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Contents

An Overview on Seismic Analysis of Multistoried Building using Equivalent Static Load Method & Response Spectrum Method: A Literature Survey.

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ABSTRACT

Performance based seismic design in the context of prediction of inelastic seismic responses and seismic performances of a building structure is very important topic to be a concern. Various forces act on a building but earthquake force is one of the most critical force and must be considered while analysis and design of the multi-storeyed building, as per, IS: 1893-2016 recommendations. Various software nowadays are available for analysis and designing of a building by considering the earthquake forces and to review or study the behaviour of multi-storeyed buildings by equivalent static lateral force method and response spectrum method and literature reviews of various papers considering this method are studied. Alternative survey of the research paper is done and it is observed that the response spectrum method is used for analysis of multi-storeyed building and incorporated in most of the course related to earthquake analysis of the building. The equivalent static load method is used often for regular buildings.

.Key Words: - Multi-storey building, seismic analysis, response spectrum method, equivalent static lateral force method, STAAD –PRO,ETABS.

I. INTRODUCTION

Now a day many mulit-storeys building in cities are in the high demand because of limited land available in country specially in cities. When earthquake occur, a building undergoes dynamic motion. These are because the building is subjected to inertia forces that act in opposite direction to the acceleration of earthquake excitation. An earthquake is a phenomena in which earth surface shakes due to the release of seismic energy from large blocks of the crust along a fault. These fault are cracks in the crust. The point under crust where the processes of earthquake begins, it is a source of earthquake and it is termed as focus. The main objective of this paper is to study the seismic behaviour of the building against the earthquake. Also analysis of structure by Equivalent static analysis and response spectrum method. Seismic loading requires an understanding of the structural performance under large inelastic deformations. Building and other structure are composed of horizontal and vertical structural elements that resist the lateral forces. The structure must include complete lateral and vertical force resisting systems, capable of providing adequate stiffness within permissible limits, deformation and strength demands.

METHODOLOGY:

The basic methodology followed during the course of the study are as follows. If the structure was not properly designed and constructed with required quantity they may cause large destruction of structures due to earthquakes. The most commonly used methods of analysis for determining the seismic forces acting on the structure are equivalent static method and response spectrum method etc. Such analysis can be carried out by static analysis and dynamic analysis.

EQUIVALENT STATIC METHOD:

It is an analysis of the dynamic response of the structure. It is also known as nonlinear dynamic analysis. All designs against seismic loads must consider the dynamic nature of the load. For simple regular structures, analysis Equivalent Static Method is often sufficient. This is permitted in IS 1893¬-2016 for regular, low to medium rise buildings. Equivalent Static Method can therefore work well for low to medium-rise buildings without significant coupled lateral-torsional modes, in which only one mode in each direction is considered. High rise building over 75m, or building with torsional effect ,where the second and higher mode is important are nor suitable for this method, require more complex method to be used in this situations

RESPONSE SPECTRUM METHOD:

The representation of the maximum response of idealized single degree of freedom (SDOF) having certain period and damping during earthquake ground motion. It is also known as linear dynamic analysis. This method is an elastic dynamic analysis on the assumptions that dynamic response of the structure may be found by considering the independent response of natural mode of vibration and then combining the response of each in same way. In this, peak response of the structure during an earthquake is obtained directly from earthquake response. The peak response is then combine to estimate a total response.

The values of total response plotted against un-damped natural period and for various damped values can be expressed in terms of maximum absolute acceleration, maximum relative velocity or relative displacement. For this purpose, Response Spectrum Method have been performed according to IS 1893-2016.

II. LITERATURE REVIEW:

Seismic behavior of a 10 storey frame with external shear wall as lateral load resisting system by S V Venkatest , H Sharada Bai, Ramya, they observed that between the two seismic methods of analysis considered, namely Equivalent Static Lateral Force Method” and “Response Spectrum Method”, not much difference in the results obtained are observed. The range of difference is generally about 2% in most of the parameters and maximum about 20%. Comparative Study of Static and Dynamic Seismic Analysis of a Multistoried Building under Pushover Analysis by V.B.S.Purna Nath, Dr. Shaik Yajdani they observed that the maximum displacements of building obtained from equivalent static method are higher as compared to response spectrum and response spectrum method gives good hinge formation result. Seismic analysis of RC regular and irregular frame structures by Arvind reddy, R.J.Fernandes they observed that the results obtained from static analysis method show lesser storey displacement values as compared to response spectrum analysis.

Comparative Study of Static and Dynamic Seismic Analysis of Multistoried RCC Building by ETAB: A Review by Gauri G. Kakpure, Ashok R. Mundhada they observed that Static analysis is not sufficient for high rise buildings and it’s necessary to provide dynamic analysis and the results of equivalent static analysis are approximately uneconomical because values of displacement are higher than dynamic analysis . Static and Dynamic Seismic Analysis of a Multi Storied Building by Pushover Analysis by Palli Naveen, Dr. Shaik Yajdani they conclude that at lower story structures the structures are safe under the design of Equivalent Static Pushover Earthquake Analysis. The hinge formed in the Response Spectrum Method is more when compared to Equivalent Static Method formed hinges. So it can be concluded that Response Spectrum Method is giving the good hinge formation results Comparative

Study of Equivalent Static Analysis and Response spectrum analysis on Flat Slab Using Etabs by Raghavendra Rao, Dr.M Rame Gowda observed that the drift and displacement result obtained by equivalent static analysis are higher than the results obtained by response spectrum analysis.

Comparative study of seismic analysis of 3 storey RC frame by Akshay Mathane, Saurabh Hete, Tushar Kharabe they observed that the results obtained from static analysis method shows lesser storey displacement values as compared to response spectrum analysis and Equivalent static method is simpler than Response Spectrum method .

Response Analysis of Multi-Storey RC Buildings under Equivalent Static and Dynamic Loads According to Egyptian Code by Sayed Mahmoud, Waleed Abdullah they observed that the dynamic response spectrum analysis produces storey shear in both directions regardless the loading direction while static analysis only produce storey shear in the direction of loading.

Seismic Analysis of Multi Storied Building for SMRF and SMRF with Shear Wall by using Static and Dynamic Methods by Akshay Agrawal , Vinita Gavanang , Shilpa Gaikwad , Shruti Patare , Pravina Mithe, Pallavi Sonavane observed tha static coefficient method is a approximate approach as it take seismic load as static and response spectrum method is more accurate as it consider dynamic nature of seismic load, and static coefficient method is easy to apply as compare to response spectrum method . Comparative study has shown that static coefficient method show linear distribution of base shear whereas response spectrum method shows non linear distribution. Dynamic analysis of multistory building using response spectrum method and seismic coefficient method by Suchi Nag Choudhary , Dr. P.S. Bokare observed that the response spectrum method for both elastic and inelastic can also be calculated by artificial modeling structure under combine quadratic combination. Static coefficient method is used to estimate maximum roof displacement I any inelastic structure and accurate result is obtained when compared to static method using software related to seismic analysis makes analysis more accurate and easy and take less time to find result. Response spectra as a useful design and analysis tool for practicing structural engineering by Sigmund Freeman he observed that response spectrum techniques allow engineer to visual imagine how building will performs during major damaging earthquake. However, response spectra, as in any other technique, must be used with caution and a good understating of the process. For single-degree-of-freedom system responding in a linearly elastic manner, response spectrum with sharp peaks and valleys, the variation due to uncertainty in actual structural period of vibration is visually apparent.

Comparative study of the static and dynamic analysis of muli- storey irregular building by Bahador Beghari, Ehsan Salimi Firoozabad, Mohammadreza Yahyaei conclude that displacement obtained by static analysis are higher than the dynamic analysis including response spectrum and time history analysis. Static analysis is not sufficient for high rise building and it is necessary to provide dynamic analysis. For important structure time history analysis is performed as it predicts the structural response more accurately in comparison with equivalent static analysis and response spectrum method. Seismic analysis of high-rise building by response spectrum method by Prof. S .S. Patil, Miss. Ghadge, Prof. C.G. Konapure, Prof. Mrs. C.A. Ghadge observed that more accurate values of response may be obtained for building by the model analysis method, using modified response spectra for inelastic analysis, building with a short time period tends to suffer higher acceleration but small displacement. Analysis and Design of G+5 residential building with seismic load using STAAD-PRO by Deepmala Pandey, observed that the support reaction in exterior columns and in edge columns increasing in seismic zone II to zone V. However the variations of support reaction are very small in interior columns. Seismic analysis and design of building structure in STAAD PRO by Anoop Singh, Vikas Srivastava, N.N. Harry observed that the fundamental natural period calculated by STAAD PRO matches with that calculated by IS 1893-2002. The maximum beam displacement of 3m span beam is 0.44mm and allowable displacement is 12mm.

Seismic Analysis & design of G+5 residential building by K Aparna Srivastav observed that in earthquake resistance design the steel quantity increased by 1.517 % to conventional concrete design. In this study of G+5 building, seismic load dominates the wind load under seismic zone III. Mahesh N. Patil, Yogesh N Sonawane made a comparison of the earthquake response of symmetric multistoried building studied by manual calculation and with the help of ETABS 2016 software. There is slight variation in the values of base shear in manual analysis as well as software analysis Khaldoon A.et.al, 2017, compared time history method and response spectrum method and explained that for non linear dynamic analysis response spectrum method is adopted. The paper concluded that various modifications are required under time history analysis and accelerograph.

III. CONCLUSION

Many of studies have been conducted on a topic seismic analysis, from which we studied some of them. So we conclude that, it necessary to analyse the building in various earthquake zones an it is clear that effect of earthquake on structure can be minimize by providing shear wall, base isolation etc.

The results of equivalent static analysis are uneconomical because values of displacement are higher than dynamic analysis. Equivalent static analysis is not sufficient for high rise building there is need to provide response spectrum analysis to ensure the safety against seismic forces.

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Thermoluminescence Properties of Red Emission Band of Sandstone

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A B S T R A C T

The red and green emission bands in thermoluminescence (TL) of natural sandstone has been recorded in the range from room temperature to 400oC.The natural glow curves have peaks at 250oC and 285oC in the red and green bands respectively with a heating rate 5oC/s. The laboratory irradiated sample revealed peaks at 115oC, 135oC, 155oC, 195oC, 250oC, and 315oC in the red band and 95oC, 135oC, 285oC, and 315oC in the green band. The TL gamma-rays dose response curves are linear for both bands over the two ranges (1Gy-100Gy) and (500Gy - 104Gy).TL fading measurements showed a remnant signal of 0.853 and 0.627 in the red and green bands respectively after 30 days of storage in dark at room temperature.

