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Measurement of environmental radioactivity for estimation of radiation Exposure from surface water in the Basrah Governorate

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Abstract:

The dose rate of emitted gamma-rays from surface water taken from different locations in the Basra Governorate by using a TL- technique has been measured. The measurements were performed using lithium fluoride (LiF) thermoluminescence dosimeters (TLD-200) at 32 stations, the average dose rate measured in the Basrah environs was $3.01 \mu\text{ rad/h}$. It is concluded that all the results obtained from this paper indicated that the inhabited area lying within the environmental monitoring stations are the areas in which the radiation is natural and that the dose rate that the human being exposed to, lie within the allowed limit.

Keywords: thermoluminescence, dose rate, dosimetry, relative humidity and gamma-rays

Introduction:

Thermoluminescence dosimetry (TLD) is a versatile tool for the assessment of dose of ionizing radiation. When exposed to radiation, the TL material absorbs energy, which stores until it is heated. The intensity of emitted light, as a function of temperature, is the TL glow curve. Most TL dosimeters demonstrate a linear response to doses up to a few Grays. [1]. TL dosimeters have small physical size, and they suite for a wide range of applications in medicine [2,3]. Proper assessment of environmental background radiation is essential in order to isolate exposures attributable to the release of radioactivity from the nuclear

facility; the environmental radiation level must be measured in order to assess population exposure accurately. In this field, many researchers worked to know the environmental radiation pollution in the soil, water, air, salt and foodstuffs, in order to protect the environment from the dangers of radiation exposed to humans [4-10]. The current study was conducted in some parts of Basra province, and through the implementation of radiation survey of 7 locations using TL-Dosimetry. The location selected are: Fao, City Center, Abu Khasib, Zubair, Shatt Al-Arab, Qurna and Medina. The sample locations (see Figure 1).

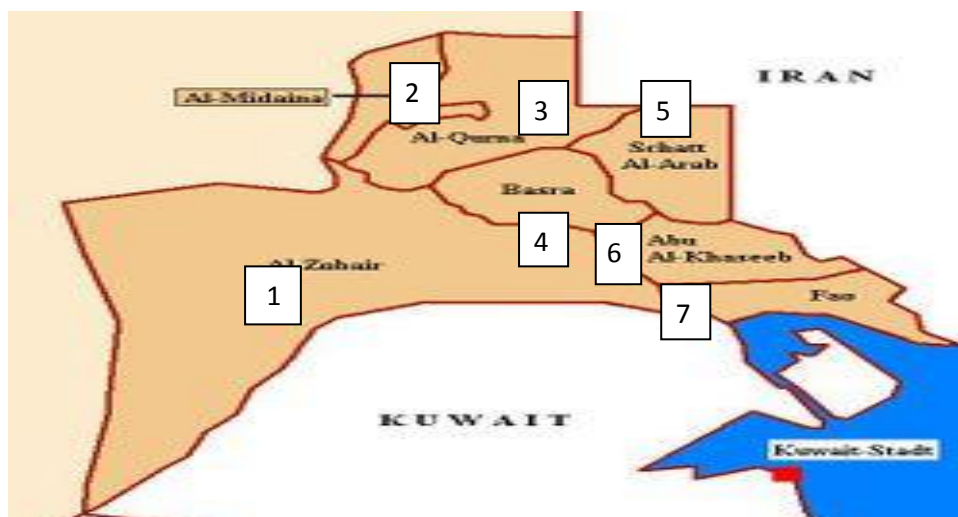


Figure 1.Map of the Basrah city with sampling site locations of the seven sites of this study.

In this paper it has been includes calculation the dos rate of emitted gamma-ray from surface water taken from different location in the Basrah city by using TL-technique .

