

Natural Radioactivity In Food Stuff

A.M.AL-Jumaily ,K.Abdul Jabar
Department of Physics ,College of Education ,Ibn-ALHaitham
University of Baghdad

Abstract

The purpose of this research is to study the natural radioisotopes in different Iraqi food as well as various fission products emitted during nuclear accidents worldwide.

This work investigated different food stuffs like flour , rice,sugar,salt ,dates,okras, lentil , cauliflowers and broadbeans.The detection system used in this study employes Ge(Li)detector connected to a multi-channel analyser.The radioactivity concentration in measured samples has been estimated .Traces of radioisotopes such as (K,Th,CS, U) potasium,Thorium, Cesium and Uranium have been found .

Introduction

Most of the food consumed by human beings is grown on land and except for elements like carbon and oxygen which may be obtained from the atmosphere, it is the soil that nourishes the terrestrial ecosystem that supplies human food .

Radionuclides such as Po^{210} and Ra^{226} that occur naturally in soil are incorporated metabolically into plants and ultimately find their way into food and water .

Artificial radionuclides behave in a similar manner and worldwide contamination of the food chains by radionuclides produced during tests of nuclear weapons in the atmosphere has taken place during the past 40 years .

The measurment of long lived Cs-137 was made for these food samples because this nuclide is well absorbed in surface layer of the soil and can be used as a good measure for the evaluation of the fall out accumulation .Gamma spectrometric of the food samples has indicated the presence of low activitily concentrate of Cs-137 which could have come from soil contaminated with fission products.

Studies of radionuclides in food may assist in predicting the possible exposure levels and doses to the population , it also can be

used as an indication of high radioactivity in the environment such as might be experienced during accidental releases.

Experimental work

Sampling: Different food samples such as (flour, rice, sugar, salt, lentil, broodbeans , dates, cauliflower and okras)have been collected from various sources of origin, some of these samples have been dried (okras , cauliflowers)and crashed before the preparation procedure for measurements .One kg of each sample was used for measurements using marneilli beaker technique .

Measuring System: The detector system consists of Ge (Li)detector shielded with lead to reduce the radiation back-ground . The detector is connected to multichannel analyzer with 4096 channel as shown in Fig (1) Calibration of the detection system: Eleven standard radioactive sources (Amersham) of known energy and activities have been used .

The gamma spectral lines cover energies in the range from 0.088 MeV to 1.836 MeV . Each measurment was taken for one hour to determine the measuring systems efficiency. Fig (2) shows the calculated efficiency values versus energy.

Samples Measurment :Concentration measurment of radioactivity in food sample needs special geometry arrangment. (Marenilli. Beaker) geometry has been used for the determination of gamma emitters such as the natural radioisotope potassium-40-. The measurment of this isotope was taken at the energy line (1460keV) .The measurement of Cs-137 which is a fission product was taken at the energy line 662 keV.Measurments of (Th – 232) was done by searching for its daughter (Ti208) for energy 860 keV.or 583keV. The measurment of uranium concentration was done by using its daughter radium –226 which decays emitting radon gas and then to (Bismuth-214) at the energy 609 keV. or by lead (pb-214) at the energy 839 keV.or 314keV.

The determination of radio activity concentration was done using the following equation:

$$\text{Specific activity} = \frac{\text{count sec} - (\text{B.G})\text{sec}}{I \cdot M \cdot \epsilon\%}$$

I: Intensity decays

M:Mass of the sample(kg)

B.G: Background

ϵ :Efficiency

Results and discussion

The activity concentration of radio nuclides in different foods like floure, rice, sugar , salt , dates , okras, lentil , cauliflowers , broadbeans were measured by gamma spectrometry , the results of the measurements have indicated the presence of Cs-137,K-40, Th ²³² ,U²³⁸ , in many important food samples .

Activity concentration of these radionuclides in most of the samples were very low only K40 and Cs-137 was detected in broadbeans and rice has K-40 and Cs-137 in okras and broadbeans with maximum activity concentration of (193,179)Bq/ Kg and (15.3,7.65)Bq/Kg , respectively as shown in table(1) .

All food samples analysed in our laboratory were below the Iraqi derived intervention level of 320Bq/Kg.