Keywords: Thermoluminescence; Sandstone; Glow Curve; Gamma Rays; Fading.

1. INTRODUCTION

Features sensed in the earlier data were, that the presence of the red signals was most obvious in quartz obtained from volcanic material. This complexity is explained by the variety of defects in sandstone that are either intrinsic (e.g., Si and O vacancies) or related to impurity atoms (e.g., Al or Ti). The concentration of impurity-related defects is dependent on the conditions of mineral formation or subsequent alteration. Experimental data have shown that theluminescence properties of sandstone are highly variable with geological source and vary even at a grain-to-grain level within sediment.

The study of the TL characteristics of quartz extracted from burnt sandstones has allowed the approximate determination of the temperature to which they had been exposed and enabled their suitability for dating to be judged [1]. Red thermoluminescence (RTL) of natural quartz grains offers many desirable properties for retrospective dosimetry, quaternary chronology and archeological dating. The RTL phenomenon was initially reported for quartz grains from dune sand [2]. Subsequently RTL of quartz grains has been observed in volcanic products , burnt archaeological samples and Chinese loess ([3]and references therein).The thermal background was reduced in combination with a light guide , cluster heater, optical filters , and photomultiplier tube cooling to −20oC in the used system [4].

The lifetimes of trapped electrons and holes related to RTL emissions were confirmed to be longer than 1Ma at ambient temperature which is long enough for archaeological dating [5]. In luminescence dating and dosimetry studies, quartz RTL provide desirable properties for equivalent dose determination [6]. Owing to the high thermal background, RTL measurements have been limited to relatively old samples, which accumulate doses of >50Gy [7].

The sensitivity of ferruginous sandstone samples as a function of the duration of annealing is not monotonic. For that reasons it seems necessary to consider the equivalent thermal history rather than an equivalent temperature [8]. Rendell et al. [9] reported on spectral changes induced in the TL of quartz as a result of a variety of thermal treatments. The rate of cooling changed the relative intensities of the component emission bands in all samples. In the volcanic quartz material, the ratio of red to blue emission is particularly sensitive to the cooling rate.

Red TL (RTL) of quartz grains has given higher activation energies than blue TL (BTL) and a good response to absorbed doses [10].

Scholefield and Prescott [11] observed a parallelism between the blue and red emissions, in the sense that red TL peaks similar to the blue tended to appear at slightly higher temperatures. They concluded that the blue and red emissions probably involved a common set of electron traps feeding separate luminescence centers.

The red emissions of quartz has been associated with high amounts of aluminum impurity centers [12], Oxygen vacancy and sodium impurity [13] and Europium and / or Samarium light rare earth elements [14].

The suitability of sandstone from Egypt for the gamma radiation dosimetry using blue –TL (BTL) technique is investigated [15]. Its properties are systematically studied utilizing measurements of natural and laboratory –induced blue TL emission band ,trap depths and storage effects. In this paper a preliminary study of the TL emission properties of the red (RTL) band of the same sample to explore the glow curves characteristics, gamma dose response, storage effects and comparison with green (GTL) and the previously measured blue band of the same sample.

2- MATERIAL AND METHOD

The employed natural sample of sandstone powder (particle diameter ≤ 45) used in this study was collected from Egypt. Information about the preparation and chemical composition of the sample is shown in Soliman and Salama [15].

To minimize the statistical error, five aliquots (5mg each) were used for each measurement. The sample was irradiated at room temperature with γ - rays from a calibrated 60Co source with doses in the range from 1Gy to 104Gy at King Saud University, Saudi Arabia .The time duration between irradiation and required TL readout was kept constant at 30min.

TL measurements were carried out using 3500 TLD reader equipped with two kinds of filter assemblies are employed to determine separately red or green TL intensity respectively and installed directly between the photomultiplier and the heater device, one is a narrow band green filter and a red glass filter (sharp-cut filter, R-60) combined with an infrared cut off filter (IRA- 05). A linear rate of 5oC s-1 was chosen in a liquid nitrogen environment.

Glow and black –body curves were successively measured for each aliquot, then the black- body curve was subtracted from the glow curve.

TL fading was studied for 30 days at a γ - dose of 50 Gy at room temperature (RT).The exposed sample, as well as the control, was stored in the dark at RT and normal humidity conditions.

3. EXPERIMENTAL RESULTS

3.1 Natural sample glow curves

For investigation of the characteristic RTL and GTL glow curves of the natural sandstone aliquots were heated from room temperature up to 400oC and the TL intensity recorded. After- words a second readout was performed to record the background signal of the reader and sample.An average TL glow curve of the natural sample without any pre-annealing and irradiation treatments can be seen in Fig.1. One can easily see in the figure that the natural glow curves has one broad peak around 250^{o}C and at 285^{o}C in the red and green bands respectively and with intensity ratio of 1:10. In the previous studies the blue thermoluminescence of sandstone from Egypt exhibited a broad peak centered at 315^{o}C [15].The electron source traps are different in the case of blue, red and green emissions and the electrons evicted from their traps recombine preferentially with the holes trapped in one or the other recombination center. When directly compared the TL intensity ratio is 28 : 10 : 1 for blue, green and red respectively. The previous studies of the natural sandstone indicated different glow curve peaks. The ferruginous sandstone from France [8] showed one peak at 110^{o}C, TL glow curve from India showed one peak at ~240^{o}C [16], while as the burnt sandstone glow curve exhibited two peaks at ~270^{o}C and 350^{o}C [1].Other sandstone from Brazil showed two peaks at 325^{o}C and 375^{o}C [17].

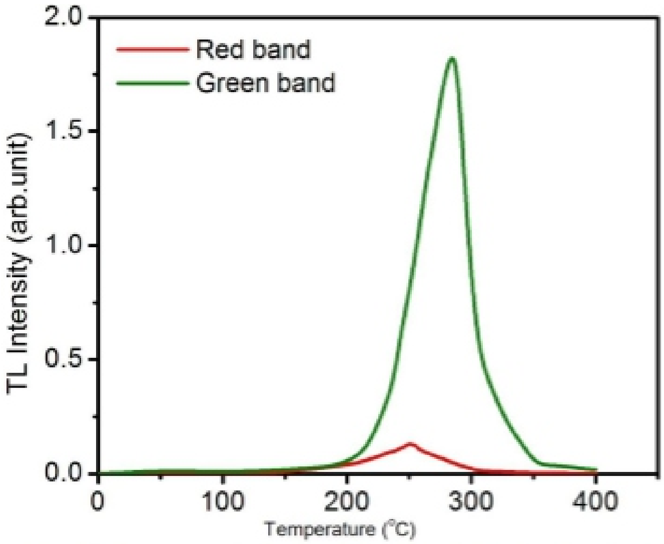

Figure 1 : The TL glow curves of natural sandstone recorded at a heating rate of 5^{0}Cs -1.

3.2 The effect of g - irradiation

Before the irradiation, the sample was oven annealed (at 400^{o}C for 30 min) in order to homogenize the impurities. As far as the detection bands are concerned there is a visible difference in the two detection bands. Figure 2 (a & b) shows typical glow curves of sandstone aliquots exposed to γ - rays dose of 50 Gy. At low doses starting at 1 Gy, the glow curves of both bands show only one peak at 315^{o}C.This peak is still appeared at high doses about 104 Gy .The irradiation added many modifications to glow curve of sandstone. At doses higher than 50 Gy,TL peaks at 115^{o}C, 135^{o}C ,155^{o}C ,195^{o}C,285 ^{o}C and 315^{o}C were appeared in red band and at 95^{o}C ,135^{o}C,285^{o}C and 315^{o}C were appeared in green band.

The dissimilarity between natural sample glow curves (Fig.1) and the laboratory induced (Fig.2) can be ascribed to thermal treatment and ionizing radiation which induced new types of defects. Previously published results have shown that the blue emission band showed peaks at 88°C ,95°C , 210°C , 220°C ,and 305°C [15].This blue emission, lies lower in temperature than does our results in green and red bands as in Fig.[2] .Sandstone sample from Japan showed that γ - irradiation induced two TL peaks at 150 °C and 350°C [18].

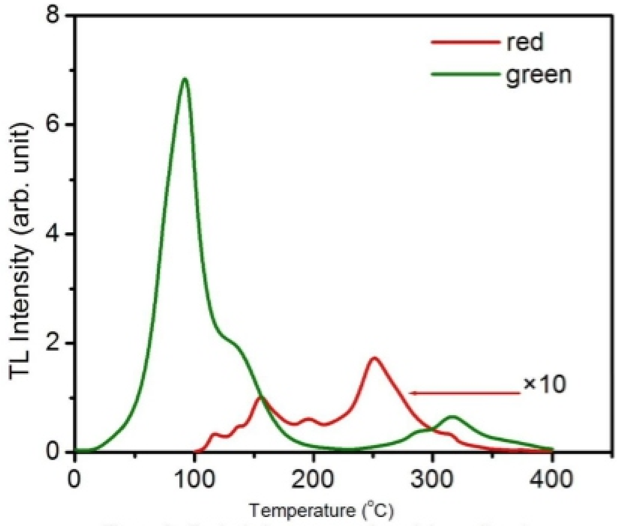

Figure 2 : Typical glow curves of sandstone aliquots exposed to gamma rays dose of 50 Gy.

3.3 TL growth curves

The response of each integral TL, covering a temperature range from room temperature to 400°C, is examined for the absorbed doses by using the filter techniques. Figure 3(a &b) shows the dose response of red and green bands of sandstone over the dose range 1Gy-104 Gy. The TL dose response of red TL band follows linear relations I=18.497+0.0041 D and I=11.678+0.203D with the correlation coefficients R^2=0.987 and 0.997 over the dose ranges 1Gy – 100Gy and 500Gy-104Gy respectively. Also the TL dose response of green TL band follows linear relations I =28.31+7.618D and I= 1880+0.704D with the correlation coefficients R^2=0.998 and 0.992 over the dose ranges 1 Gy – 100Gy and 500 Gy -104Gy respectively; where I refers to the intensity of the TL signal and D is the given dose. The evolution of the induced TL of blue band [15] with the dose over the range 1 Gy –50 Gy showed a linear fitting (R2 = 0.999) with an equation of the type I = 135.62+5.82 D; followed by a sub-linear relation I=74.3 D0.61 at higher doses up to 104Gy.

