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BREAST CANCER

All that you need to know

A Guide for general understanding of breast cancer, Risk factors, Genetics and Management

DR. NANDINI VAZ FERNANDES
DR. PREETESH KOTE
MS. REGINA FERNANDES

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PREFACE

Dr. Nandini Vaz Fernandes

Breast cancer survival rate in India is low because of failure of early detection. Many lives can be saved if breast cancer is detected early. The only way to change the high death rate is by increasing awareness on breast cancer. Fortunately, Breast cancer is a treatable disease and the chances of survival are higher if it is detected early. Therefore, women need to have a better understanding of this condition. This book is written with a purpose of creating this much needed awareness on breast cancer.

The Book is specifically scripted for women who would like to understand breast cancer more deeply. We tried to keep the language simple for the ease of understanding of the readers of all walks of life. Further, glossary of the terms used in given as an appendix. The book describes all that you need to know about breast cancer, its mechanism, how it progresses, the possible risk factors, diagnosis and management. We have also added a topic on genetic counseling for breast cancer so that many women are benefitted. The book also gives illustrations for better understanding of the content.

We wish our readers 'happy reading' to be more informed and stay healthy.

DR. NANDINI VAZ FERNANDES

Breast Cancer is a treatable disease and the chances of survival are higher if it is detected early.Therefore women need to have a better understanding of this condition. This book is written with a purpose of creating this much needed awareness on breast cancer. The book describes all that you need to know about breast cancer , its mechanism , how it progresses , the possible risk factors , diagnosis and management . "Assuredly, health conscious women reading this book authored by Dr.Fernandes,Dr. Kote and Ms. Fernandes, will be well informed and less anxious in life." says Dr. Phillip.

We wish our readers 'Happy Reading' and be more informed and stay healthy.

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Uday Chatterjee · Angela Oyilieze Akanwa · Suresh Kumar · Sudhir Kumar Singh · Abira Dutta Roy *Editors*

Ecological Footprints of Climate Change

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Dedicated to Young Scholars in the Field of Geography, Environmental Science and Sustainability Science

Chapter 20
Analysing Spatio-temporal Changes in Land Surface Temperature of Coastal Goa Using LANDSAT Satellite Data

Venkatesh G. Prabhu Gaonkar, F. M. Nadaf, Vikas BalajiraoKapale, Siddhi Gaonkar, Sumata Shetkar, and Merel D'Silva

Abstract Rising temperatures, ice cap melting, sea level rising, heatwaves, droughts, flooding, extreme cold and snow, tropical cyclones and extratropical storms are some of the key environmental concerns confronting the planet today due to climate change and anthropogenic actions. To detect climate change, and estimate the temperature, land surface temperature (LST) is a very vital parameter. Evaluation of LST helps in understanding temperature differences, which in turn, is affected by Normalized Difference Vegetation Index (NDVI), altitude, and land cover. At a given place and time both natural and anthropogenic activities affect LST.

The studies conducted in different parts of the world including Goa and India indicate the impacts of climate change on different ecosystems. Hence, to quantify the spatio-temporal variability of the LST in Coastal Goa, Landsat series for 1991–2021 were used. A six-fold process using geospatial tools is employed to determine the land surface temperature. The present study shows that the processed mean land surface temperatures, data obtained from data access viewer as well as meteorological data exhibit a similar trend.

Keywords Land Surface Temperature (LST) · Earth surface · Satellite Data · Normalized Difference Vegetation Index (NDVI) · Land use land cover

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Introduction

Land surface temperature (LST) and air temperature are two different parameters. NASA defines land surface temperature as 'a condition of the Earth at a given geographic location that indicates the heat of the surface'. The sensors fitted to the satellite, observe the surface which includes snow cover, grass, the roof of a structure, or the greenery which is perceived by the sensors as the earth's 'surface' (Li and Duan 2017). LST is also well-defined as the emitted temperature of the skin of the earth's surface received by satellite-based distant sensors (Copernicus 2021). On the other hand, air temperature is the condition just above the surface which is normally recorded using weather instruments.