References

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Table (1) Summary Of The Analytical Results For Different Food (Bq Kg⁻¹)

Samples	CS – 137 Bq/Kg	K-40 Bq/Kg	Th-232 Bq/Kg	U-238 Bq/Kg
FLOUR	2.3	21	6	9.35
BROAD BEANS	7.65	193	5.25	2.95
RICE	1.4	179	2.25	1.25
OKRAS	15.3	66	8.8	4.54
DATES	2.7	35	3.1	2.96
SALT	3.2	74.5	0.6	3.14
LENTIL	0.23	77.4	5.6	8.7
CAULIFLOWERS	0.35	57	1.6	6
SUGAR	0.48	118	3	7

Table (2) The Standard Radioactive Source

Radionuclid	Half life	Energy(Mev)
(Co) ⁶⁰	5.62Y	1.173 , 1.332
(Na) ²²	2.62Y	0.511 , 1.275
(Mn) ⁵⁴	303 d	0.835
(Cs) ¹³⁷	30Y	0.662
(Ba) ¹³³	7.2Y	0.356 , 0.276
(Cd) ¹⁰⁹	453d	0.088
Co ⁵⁷	370d	0.122 , 0.136

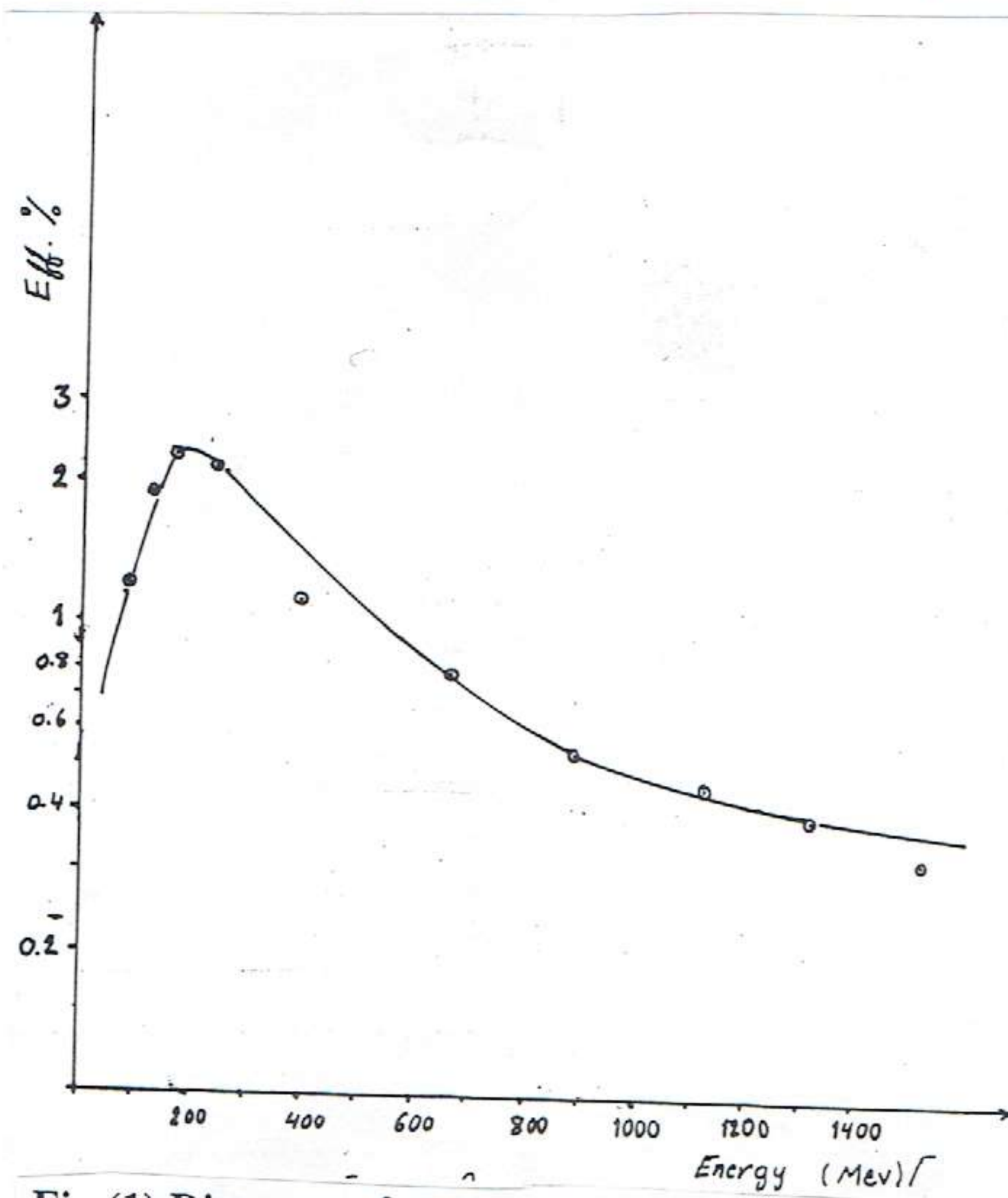


Fig.(1) Diagram of gamma ray spectrometer system