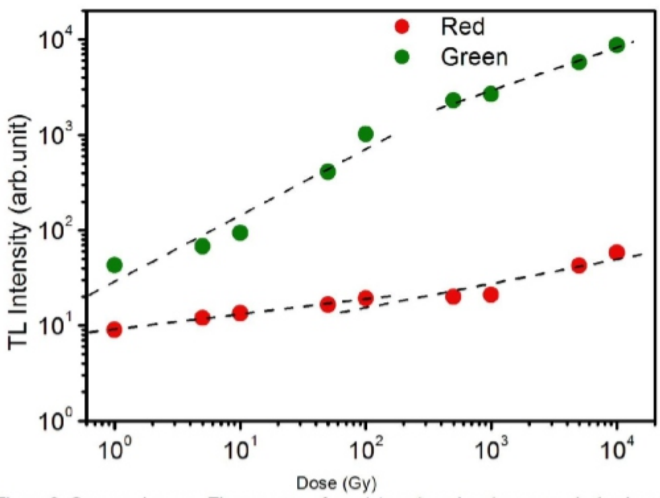

Figure 3: Gamma dose vs. TL response of sandstone in red and green emission bands.

3.4 Batch homogeneity

It is recommended that the evaluated value for any dosimeter in a batch shall not differ from the evaluated value of any other in the same batch by more than 30% [19], that

$$f = \frac{TL_{max} - TL_{min}}{TL_{min}} \leq 30\% \qquad (1)$$

The average f value of sandstone has been estimated to be 26.3% and 21% for red and green bands respectively over the studied dose range, which is within the recommended upper limit.

3.5 Thermoluminescence Fading

It is important to know the stabilities of the traps connected with the peaks ; since these reflect the storage capacities of the traps. To determine the stabilities, the thermoluminescence measurements were performed for a period of 30 days (d) in the room environment over the range (20°C -25°C). Prior to storage the investigated material was given a standard annealing treatment at 400°C for 30 min. The large amount of annealed powder sandstone was irradiated (50 Gy) and stored in dark before TL reading.

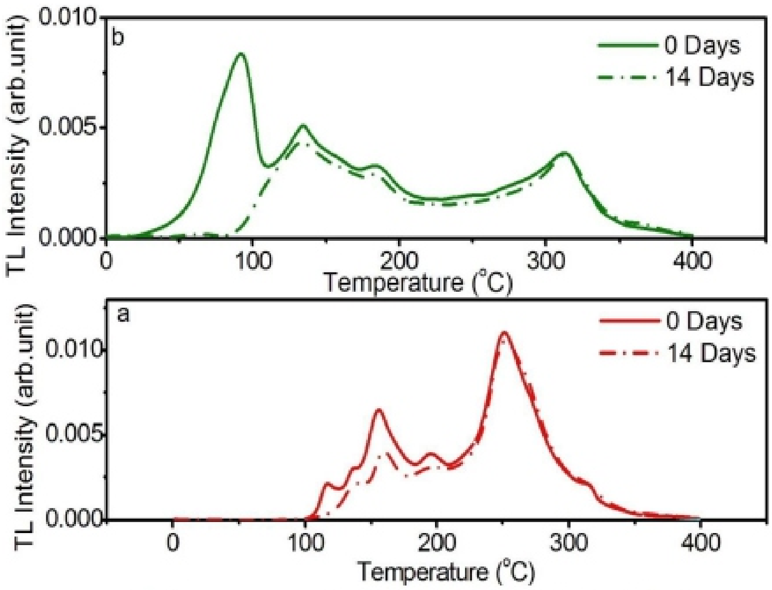

Figure 4:TL glow curves of sandstone measured immediately after irradiation (0-Days) and after 14 days of storage at room temperature measured in red (a) and green band (b).

Another amount of the annealed sample used as the control being stored for a period of 30 days in the same conditions, then irradiated with the same dose and read out immediately on the same day to avoid variations from instrumental drift. Glow curves of the red and green bands are shown in Fig.4 (a&b) after a delay period of t= 14d, and without any delay period (t=0).The differences in the glow curves with t=0 d and t=14 d result from the migration of the low temperature trapping centers to the high complex centers. Figure 5 (a&b) shows the time dependent TL fading in the period 0d – 30d. It is shown in TL signal felt to 85 % and 63 % of its original value in red and green bands respectively.

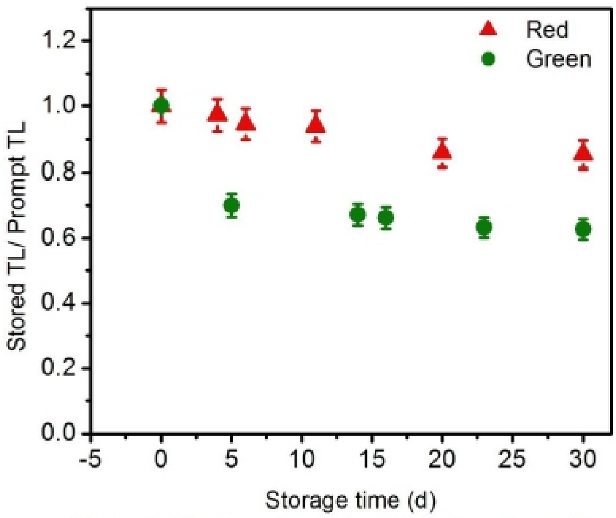

Figure 5: The time dependent TL fading of sandstone at room temperature.

4. CONCLUSION

The results indicate the complexity of the luminescence mechanisms in sandstone. The natural glow curves of present red, green and previously blue [15] bands show different natural electron traps responsible for the three emissions.

The laboratory induced glow curves of the red and green bands involved same electron traps at 135 oC and 315 oC and other different traps. The results may be explained by that there are more than one zone in the crystal containing populations of different holes responsible for the three emissions. In each zone type, there is different concentrations of electron traps of similar and different types. If the zones are large composed to the size of crystal cell, than it may be possible that the evicted electrons preferably recombine in the zone from which they originate.

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Energy Efficiency in Green Buildings: A Sustainable Approach

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ABSTRACT

At present, the building and construction industry is one of the largest economic activities in India. It is estimated that the construction industry has contributed around 8.1% to India's GDP in 2010-11 up from around 5.1% in 1999-2000.One survey reveals that built space in India will increase 5-fold from 20,000 million sq ft in 2005 to over 100,000 million sq ft in 2030.This growth will put enormous pressure on various resources such as energy, water, minerals and will have a discernible impact on the environment. Faced with an increasingly scarcity of resources, there was an increasing focus on "green building as solution". As a result, India has emerged as one of the world's top destinations for green building and has implemented a number of home rating schemes and building codes, which open up a wide range of opportunities in construction, architecture and engineering design, building materials and equipment manufacture.

Keywords: Green Building, Energy efficiency, Environmental Footprint, Better Productivity, Renewable

INTRODUCTION

The building sector accounts for at least one-third of all energy related CO2 emissions worldwide therefore, enhancing resource (input) efficiency such as reducing water and energy usage in this sector can be an affective abatement wedge to address climate change.

At present, the building and construction industry is one of the largest economic activities in India. It is estimated that the construction industry has contributed around 8.1% to India's GDP in 2010-11 up from around 5.1% in 1999-2000.One survey reveals that built space in India will increase 5-fold from 20,000 million sq ft in 2005 to over 100,000 million sq ft in 2030.This growth will put enormous pressure on various resources such as energy, water, minerals and will have a discernible impact on the environment. Faced with an increasingly scarcity of resources, there was an increasing focus on "green building as solution". As a result, India has emerged as one of the world's top destinations for green building and has implemented a number of home rating schemes and building codes, which open up a wide range of opportunities in construction, architecture and engineering design, building materials and equipment manufacture.

What is a green building?

A high –performance green building can be thought of as a living organism, and as with all living things, it must have a nurturing environment to achieve sustained health and performance over its life. Such buildings are designed for economic and environment performance over time, with an appreciation for unique local climate and cultural needs, ultimately providing for the health, safety, and productivity of building occupants. Architectural, systems, and end-use design, coupled with continual care and monitoring, leads to lower energy use, reduce CO2 emissions, and focused environmental stewardship while providing long term value to the community, building occupants, and building owners.

According to US green building council generally Green Homes are healthier, more comfortable, more durable and more energy efficient and have a much smaller environmental footprint then the conventional homes.

NEEDS FOR GREEN BUILDING

There is a variety of a reason to" go green" but most come back to supply and demand. We have a limited amount of resources available and more and more using them up .If we want our future generations to enjoy the same standards of living we have experienced, we need to take action.

"Green building" is great places to start as building consume 14% of potable water, 40%of raw materials and 39%of energy in United States alone (according US green building council).that is 15trillion gallons of water and 3 billion tons of raw material each year. If it is not enough to convince you, here are some other reasons to explain the need of green buildings

- Green buildings improve productivity
- Green building can trade energy.
- Green buildings present exciting new challenges for environmental stewardship.
- Green building awareness of what constitute a high quality environment.
- Green building can help electricity utilities by reducing peak demand.
- Green building inspire innovation.
- Green building raises the quality and standards of building generally.

BENEFITS OF GREEN BUILDING

- They use key resources like materials, energy, water and land much more efficiently than buildings simply built to code.
- They create healthier work ,learning and living environments by providing more natural light and cleaner air.
- They improve employee and student's health, comfort and productivity.
- They save money by reducing the operation and maintenance cost, and also by lowering utility bills.

They consume at least 40-50%less energy and 20-30%less water than conventional buildings.

FEATURES OF GREEN BUILDING

Green buildings have many advantages and features. Some important features are as follows:

1) Water conservation
2) Efficient use of landscape and minimal possible damage to earth
3) Use of energy efficient equipment with BEE rating
4) Use of solar energy street lights
5) Use of recycled materials in construction and operations
6) Use of building management system
7) Building design with all reduced green house effect and global warming
8) Preferred parking space for low carbon emission vehicles
9) Improved indoor air quality
10) Use of rapidly renewable materials

Rating systems for green buildings in India

- GRIHA (Green rating for integrated habitat assessment)
- IGBC (Indian green building council)
- BEE (Bureau of energy efficiency)

GRIHA in India has own rating system jointly developed by TERI and ministry of new and renewable energy, government of India. GRIHA rating system consists of 34 criteria categorized in four different sections.

