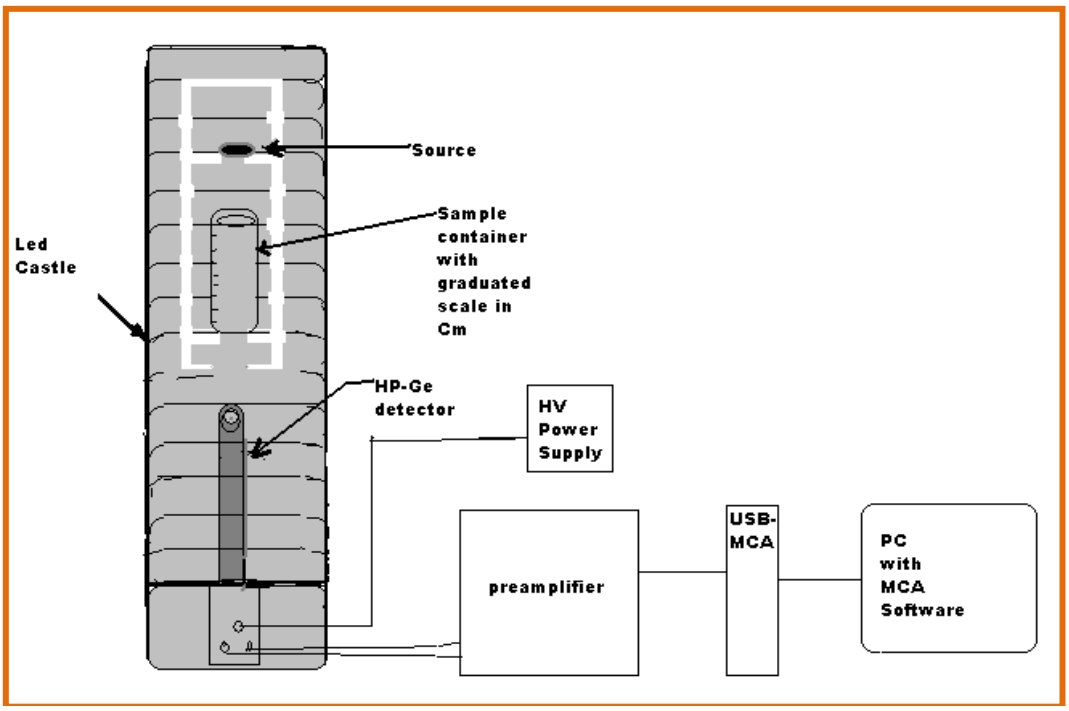


Figure - 1: Experimental Set up

Method and Observation:

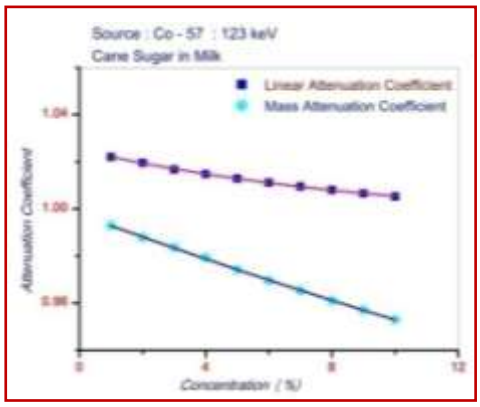
A cylindrical glass container for cane sugar with milk sample of internal diameter 2.9 cm placed in between detector and source as shown in Figure-1. The path length of milk sample for gamma ray transmission is x = 10 cm with suitable narrow beam arrangement. The sample (cylinder) is kept in a stand between source and detector.

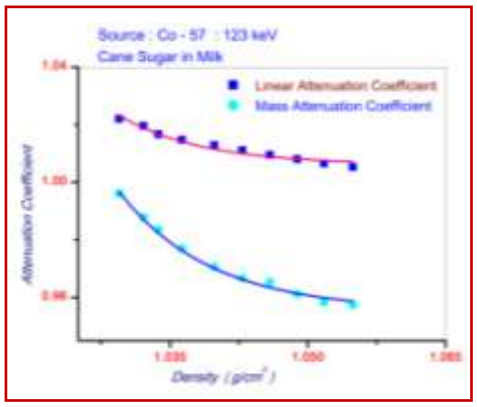
The assembly was placed in lead castle. The distance between source Co-57 and detectors NaI (Tl) is 18.3 cm. The transmitted and scattered gamma rays were detected using USB-MCA along with external NaI (Tl) detector. First, the cylinder was kept empty keeping acquisition time 1000 sec and readings were taken for gamma rays of a particular energy and noted as N_0. Thereafter, the path length(x) of milk sample varies by length 1 cm up to 10 cm and readings taken as N. The same procedure used for each samples with various concentrations by adding lactose and urea in the milk and prepared for 1%, 2%, 3%, 4% up to 10%.

Observations : Experimental measured values of linear & mass attenuation coefficient of milk sample of cane sugar using energy source Co – 57 as shown in the following table.

Concentration %	Density (ρ)	Linear Attenuation Coefficient μ	Mass Attenuation Coefficient $\mu_m = \mu/\rho$
1	1.02945	1.0220991	0.992859
2	1.0321	1.0195885	0.987878
3	1.03371	1.0167158	0.98356
4	1.03628	1.0147959	0.979268
5	1.0398	1.0129263	0.974155
6	1.04285	1.0111354	0.969589
7	1.04586	1.0095462	0.965279
8	1.04884	1.0080613	0.96112
9	1.05175	1.0065753	0.957048
10	1.0549	1.0053144	0.952995

Results: The experimental values of linear and mass attenuation coefficient V/s. concentration and. Density at an energy 123 keV using gamma source Co^{57} as shown in following figures.





Conclusion : The linear and mass attenuation coefficients are studied. The solution of sane sugar of milk samples valid absorption law. This method is useful to detect the adulteration. The other work is in progress.

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