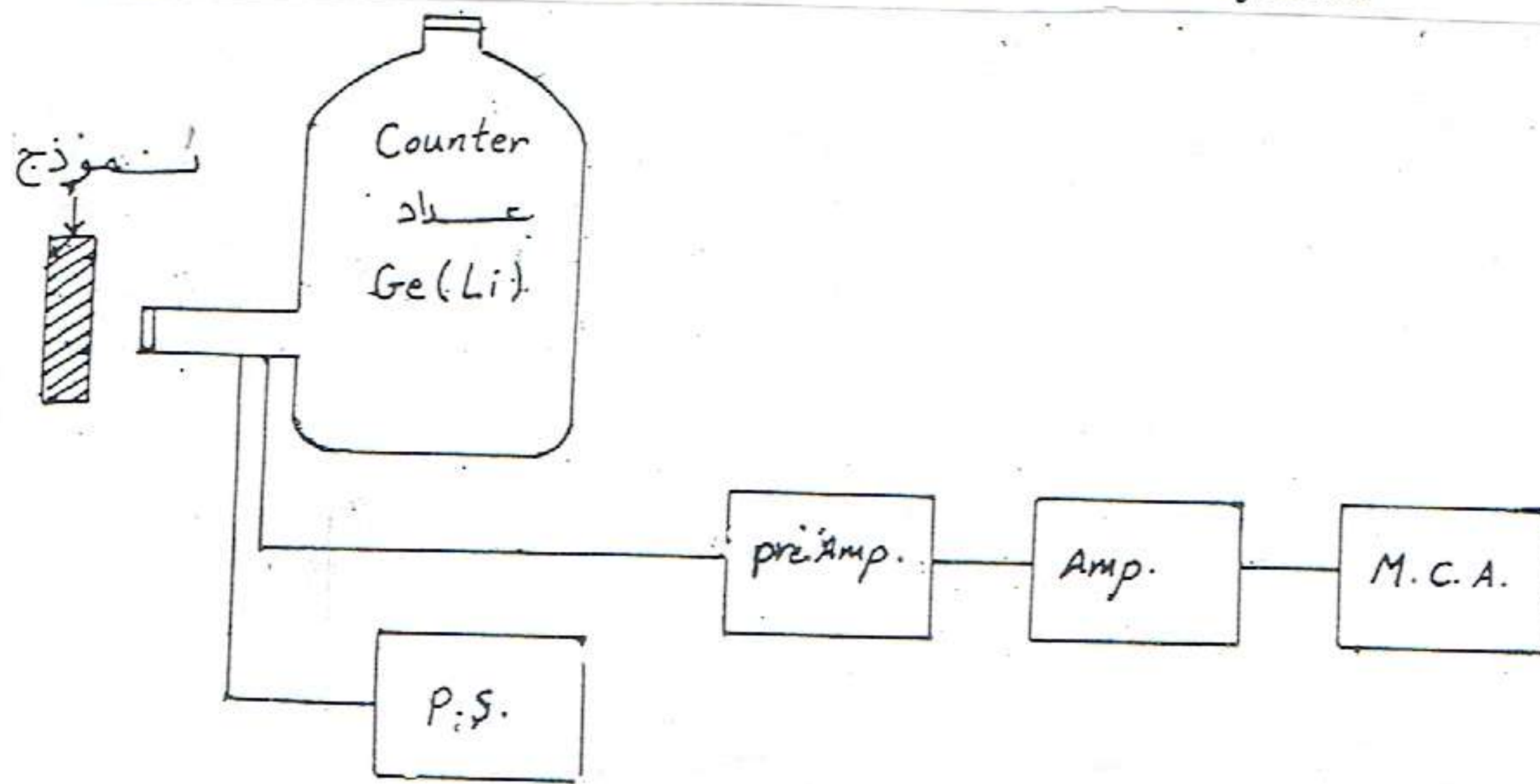


Fig.(2) Full energy peak efficiency as a function of gamma-ray energy

النشاط الاشعاعي في المواد الغذائية

عبد الرحمن الجميلي، قيس عبد الجبار ياسين
قسم الفيزياء ، كلية التربية ابن الهيثم ، جامعة بغداد

الخلاصة

ان الغرض من هذه الدراسة معرفة مدى تأثير الغذاء المنتج محليا في العراق بالتلوث الاشعاعي .
اجريت فحوصات النويدات الباعثة لاشعة كاما باستخدام كاشف الجرمانيوم ليثيوم (Gecli) المتصل بمحلل متعدد القنوات حيث تم الكشف عن النظائر المشعة الاتية .-K-
40,Cs-137, Th-232,U-238
استنتج بان مستويات تركيز المواد المشعة في الغذاء العراقي هي عند الحدود الدنيا للتلوث الاشعاعي خلال المدة 1991-1992 وتعتبر امينة وضمن الحدود المسموح بها دوليا من ناحية السلامة الاشعاعية .