Some of them are:

1) Site selection and site planning
2) Conservation and efficient utilization of resources
3) Building operation and maintenance
4) Innovation

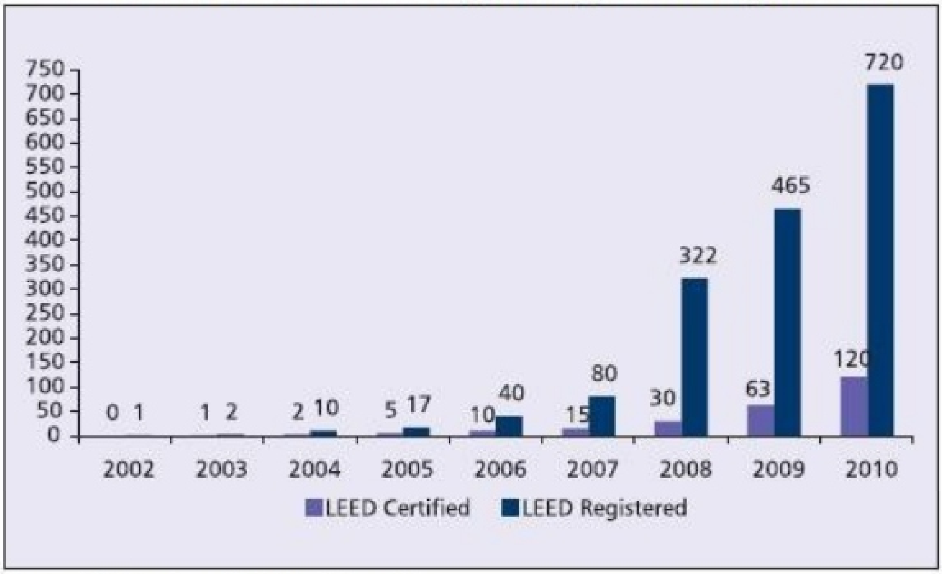
Commonwealth games village, New Delhi, Fortis hospital New Delhi, CESE (centre for environment science and engineering), IIT Kanpur, Suzlon one earth ,Pune and many other buildings have received GRIHA RATING.

LEED(Leadership in Energy & Environment design) is the rating system developed for certifying green buildings .LEED is developed by USGBC. It is a frame work for assessing building performance against set criteria and standard point of references. The benchmark for the LEED green building rating system were developed in year 2000 and currently available for new and existing construction.

Confederation of Indian industry (CII) formed IGBC in year 2001.IGBC has licensed the LEED green building standard from USGBC. Till date the following green building rating systems are available under IGBC:

- LEED India for new construction (LEED India NC)
- LEED India for core and shell(LEED India CS)
- IGBC green homes
- IGBC Green Factory building
- IGBC Green SEZ
- IGBC Green Townships

Growth in LEED Certified and Registered green buildings in India



Source: Indian Green Business Council

BEE developed its own rating systems for the buildings based on 1 to 5 star scales. More stars mean more energy efficiency.BEE has developed energy performance index (EPI).

IGBC green home rating system evaluate certain mandatory requirements and credit points using a prescriptive approach and others on performance based record. It is a measurement system designed for new and major renovated residential buildings which are broadly classified in two construction type:

1) Individual residential unit (IRU)
2) Multi dwelling residential unit (MRU)
    - Gated communities
    - High rise residential apartments
    - Hostels, service apartments ,resorts, motels and guest houses

IGBC green home rating system addresses green features under the following categories:

1) Site selection and planning (SSP)
2) Water efficiency (WE)
3) Energy efficiency (EE)
4) Materials and resources (MR)
5) Indoor environmental quality (IEQ)
6) Innovation and design process (ID)

IGBC GREEN HOMES CHECK LIST

Sr. No	PARTICULARS	MANDATORY REQUIREMENTS	CREDIT POINTS	
			IRU	MRU
1	SSP	1. Local building regulations 2. Soil erosion control	9	19
2	WE	1. Rain water harvesting 2. Water efficient plumbing	11	18
3	EE	1. CFC free equipment. 2. Minimum Energy performance	22	25
4	MR	1. Separation Of Household Waste	13	18
5	IEQ	1. Tobacco smoke control 2. Minimum day light-50%	15	15
6	ID	---	5	5
		TOTAL	75	100

(SOURCE: IGBC)

IGBC GREEN HOMES CERTIFICATION LEVELS

	POINTS	
RATING	INDIVIDUAL RESIDENTIAL UNIT (IRU)	MULTI –DWELLING RESIDENTIAL UNIT (MRU)
CERTIFIED	38-44	50-59
SILVER	45-51	60-69
GOLD	52-59	70-79
PLATINUM	60-75	80-100

The rating levels "Platinum", "Gold", "Silver", and "Certified" indicate the extent to which a building excels the requirements of the national codes.

ENERGY EFFICIENCY IN GREEN BUILDINGS

Energy efficiency is the first step to green. A building can't be green if it isn't energy efficient . Building energy efficiency is the first step toward achieving sustainability in buildings and organizations. Energy efficiency helps control rising energy costs, reduce environmental footprints, and increase the value and competitiveness of buildings. To cope up with present environmental problems and for sustainability, the best option is renewable energy. Green buildings encourage the use of renewable energy sources like

a) Cool day lighting
b) Passive solar heating and cooling
c) Geothermal heating and cooling
d) Recycled and sustainable materials

Green design and renewable energy can provide us a healthy and efficient house that is also environment friendly and save money in long term.

BARRIERS FOR GREEN BUILDINGS

- Lack of awareness about green buildings.
- Limited availability of local materials and equipments.
- Combating the cost of higher cost of green buildings which new cost is Only around 2% higher of conventional buildings.
- Performance evaluation tools to measure and verify the needs of green buildings under occupation.

CONCLUSION

To achieve green low carbon and sustainable built environment, green buildings are best options. Green building has a potential to save 30-40% of energy consumption with reduction of operating cost and enhance good health.

The green building technology is for the benefit of mankind, society, country and global environmental concerns on large scale.

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Dynamic Changes of Bar Formation of Teesta River Based on GIS Application

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A B S T R A C T

Teesta River is one of the most important river of North Bengal and North-Western region of Bangladesh. In the late eighteenth century this used to be a tributary of Karatoya-Atrai-Jamuna- Saraswati river system. The starting point of this river is situated in the glaciers of Sikkim but climatic condition changed in the last 150 years. Temperature increased 3-4 degrees Celsius as a resent of global warming and other causes. In recent times river Teesta sediment gets its input mainly by rainfall due to the monsoon. So, during monsoon when rainfall increases, the amount of water flow through the channel increases. Thus erosion increases in river Teesta's lower part. The incoming sediment and water discharge make a big role for mid channel bar or side bar. So, result is that deposition also increases over this region. This form of river bars was found in that area. Every year, this continuous process is found in Teesta River. Sand bar data of every year will be able to describe the shifting of the river and it is also dependent on amount of monsoonal rainfall, flood or incoming sediment.

Key words: Channel shifting, Neo-tectonic, Scroll bar topography, Channel avulsion.

INTRODUCTION:

A river has three main principle micro geomorphic features-bar, ripple and pothole. Bar is most important alluvial landform. Some types of bars are Mid-channel bars, Alternate bars and Point bars. The study area is mainly composed of Mid-channel bar and Point bar. Shifting of bar along with shifting of river channel is a natural process depending upon source of sediment, water velocity and sediment roughness. It is the new look and an ample scope for bar deposition and river shifting. Form late eighteenth century to now river Teesta shifted its channel. So, the sandbars are also shifted. River hydrology, subtropical monsoon and sediment production is correlated and main factor for bar shifting (Goodbred, 2003). Flood is the main factors for channel shafting and river bank erosion for any particular river basin (Schumm and Litchy, 1963).Subtropical monsoon affects rainfall which affects river velocity and discharge which further affects sediment production. Greater precipitation is main component for bar shifting (Cullen, 1981). Greater precipitation means high rainfall or high snowfall which affects the bar shifting directly. When the amount of rainfall increases in hilly region, then the rainfall pressure also increases in plain region like lower part of the river and as a result the river floods. Bed load sediment increase of the lower part of the river basin and flow pattern changes (Desai et.al. 2012). C limatic impact and tectonic process effects sediment production, thus causes bar shifting (Curray and Moore, 1971). Sometimes, regional climatic factors are more important than anthropogenic factors. Regional climatic changes and its variation are significant over the river water discharge (Dynesius and Nilsson, 1994). From late eighteenth century till date, the temperature has increased in Himalayan foothills, affecting the flow and bar shifting. Lithological attributes effects on alluvial deposits like bars (Moracke et al.2001).Temporal sediment variation directly effect on sand bar shifting (Prart-Sitaula et al.2003). The topography of the study area is also known as Scroll bar topography, as a series of bars present there. The channel form in the study area is braided. The main characteristics of the braided channel in this area are deposition, flashy discharge and flooding. As the river is mainly fed by rainfall, in monsoon the volume of water is much more than that in winter. The huge amount of water carries huge amount of sediment, which is now deposited to form bar. In every monsoon, a set of bar is deposited and the channel is shifted year by year. Thus the bar also changes from year to year.

Study Area: The study area is located in Teesta River near Jalpaiguri town. It is situated immediate after Teesta Barrage. The type area is located between 26° 28′ 30″ N-26° 3′ 31″ N latitude and 88° 44′ 4″E-88° 46′ 10″E (fig_1). Mainly fine sand bars are present in that area surrounded by flood plains. The area is 9 km in length and 4km in width. The study area is approximately 36sq.km (fig_2).

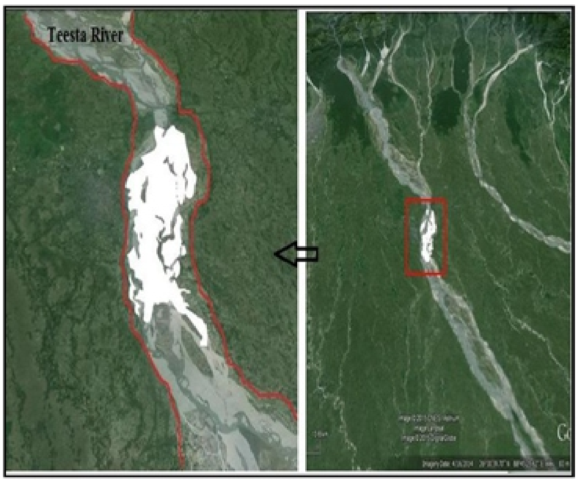

Fig_1. Location map of the study area from Google Earth, Sep, 2015.