Land surface temperature is an important parameter in land surface processes, not only because it serves as an indicator of climate change, but also because it controls upward terrestrial radiation (Sun 2008). Determination of LST requires thorough attention towards the intensity of solar radiation (energy received per unit time per unit surface area of the Earth). During the winter solstice, the angle of depression of the Sun is lowest vis-a-vis the angle of incidence of solar radiation in the northern hemisphere is highest which in turn increases the distance solar radiation has to travel through the atmosphere which directly affects the amount of energy received and emitted by the Earth's surface. The solar energy intercepted by the earth fluctuates by $\pm 3.3\%$ about the mean value due to variations in the sun-earth distance, with the maximum at the start of January and the lowest at the start of July (Landsberg 1961).

Land surface temperature is a precise estimation tool for signifying the energy exchange balance between the Earth and the Atmosphere (Youneszadeh et al. 2015). It is also a vital variable in estimating the temperature of the surface of the earth which helps in understanding global climate change (Devi et al. 2020). The level of LST is fundamentally affected by the altitude, gradient and aspect. Notwithstanding, physiography is one of the variables that regulates distribution of soil moisture and applies an extra impact on the LST (Youneszadeh et al. 2015).

Varied land use categories have different surface reflectance and roughness, resulting in variances in land surface temperature (Deng et al. 2018). Specular surfaces have uniform reflection whereas Lambertian surfaces have diffused reflection (Griffiths and De Haseth 2007). Non-evaporative and non-porous urban materials tend to have high heat capacity and low solar reflectivity compared to organic surfaces. Thermal inertia is very high for materials such as concrete masses, asphalt roads and metal surfaces (Farina 2012).

The underlying premise behind using satellite imagery to estimate soil moisture is that soil moisture has an impact on surface properties that can be measured through remote sensing techniques. Biophysical elements like vegetation cover can be assessed by vegetation indices, and the surface energy balance can be measured by surface temperature (Petropoulos et al. 2009; Wang and Qu 2009; Shafian and Maas 2015). Soil moisture and vegetation cover are two de-facto features that have complex interdependency and the highest weighted value in the determination of

LST (Carlson et al. 1994; Entezari et al. 2019). We must take into account the fact that barren land and moisture-rich soil have different thermal signatures (Moukalled et al. 2006).

Vegetation may be recognized from most other materials using remote sensing data due to its noticeable absorption in the red and blue regions of the visible spectrum. The spatial and spectral resolution helps to understand to determine NDVI. This index has been used to correct land surface emissivity and also serves as a pivot point in the calculation of LST.

Many studies have been conducted by scientists to study LST using Landsat data (Ravanelli et al. 2018). To comprehend the physical processes, Landsat data has opened the floodgates through remote sensing (Yuvaraj 2020). Surface temperature is a vital parameter to map and monitor environmental complications (Becker and Li 1990).

For changes in land use and land cover, human and natural actions are principally blameworthy (Brovkin et al. 2013). Alterations in land cover have impacted the environment framework through the release of Green House Gases, for example, CO_2 and CH_4 and adjustment of land surface albedo, evapotranspiration, and surface roughness. Changes in the land cover affect both regional and global climates (Brovkin et al. 2006). Due to a blend of physical and anthropogenic reasons, there are modifications in the climatic patterns of a geographical area over a long period (Lambeck 2010).

Over the last century, the Earth's climate has warmed by about 0.6 °C, with two major periods of warming occurring between 1910 and 1945, and from 1976 onwards (Walther et al. 2002). Climate change has a direct impact on land surface temperature (LST) and accelerates permafrost thawing, which affects land degradation, sea level rise, etc. (Lawrence and Slater 2005; Zimov et al. 2006; Petropoulos et al. 2012; Haigh and Cargill 2015).

