การศึกษาสมบัติการตอบสนองต่อรังสีของอุปกรณ์วัดปริมาณรังสีโอเอสแอลชนิด InLight®

Radiation dose response of InLight® optically stimulated luminescence (OSL) dosimeter

ช่วงเวลาดำเนินการ ปี พ.ศ. 2561

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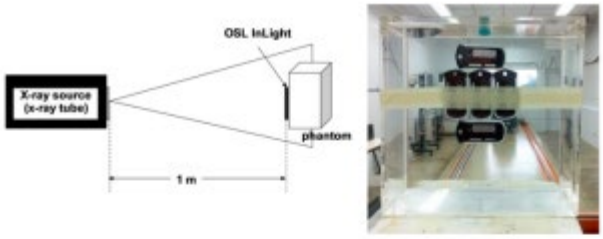
Introduction: Optically stimulated luminescence (OSL) dosimeter has been widely used for personal radiation dosimeter. The radiation dose is recorded and compared with the dose limitation in order to monitor risk from working with radiation. Therefore, the efficiency of personal OSL dosimeter is importantly concerned.

Objective: The purpose of this study is to define the efficiency of InLight® OSL dosimeter by comparing with the standard radiation source of the x-rays (x-rays tube), beta rays (Strontium-90) and gamma rays (Cesium-137). The radiation dose responses of OSL dosimeter were studies where the findings can be used for differentiating the types and energy of radiation.

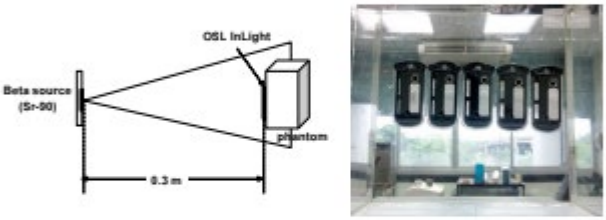
Materials and methods: InLight® OSL were placed on the phantom and irradiated with three different radiation sources which were x-ray from x-ray tube, beta from Sr-90 and gamma ray from Cs-137 with different mean energy range between 33 - 662 keV and varying the radiation dose of 0.2 mSv, 2.0 mSv and 5.0 mSv. The standard radiation source is placed at an angle of 90 degrees with the OSL dosimeter.

Results: The efficiency of OSL dosimeter depends on the type, dose, and energy of radiations. OSL dosimeter was poorly response to the low radiation dose (0.2 mSv) from x-ray and beta with the measurement error of 28% and 74%, respectively. The x-ray standard graph of OSL can be used to distinguish the energy of x-ray however; it cannot differentiate the x-ray radiation dose. The differences of beta and gamma ray standard graph can be used to distinguish the types of radiation.

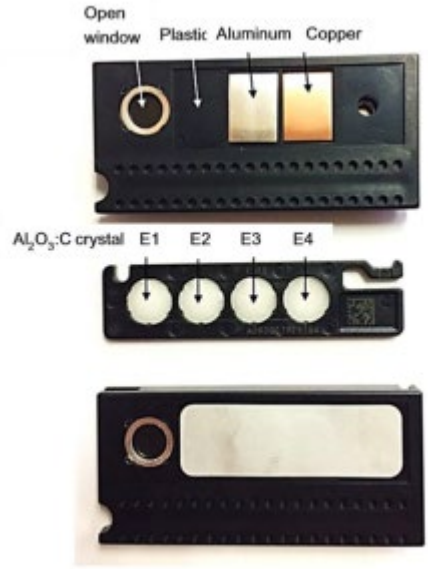
Conclusion: The use of OSL dosimeter to analyze the type, dose, and energy of radiations requires the standard graphs and radiation dose responses. The different types of radiation such as x-ray, beta, and gamma including the dose and energy of radiation must be examined before measuring the dose received from radiation workers. The angle of radiation source and dosimeter must also be concerned.

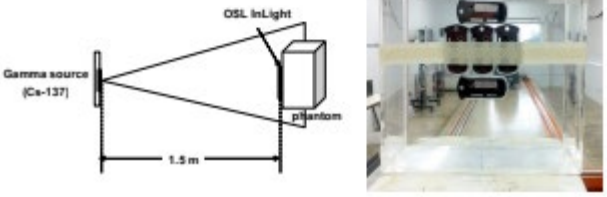


ภาพที่ 2 การฉายรังสีเอกซ์จากหลอดเอกซเรย์ลงบนอุปกรณ์วัดปริมาณรังสี OSL InLight® ที่ติดบนเนื้อเยื่อจำลอง



ภาพที่ 3 การฉายรังสีบีตาจากแหล่งกำเนิดรังสีสตรอนเชียม-90 ลงบนอุปกรณ์วัดปริมาณรังสี OSL InLight® ที่ติดบนเนื้อเยื่อจำลอง





Type of Radiation	Energy (keV)		Radiation dose (mSv) 0.20	2.00	5.00
X-ray	33	$\bar{X}$ ± S.D.	0.15 ± 0.01	1.73 ± 0.05	4.35 ± 0.11
		%error	25.00	13.30	12.96
	48	$\bar{X}$ ± S.D.	0.14 ± 0.01	1.90 ± 0.28	4.79 ± 0.66
		%error	28.00	5.00	4.12
	65	$\bar{X}$ ± S.D.	0.20 ± 0.02	1.96 ± 0.07	4.99 ± 0.20
		%error	2.00	2.20	0.20
	83	$\bar{X}$ ± S.D.	0.22 ± 0.06	2.07 ± 0.22	4.95 ± 0.38
		%error	9.00	3.70	1.00
	100	$\bar{X}$ ± S.D.	0.23 ± 0.00	1.91 ± 0.12	4.80 ± 0.34
		%error	14.00	4.50	3.96
	118	$\bar{X}$ ± S.D.	0.19 ± 0.01	1.93 ± 0.11	5.14 ± 0.25
		%error	6.00	3.60	2.72
Beta	546	$\bar{X}$ ± S.D.	0.05 ± 0.01	2.17 ± 0.13	5.40 ± 0.40
		%error	74.00	8.70	8.04
Gamma	662	$\bar{X}$ ± S.D.	0.21 ± 0.02	2.03 ± 0.04	5.05 ± 0.17
		%error	5.00	1.50	1.00

*Percentage error is ≤15% recommended by the manufacturer [9]