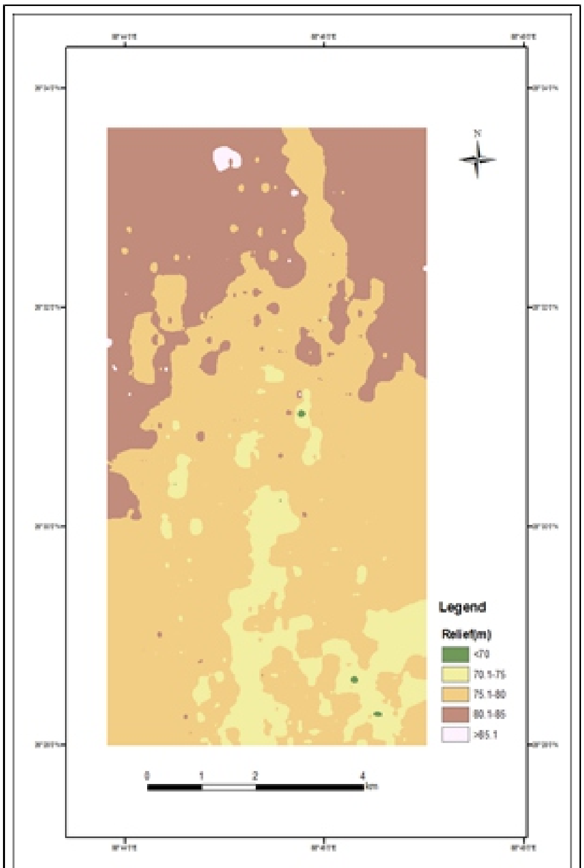

Fig_2. Relief of the study area.

RESEARCH OBJECTIVES:

1. Analysis of the scenario of dynamic shift of sandbars during last 12 years.
2. To understand the direction of shifting of active channel.

METHODOLOGY: This work mainly shows the bar shifting of part the Teesta River. In the initial stage this research mainly identifies the clear objective of the study. This work is totally based on GIS application in different ways. The methods used for the study is analysis of data and graphical representation of data. Software used in this research work is Arc GIS10.2.2. The study area is identified on Google Earth. KML file is created on the Google Earth. Then convert to KML on Arc GIs 10.2.2. Different bar formation provides different information of the study area. The present flow direction map creates by Arc GIs 10.2.2. It is the significant result for bar shifting in this place. When different bars are create in Arc GIs 10.2.2 than we are measurement of area and bar direction from Arc toolbar. At last here, the programs used in this work are Microsoft Word document and Microsoft Excel.

RESPONSIBLE FACTORS FOR DYNAMIC CHANGES OF BAR FORMATION: From the given 12 years data of Teesta River, bar formation and corresponding diagrams provide the changing results of this particular area. Different year like 2014 and 2005 indicates the maximum area of bar formation and the other type of year of bar formation (area) the all-over same. Exceptionally year 2002 is a lower area out of total bar formation. On the other hand bar shifting and its directional changes provide new information. Stream velocity, sediment roughness, and nature of flow are also the responsible factors here. Sand and fine grain sediment make a big role in the deposition of bar formation. Large amount of floods and frequent nature of floods in lower part of Teesta River change their bar formation. From the google earth image observation along with previous data reports provide us with the scenario of flooding of the Teesta River. The nature of the drainage system of the Teesta River is an important factor for river channel shifting and bar shifting. Number of tributary carry large amount of sediment and provide deposition of alluvium. Local lithological factor, structural geology, and neo-tectonic activity are the other causative agents for the formation of bars. Himalayan mountain range is a young fold mountain; the instability is possible factor of this region. Tectonically this region is more active and it is responsible for source of sediment. Land slide and eroded material those are other factors for channel shifting and the result is dynamic changes of bar formation. Monsoon constitutes 80-90% rainfall out of the total rainfall in this area. So, during this time amount of water discharge, sediment load and flood is mainly responsible for bar formation.

RESULTS: Based on various images and analysis of data thereafter we are provided with some important information regarding this region. From 2002 to 2014, during 12 years, the changes of bar formation indicate some fluvial dynamic characters and sediment character (fig_3- 6).

Fig_3. Bar formation of year 2002.

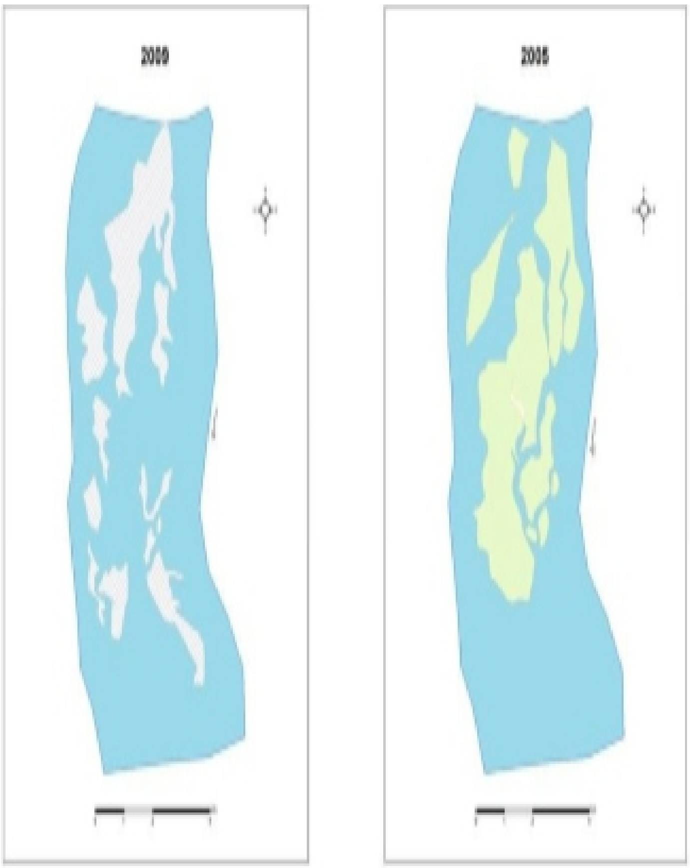

Fig_4. Bar formation of year 2005 & 2009.

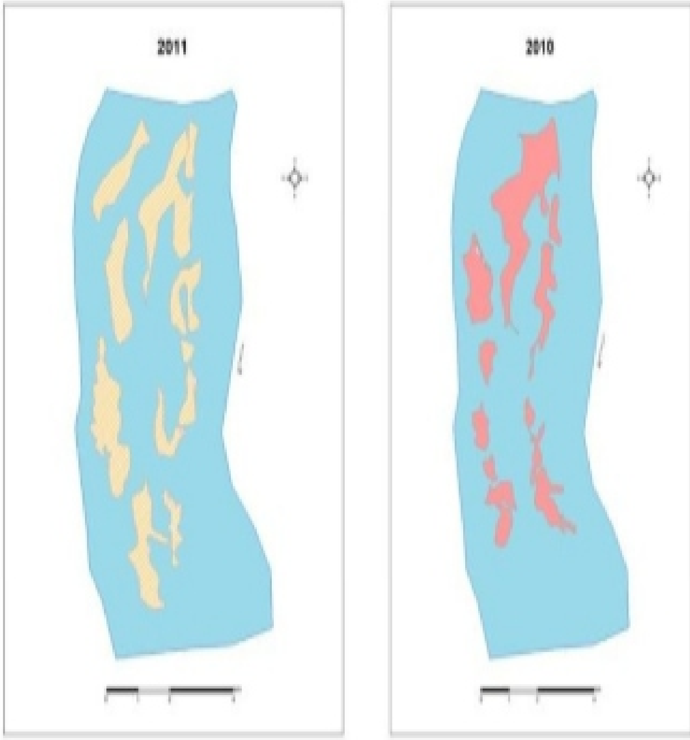

Fig_5. Bar formation of year 2010 & 2011.

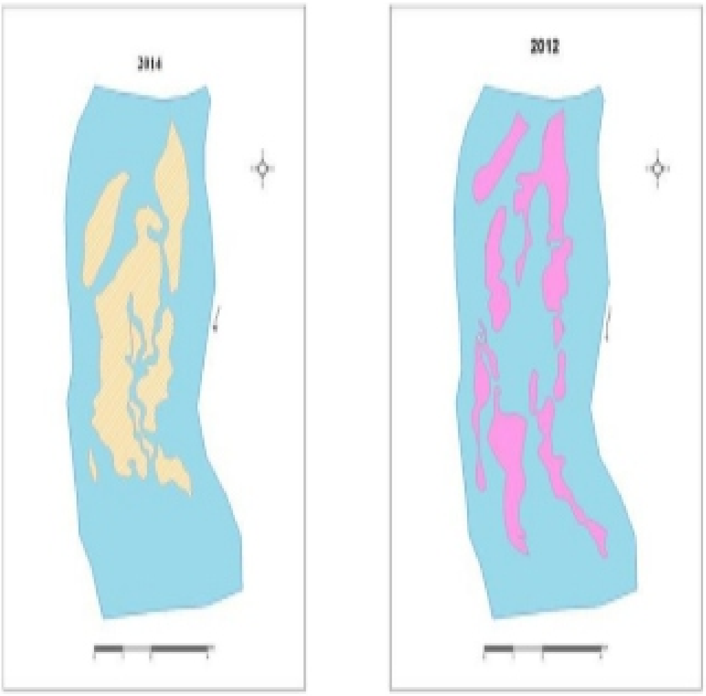

Fig_6. Bar formation of year 2012 & 2014.

The position of channel and the bar avulsion are related to the monsoonal water. Channel geometry, departure of channel and bar shifting in this area is also significant. The channel is braided and this micro landform deposition change from year to year. The year 2005 indicate the maximum deposition (35.56%) and the year 2002 provide the minimum deposition (20.83%) of bar. In year 2009, 2010, 2011and 2012 are almost same. The total area of the bar in 2014 represents 34.81% of the total area (Table_1).

Year	Bar area(sq.km)	Percentage of Bar
2014	12.53	34.81
2012	10.28	28.58
2011	8.73	24.56
2010	7.34	20.39
2009	9.01	25.03
2005	12.8	35.56
2002	7.5	20.83

Table_1. Showing percentage of bar in different years.

Main cause of variation of bars in this area is maximum rainfall due to monsoon and flooding. The possible results are heavy discharge and large amount of sediment supply. On the other side, year 2002, 2011, 2009 also indicates the lower area of bars out of total area (fig_7).