Method and experiment

It is well known that for the detection of low radiation dose, thermoluminescence dosimetry is more advantageous than any other methods .This is because thermoluminescence dosimeters are small economical ,field work is minimal ,measurements are performed under laboratory condition and sensitivity ,accuracy and dependability over extreme environmental conditions are satisfactory .In the present study LiF(TLD-200) chips were chosen because of their better degree of accuracy sensitivity.[11] Calibration and the determination of TL response per m rad were done by the batch method [12] .An entire batch of dosimeters was

annealed together for 1 h at 400⁰c followed by 2 hours at 100 ⁰c[13,14]. Also, this treatment increases the sensitivity of a dosimeter . Each environmental dosimeter consists of three annealed TLD chips encased in an opaque plastic capsule . The TLDs are permanently placed on a number of selected locations surveillance for three months. There are thirty-two TLD monitoring locations distributed within 200 km covering all the important districts in the province. All TLD chips were read out using a TLD reader (Harshaw model 2000B/C) with a flow of nitrogen at a constant rate .Just before reading ,the chips were post –annealed for 10 min at 100⁰c to reduce fading .The standard procedures for pre-and post – annealing of chips was adopted [15]. Pre-field and post-field calibration factors are evaluated on a few

TLD from the same batch by a known exposure a Cesium-137 gamma source made by J.L. shepherd and associates company ,California was placed in the irradiation room of the thermoluminescence Laboratory at the Department of physics ,college of Education for pure science, University of Basrah.The average of the pre-and post-field calibration factors is used to evaluate the field exposures .The precision of the TLD system has been statistically evaluated to be $\pm 85\%$.Fading to the extent of 8 % has been observed during storage at temperatures ranging from(25-37) $^{\circ}\text{C}$ and 85% relative humidity after two months from the date of irradiation.The thirty -two sampling stations are located in seven zones. All zonescomprisefrom two to five stations.As described in(Table 1) .

Result and discussion

Thermoluminesce technique was used to study and measure the average environmental gamma-ray dose rate for Basrah city.Thirty –twoenvironmental stations were set and used for this purpose .The monitoring was continued for three months . Table 1 summaries the result of average dose rate measured with TLD-200 chips for the period three months in

the Basrah city.As can be seen in Table 1 , the mean average environmental gamma-ray dose quoted 2.01 $\mu\text{rad/h}$ up to 4.67 $\mu\text{rad/h}$ with the average dose ratewas 3.01 $\mu\text{rad/h}$.The minimum value obtained in sample code A4 (Abu Khasib) and a maximum for the sample code M4 (Medina). The high value recorded as, .4.67 $\mu\text{rad/h}$.From figure 1, it can be seen that monthly values do not show any definite pattern,although a slight random variation in the period time three month was observed .This variation may be due to different sources of pollution like mixing of sewage and toxic chemicals from pesticides and fertilizers in different sites as well as variability inherent in the placement of the dosimeter,and the preparation and calibration of the dosemeters[16].The results proved that the inhabited area ling within the environmental monitoring satiations are the area in which the radiation is natural and the rate that the human being exposed equal 0.1 m Sv/y which considered natural exposure limit[17,18,19].Moreover, the results of this long-term survey will provide basic data to assess the potential exposure of the population from radioactive waste releases, if any, in the surface water .

Table 1. Result of dose rate of emitted gamma-rays from surface water in Basrah city

Zone	Station	Dose rate $\mu\text{rad/h}$	TL(AU)
Fao	F ₁	2.67	7.579
	F ₂	2.50	7.143
	F ₃	3.03	8.643
	F ₄	3.07	8.763
	F ₅	2.42	6.891
Abu Khasib	A ₁	2.41	6.876
	A ₂	2.43	6.932
	A ₃	2.12	6.051
	A ₄	2.03	5.734
	A ₅	2.46	6.895
City Center	C ₁	3.07	8.753
	C ₂	2.91	8.288
	C ₃	2.66	7.594
	C ₄	2.79	7.961
	C ₅	2.99	8.529
Zubair	Z ₁	2.96	8.428
	Z ₂	2.95	8.420
	Z ₃	3.24	9.224
	Z ₄	2.07	7.135
	Z ₅	2.83	8.070
Shatt Al-Arab	S ₁	4.00	11.4
	S ₂	4.46	12.7
Qurna	Q ₁	3.13	8.938
	Q ₂	3.08	8.773
	Q ₃	3.07	8.647
	Q ₄	2.73	7.785
	Q ₅	3.12	8.883
Medina.	M ₁	3.18	9.051
	M ₂	3.09	8.817
	M ₃	4.13	10.6
	M ₄	4.67	13.300
	M ₅	3.75	10.700
Minimum value= 2.01	Maximum value=4.67	Mean= 3.01	