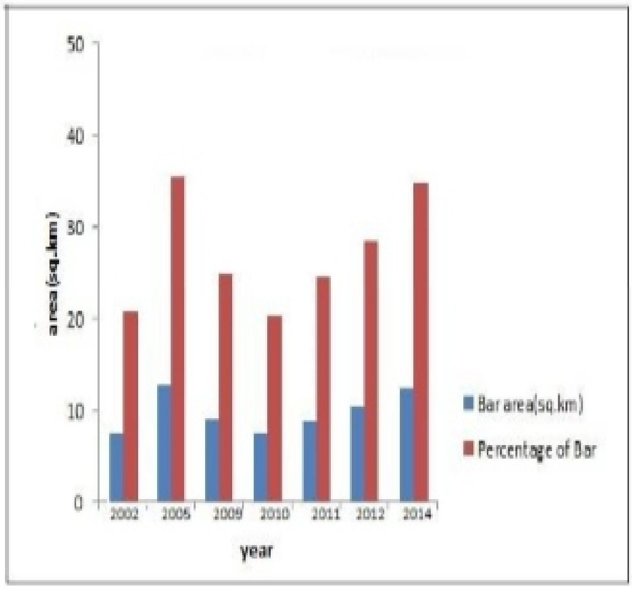

Fig_7. Distribution of bar formation in different years.

Primarily, Bar formation has changed year by year and the elevation of particular point of a bar is also different. Seasonally, incoming sediment and water velocity are affected over the bar and sometime sediment deposition is removed from one place to another. So, bar elevation profile have changes. On the other side, the directional change of bar provide the flow of water discharge. The mean bar direction are mainly south-east direction and south- southeast direction (Table_2), (Fig_8).

Year	Bar mean direction	Bar mean angle
2002	SSE	162° 30?
2005	SSE	168° 30?
2009	SE	142° 00?
2010	SE	148° 30?
2011	SSE	172° 00?
2012	SSE	156° 30?
2014	SSE	176° 30?

Table_2. Bar shifting on different angle in different years.

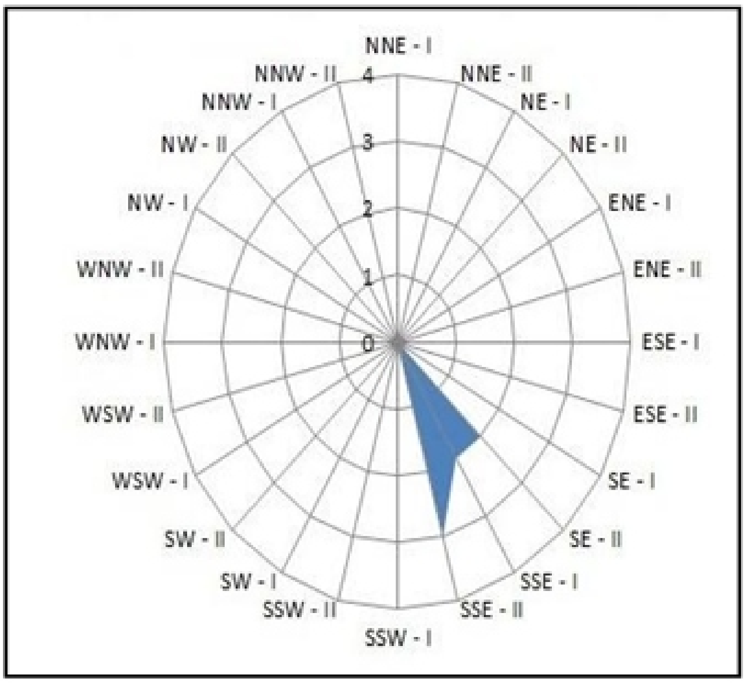

Fig_8. Mean directional changes of bars in different years.

The overall flow velocity nature indicates north to south-east direction. The flow direction indicates the overall regularity of flow and seasonal flow velocity depends on flashy water discharge and heavy rainfall (fig_9).

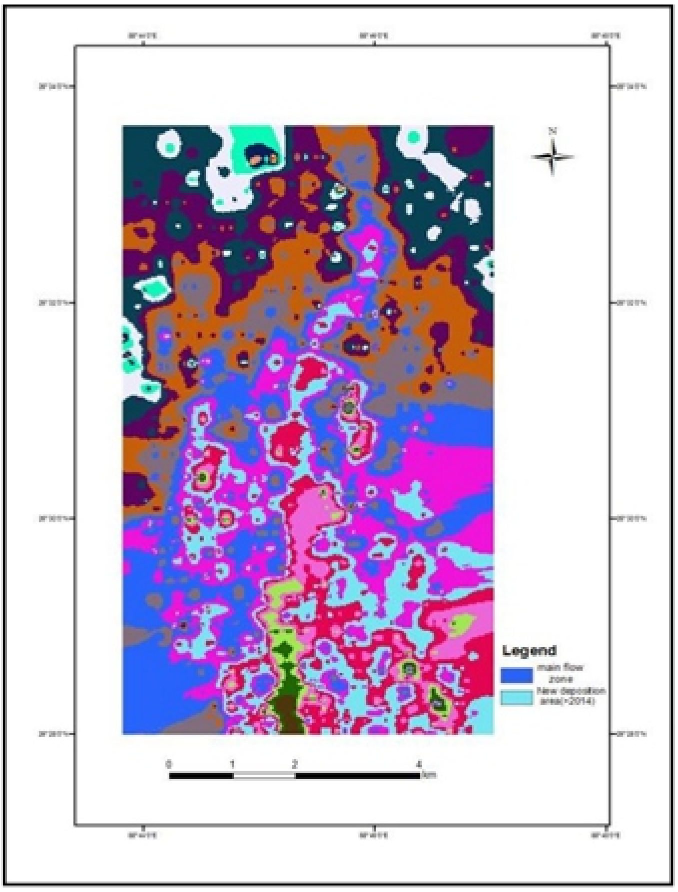

Fig_9. Present flow direction and new bar formation area (Feb, 2015).

But the bar stability of those years provide a new information of this area. Mainly less than 5% (approximate) area indicates the stable bar formation and other 95% bar area is shifted year by year .So, the overall bar instability provide strong relation between deposition of sediment and water velocity. From previous scenario and data provide the flood information and very strong water flow. The erosional power of the flow is most responsible factor for shifting of the bars. Here the zone of intersection is a common zone for stable bar. On the other side, zone of union provide the bar area, those area is an overlapping area but not common area or stable bar. Less than 27% (approximate) area was zone of union. The shadow zone of bar stability isn't too large. So, the union zone and the intersection zone are also related to each other in this area. However, the bar formation of this area was also instable (fig_10).

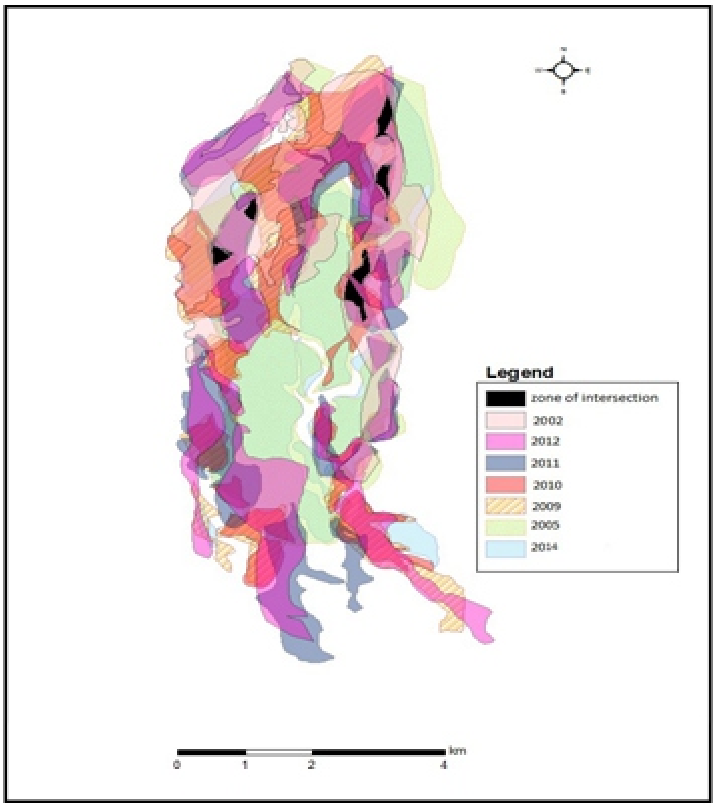

Fig_10. Stable bar area during last 12 years.

CONCLUSION: Detailed analysis of the bar formation and shifting of bars from 2002 to 2014 gives very important information. Flood in monsoon is the main factor for dynamic changes of the bar formation. The incoming sediment has an important role for the changes of bar. Sometime landslide due to cloud burst influence the source of sediment. The result shows, year 2002 and 2005 provide the maximum bar deposits and year 2014 represent minimum bar area. The incoming rain water of previous monsoon is the main factor for these changes. The sediment character of this area is mainly fine grained, coarse sediment and sand. The water flow and discharge are also dependent on incoming rainfall. The tectonic instability of this region is the other source of sediment. The hydraulic factor (water velocity, discharge) is also responsible for bar shifting. The temporal variation of sediment has a big role for bar shifting in this area The bar intersection and union method aids to understands the dynamic (shifting) nature of the bars. Changing and shifting of channel bars are not a new scenario of this region. It is a frequent observation amongst most of the rivers in the alluvial plain and Teesta being one of them.

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Thermoluminescence of Beach Sands Relevant to Radiation Measurements

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A B S T R A C T

In this study the thermoluminescence(TL) properties of natural beach sand sample collected from Saudi Arabia were investigated for the purpose of determining whether it is suitable as a dosimetric material or not. The experiments carried out can be outlined as the effects of pre- irradiation annealing procedures on TL sensitivity and calculating the kinetic parameters. The dose response has a linear behavior over the dose range 0.1Gy-100Gy followed by sub-linearity at higher dose level. The variation in TL signal over two weeks of storage period at room temperature was ~27%. From our results it is possible to conclude that beach sand over the dose range of 0.1Gy -100Gy is a suitable material for dosimetric applications.

1. INTRODUCTION

Sand is a natural material easily available in large quantities. Two important constituents of sand are quartz and feldspar which are well known to show thermoluminescence. Sand also contains varying concentrations of heavy minerals. It can be used as a dosimeter during nuclear emergencies like reactor accidents for monitoring a large number of people [1].

The thermoluminescence (TL) properties of typical sand from India have been studied for possible use as a high gamma dosimeter [1]. Earlier studies showed good dose response linearity in the used range [2]. The dependences of the TL spectra on radiation dose were examined for both laboratory dose and natural dose, which differ by 9 orders of magnitude in dose rate, no effect due to dose rate was observed.

The dose responses of both blue and red emission bands of quartz were examined in the range 0Gy-1600Gy and were found to be highly nonlinear and different. It is shown that the pre-dose effect in the high temperature thermoluminescence peak is associated with the blue emission and not the red emission [3]. The search using X-ray diffractometry and instrumental neutron activation analysis proved that the cause of distinctly different colorations was attributable to the impurity atoms; while structural defects were yielding the blue TL color images [4]. The study of TL characteristics of quartz extracted from sandstones has allowed the approximate determination of the temperature to which they had been exposed [5].Rendell et al.[6] reported on spectral changes induced in the TL of quartz as a result of a variety of thermal treatments. As a result in volcanic quartz material, the ratio of red to blue emission is particularly sensitive to the cooling rate. The blue thermoluminescence (BTL) sensitivities from natural and synthetic quartz samples showed a negative relationship with the Al contents above a few tens of ppm [7]. Scholefield and Prescott [8] study concluded that the blue and red emissions probably involved a common set of electron traps feeding separate luminescence centers, not necessarily in the same grains.

There are some applications of sand as a dosimeter presented in literature. Benny et al [9] reported the application of sand as an in-situ dosimeter for estimating gamma dose observed by sludge during its sterilization. Sand samples have also been used for dating [10]. Investigation of sand as a TL dosimeter for radiotherapy was undertaken by Pitalua et al.[11]. Sand near a nuclear power plant can be used for dose estimation in the case of nuclear emergencies. Sand samples can also be used as ESR dosimeters for different applications in medical, agricultural and industrial areas [12].

Although there has been a lot of work done related to application areas of sand samples in literature, there are no TL studies on sand samples from the Kingdom of Saudi Arabia .The aim of the present work is to carry out some TL studies relevant to gamma measurements on the beach sand sample such as, effect of thermal treatments, glow curves, gamma dose response, batch homogeneity and storage effects using some techniques in Topakasu et al. [13].

2. MATERIAL AND METHODS

The sand sample used in our study is poorly graded sand, with silt taken from Jeddah, the west coast of Saudi Arabia. The sample was sieved and fractions of 75μm were used for TL measurements. The sample was washed with 1N hydrochloric acid; after that distilled water was used to remove the HCl and inorganic impurities. The sample was then allowed to dry at 50°C. Magnetic particles were removed using Franz Magnetic Separator. After washing, drying and removal of magnetic particles, the sand sample was encapsulated in plastic capsules and kept in dark until measurements were achieved.

The results of the chemical composition of the sample obtained by the atomic absorption spectrometry are shown in Table 1.

Table 1: The chemical composition of beach sand.

Element/Compound	Ratio (wt. %)
SiO_2	89.3
Al_2O_3	0.348
Fe_2O_3	0.018
CoO	0.204
CuO	5.07
PbO	3.656

Irradiations were performed at room temperature (25°C-30°C) in air using a 60C° gamma ray source. TL measurements were monitored using a Harshaw 3500 TLD reader. Light pulses were detected by the photomultiplier tube provided with a narrow band blue filter plus Schoot BG39 glass filters of blue-violet transmittance band. A linear heating rate of 5°Cs-1 was chosen; heating the sample from room temperature up to 400°C. The incandescent background was measured then subtracted from the data. To minimize the statistical error, five aliquots each of 7 mg were used for each measurement.

All irradiations and measurements were performed in King Saud University, Saudi Arabia.

3. EXPERIMENTAL RESULTS AND DISCUSSION

3.1 TL glow curves of beach sand before and after annealing process

For investigation of the characteristic TL glow curves, the natural sand sample was heated from room temperature up to 400oC and the TL intensity recorded. Then a second readout was performed to record the background signal of the reader and the sample. An average TL glow curve of the natural sand aliquots without any pre-annealing or irradiation treatments can be seen in Fig.(1).

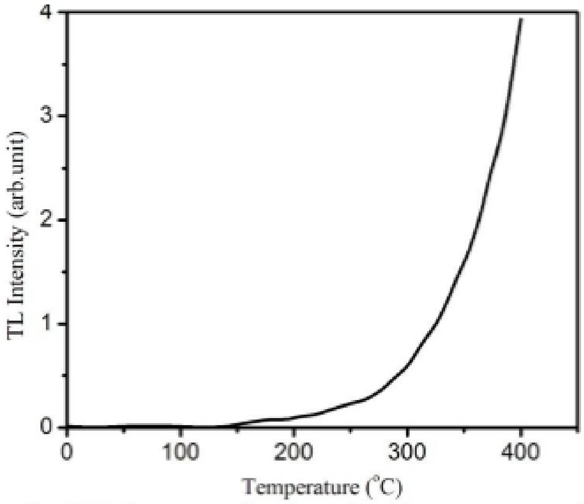

Fig. 1 TL glow curve of sand sample without any pre-annealing or irradiation treatment (The back ground is already subtracted).

3.2 Thermal treatment

The natural sand aliquots were pre-heated at different temperatures ranging from 250°C-700°C, for 15 min, cooled in air and subsequently irradiated up to γ-dose of 50Gy. After 1 h of irradiation the TL glow curves were read out. Important modifications in the shape of the glow curve are observed (Fig. 2).

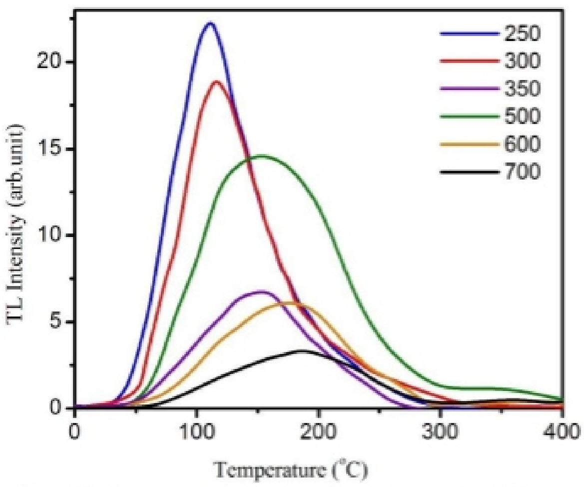

Fig. 2 TL glow curves of sand sample pre-annealed at different temperatures changing from 250°C up to 700°C.

Treated aliquots show one main TL peak starting at~130°C after annealing at 250°C and gradually shifted to 190°C after annealing at 700°C (Fig. 3).

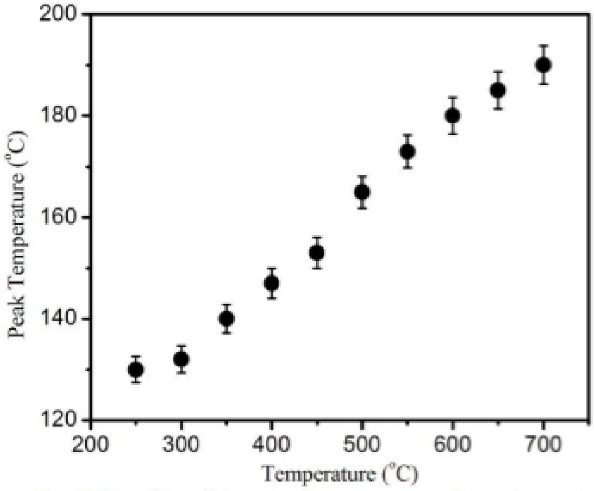

Fig. 3 The effect of the annealing process, on the peak temperature of the TL glow curves of sand.

Figure (4) shows the normalized TL sensitivity (i. e. the TL output per unit test dose) measured in the range from room temperature up to 400 °C as a function of annealing temperature. The main effect of this thermal treatment is an increase of the TL signal with increasing temperature. The sensitivity of sand sample annealed at 500 °C is found to be ~ 1.5 times that annealed at 250 °C. This sensitizing effect of thermoluoninescence may be due to heat- induced changes in the population of radiation induced defects or in the diffusion of impurities to the lattice, or interstitial sites at which they constitute effective trapping centers [14.15]. The reduction of TL intensity at temperatures ≥ 550 °C can be attributed to thermal quenching [16]. As can be seen in Fig.(4), the changes of TL sensitivity become smaller around 400°C. Eventually in this study, the most convenient annealing temperature was 400 °C.

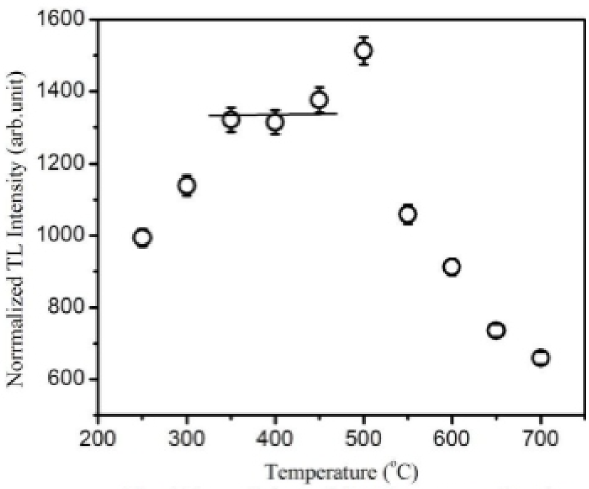

Fig. 4 The variations of the TL response of sand with the pre-heating temperature.

3.3 Gamma irradiations

In order to examine the TL glow curve of beach sand aliquots after annealing and irradiation process, the aliquots were annealed with the annealing receipt of 400°C (15min + cooling to room temperature). Afterwards they were irradiated with different doses in the range 0.1 Gy- 1000 Gy and the TL glow curves were recorded 30 min after irradiations. As it is seen in Fig.(5 a), the TL glow curve has one peak ~ 145°C after annealing and irradiation to a gamma dose of 10Gy then shifted to slightly higher temperature at ~148°C with increase of dose to 50 Gy. In the high dose range 0.25 kGy-1 kGy (Fig. 5 b) two peaks appeared; the first one at 153°C, which shifted to a higher temperature at 165°C, the second peak appeared at 293°C, and shifted to a lower temperature at 285°C. The previously investigated beach sand [11] exhibited the same low temperature peaks at ~145°C and 148°C.

3.4 Dose response

The plot of the TL signal versus dose, yields the so called 'growth curve'. The signal was estimated as an integrated TL signal over the temperature range from 50°C to 400°C. Gamma irradiations were obtained by carrying out laboratory irradiations with a $60C^o$ source, in the range from 0.1 Gy to 1000Gy.