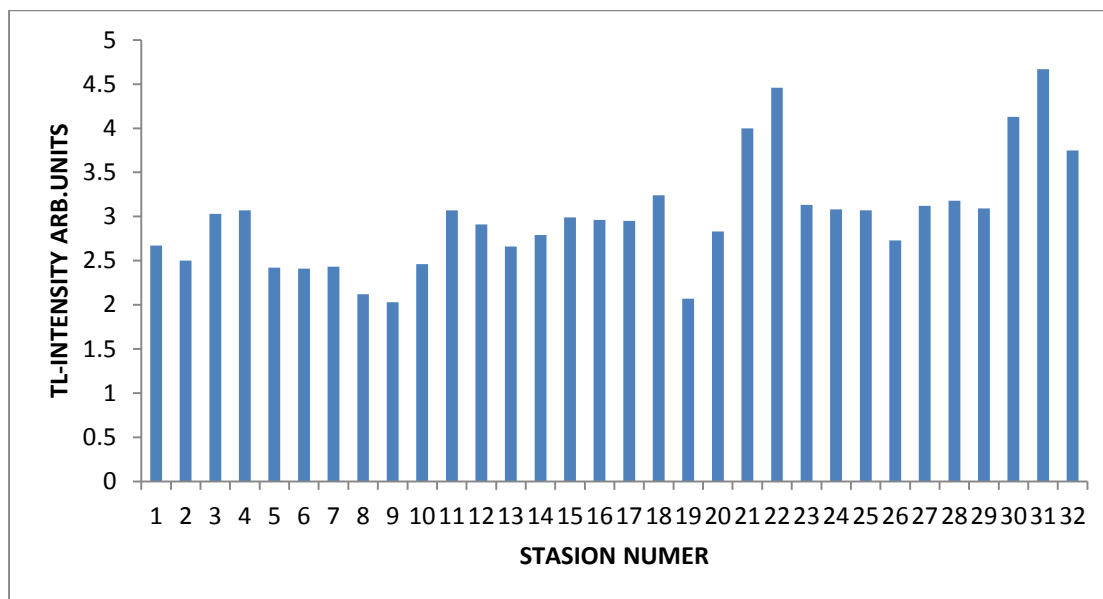


Figure 1: The dose rate of emitted gamma-rays from different stations

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قياس النشاط الاشعاعي البيئي للتعرض من المياه السطحية في محافظة البصرة

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الملخص:

تم قياس معدل جرعة اشعة كاما المنبعثة من المياه السطحية الماخوذة من مواقع مختلفة في محافظة البصرة باستخدام تقنية التالاق الحراري . تم اجراء القياسات باستخدام مقننات التالاق الحراري (TLD-200) في اثنان وثلاثون محطة , كان متوسط معدل الجرعة المقاسة في ضواحي البصرة $3.01 \mu \text{ rad/h}$ وتضمن ان جميع النتائج التي تم الحصول عليها في هذا البحث, تشير الى ان المنطقة المعنية التي تقع داخل قاعدة الرصد البيئي هي المناطق التي يكون فيها الاشعاع طبيعي, وان معدل الجرعة التي يتعرض لها الانسان يقع ضمن الحدود المسموح به.

الكلمات المفتاحية : التالاق الحراري ، معدل الجرعة ، قياس الجرعات ، الرطوبة النسبية ، أشعة كاما