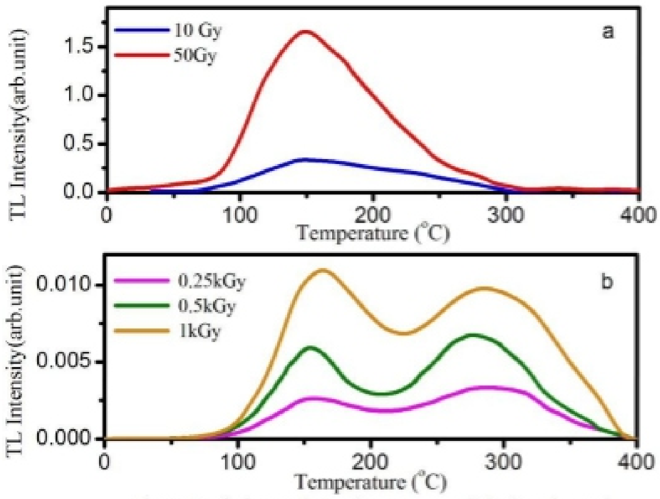

Fig.5: Variations of TL glow curves of the beach sand with the irradiation gamma dose.

After 30 min of irradiations the TL signal was read out. Figure (6) shows the dose response of beach sand over the dose range 0.1 Gy - 1000Gy. The TL response follows linear relation Y=0.0001X+ 0.013 followed by sub linearity Y=0.0047 X0.8808 with the correlation coefficients R^2=0.921and R^2=0.988 over the dose ranges 0.1Gy- 100Gy and 200Gy – 1000Gy respectively. Where Y corresponds to the TL intensity per gm and X is the irradiation dose in Gy.

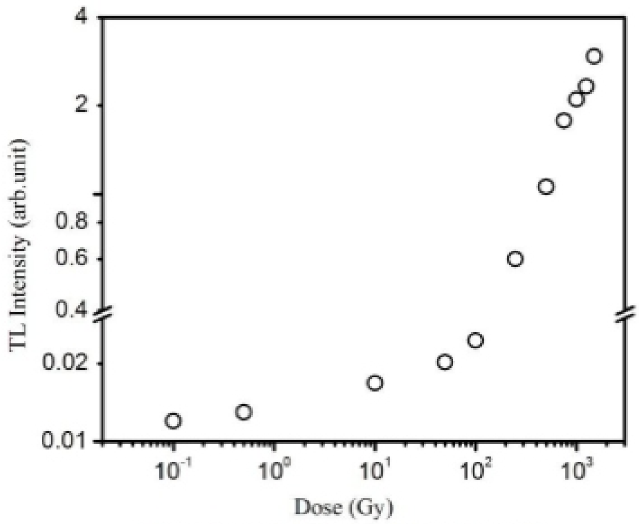

Fig.6: The variability of TL intensity with incremeant of gamma radiation dose.

The TL intensity of the natural sample (measured from Fig.(1) and estimated from the dose response curve (Fig.6)) corresponds to a laboratory irradiated dose with a ɣ -dose of 1.06 Gy. The minimum dose detected by the investigated material was 0.1Gy, after being subjected to gamma radiation. The previously studied samples [11] exhibited a linear dose response over the range 1 Gy– 10 Gy.

3.5 Kinetic analysis

Calculations of trap parameters related to the TL peaks of beach sand were performed by the 'initial rise' method. This method is known to be based on the assumption that the initial rise of a glow peak is independent of the kinetic order in the TL response, so that it may be represented by the following equation:

$$I \,\alpha\, \exp\left(-\frac{E}{kT}\right) \qquad (1)$$

where I is the TL intensity, E (eV) the activation energy, k (eV/k) the Boltzmann constant and T (K) the absolute temperature. A plot of ln (I) vs. 1/T over the initial part of the peak gives a straight line with slope – E/k. The frequency factor S is given by

$$S = \left(\frac{\beta}{k}\right)\left(\frac{E}{T_m^2}\right)\exp\left(\frac{E}{kT_m}\right) \qquad (2)$$

where β is the heating rate and T_m is the glow peak maximum. In this procedure, the beach sand has discrete sets of traps for both the natural and laboratory – induced glow curves (Table 2).

Table 2: Determined trapping parameters of the main peaks of the beach sand.

T_m(°C) Peak temperature	E(eV) Activation energy	S(s^{-1}) Frequency factor
145	0.1584	143958.735
148	0.44047	1.25E+15
153	0.23717	3.97E+07
155	0.28676	1.53E+09
165	0.28974	4.56E+08
285	0.69441	1.00E+12
290	0.68297	3.69E+11
293	0.62378	2.38E+10

3.6 Storage effects

TL fading of the beach sand studied is as follows: Large amounts of aliquots (annealed at 400°C for min) were irradiated (50Gy) and stored for a period of 14 days (d) in dark, at room temperature before the TL reading was taken. Small amounts of them were used as control samples, first being stored and then irradiated with a dose identical to the above mentioned, and read out immediately on the same day to avoid variations from instrumental drift. Glow curves of the blue band are shown in Fig. 7 after a delay period of t= 14d and without any delay period (t= 0d). The 'plateau test' is also shown in Fig. 7; in which the ratio between the two glow curves; at t = 14 d and the prompt at t = 0 is compared. This ratio is seen to rise from zero to maximum value 0.134 near 140°C.

In Fig. (8) the TL intensity is observed to settle down to a 94% of the initial value after one day of storage. Total fading is obtained as 73% of the TL left after 9 days of storage at room temperature, and remained constant over 14 days. Using this remnant (73%) of TL, the calculated natural dose in Section 3.4 (~1.06Gy) is corrected to 1.452Gy.The previously studied beach sand sample [11] after 5 days of storage at ambient conditions showed a signal decay of 36% approximately , tending to a constant value during the next 30 days.

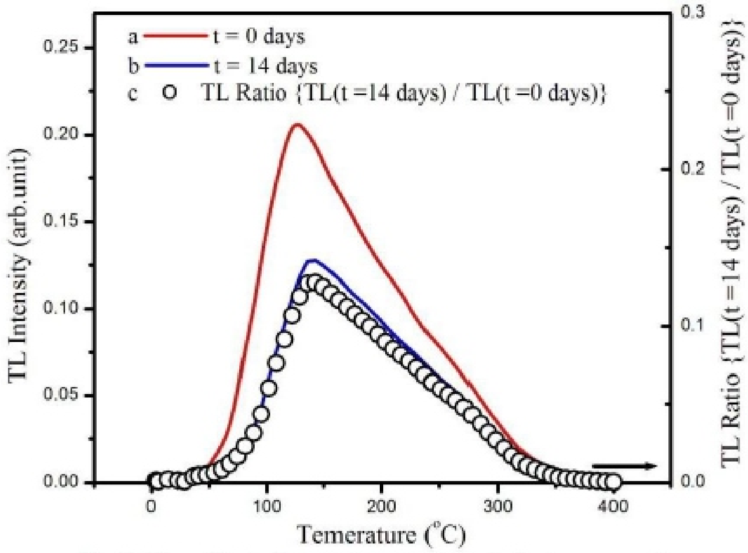

Fig.7: The effect of room temperature dark storage on the laboratory - induced glow curves of beach sand (a) Immediately after radiation ,(b) After 14 days of storage and (c)TL Ratio {TL(t =14 days) / TL(t =0 days)}.

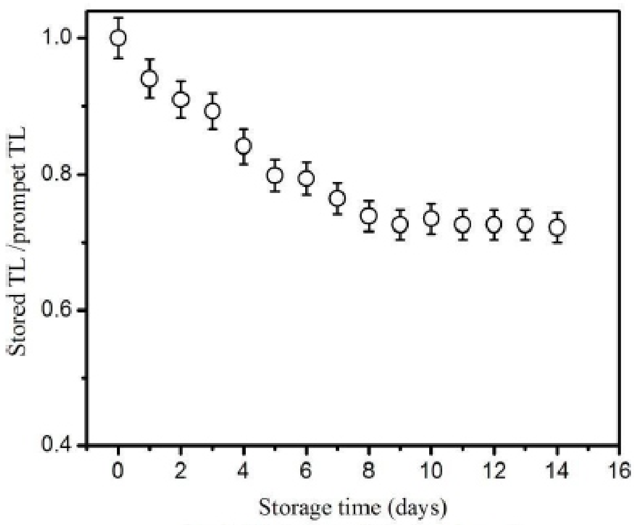

Fig.8: TL fading of the beach sand.

3.7 Batch homogeneity

It is recommended that the evaluated value of the batch homogeneity for any dosimeter will not differ from the evaluated value of any other in the same batch by not more than 30% [17]. Using the following definition of the batch homogeneity (f),

$$f = \frac{TL_{max} - TL_{min}}{TL_{min}} \leq 30\%$$

The average value of f for beach sand has been estimated to be 23.2±1.35% over the low dose range 0.1Gy-100 Gy and 28.3±1.08% over the high dose range 500Gy-1000Gy, which is lower than recommended upper limit.

4. DISCUSSION

By comparing the glow curves of the investigated material with the others [11], it appears that they have the same peaks at 145°C and 148°C when irradiated with low doses. This low intensity is associated with a lower concentration of defects of traps in the material, leading to a lower concentration of electrons in traps and holes in the recombination centers. Initial rise method showed trap depth values in the range 0.158 eV – 0.694 eV and frequency factor values in the range 143958.7 s-1 – 1.25E+15 s-1.

The changes of peaks positions with increase of absorbed doses signify that either a multilevel or continuous distribution of trap depths is associated with the main TL peaks [18], which means that these peaks are likely to be a second order kinetics [19]. The sample presented a constant level of TL decay at 73% during the 9 days of storage at room temperature.

5. CONCLUSION

Beach sand showed a strong natural blue TL signal during the first cycle of heating to 400°C with an estimated natural dose of ~1.452Gy. The annealing study showed one main TL peak that started at 130°C after treatment at 250°C and gradually shifted to 190°C after treatment at 700°C. The TL sensitivity of aliquots annealed at 500°C is found to be 1.5 times of that annealed at 250°C. The TL characteristics of the investigated material such as: small weight (~7mg), simple glow curve, strong natural signal, linear TL dose response, and a good batch of homogeneity, offers beach sand the possibility of being used in radiation dosimetry over the dose range of 0.1Gy – 100Gy. A future study of post radiation heat treatment may reduce TL fading effects and increase sensitivity to radiation.

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