Urbanization brings key changes in land use thereby affecting LST by destabilizing the surface energy balance (Imran et al. 2021). Urban hydrology, urban heat islands (UHI), temperature regimes, and others are some of the major changes inflicted by the land use/cover changes which have led to unsustainable environments (Grover and Singh 2016). Further UHI affects local and global climate change due to city power consumption (Chotchaiwong and Wijitkosum 2019). Climate change is perhaps the most serious problem planet is facing. Past research indicates that climate change significantly affects the land surface temperature and other parameters (Mustafa et al. 2020).

Many research studies have investigated the various aspects of rainfall, temperature and climate change in Goa. However, only a few studies have examined land surface temperature and land use land cover change in Goa.

Dhorde and Korade have studied trends in surface temperature variability over Panaji City of Goa and indicated that Panaji has shown signs of warming with change in seasons (Dhorde 2015). T. V. Ramachandra, Uttam Kumar and Anindita Dasgupta in their technical report "Analysis of land surface temperature and rainfall with landscape dynamics in Western Ghats" have observed that area under dense forest has declined and area under agricultural/grassland has amplified in the

Western Ghats. The rainfall showed a decreasing trend in the pattern over forest and agricultural/grassland. Further, the study specifies various responses to changing LST and precipitation with reference to NDVI of dense vegetation (Ramachandra et al. 2016).

The study of Ramaiah, Avtar and Rahman endeavours to look at Panaji and Tumkur cities of India with the help of landscape sensitivity analysis and its effect on LST. The study uncovers that water bodies and vegetation are effectively responsible in reducing LST (Ramaiah et al. 2020). The IMD, Pune report "Climate of Goa State", makes an attempt to study the Climate of Goa with the help of meteorological data (India Meteorological Department 2019).

As per the "State Action Plan on Climate Change for the State of Goa for Period of 2020–2030", between 1901 and 2018, the mean annual temperature of Goa has increased more than 1 °C with noticeable rise during 1990–2018. Further, the report predicts that under the high emission circumstances, the mean annual temperatures may rise by 2 °C in 2030s and 4 °C by 2080s in relation to 1901–1950. The state of Goa will begin encountering hot spells (>40 °C) beyond 2040s due to rise in temperature by 5 °C towards the culmination of this century under high emission conditions. Under high emission conditions, the minimum temperatures are relied upon to upsurge more than to 8 °C by the end of this era (NABARD 2012). Hence, in the light of the above observations, this chapter makes an attempt to explore the spatio-temporal changes in land surface temperature using Landsat data.

Objectives

The key objectives of this study include

1. To examine spatio-temporal changes in land surface temperature from 1991 to 2021 in coastal Goa using Landsat series data.
2. To validate land surface temperature with the help of Data Access Viewer and Meteorological data.
3. To identify and examine the spatial pockets revealing the rise in land surface temperature.

Study Area

Goa located along the coast of the Arabian Sea is a geographically tiny yet highly diversified state. Administratively state is divided into 12 talukas (administrative units) of which 7 talukas namely Pernem, Bardez, Tiswadi, Mormugao, Salcete, Quepem and Canacona are coastal talukas. The coast of Goa is 105 km long with varying widths (Nadaf 2019). The coast of Goa is dotted with some of the breath-taking beaches of the world Arambol, Anjuna, Baga, **Vagator, Calangute,** Miramar, Colva, Agonda, Palolem, Patnem and Galgibag and incredible estuarine rivers and

mangrove ecosystem. Arambol and Galgibag beaches are identified for Olive Ridley Turtle nesting sites (Nadaf 2020).

For this study, the costal Goa is explicitly divided into three regions, i.e. Northern Coast, Mid Coast and Southern Coast. The Northern Coast consists of the coast of Pernem, Bardez and Tiswadi. Mormugao and Salcete make the mid-coast, whereas Quepem and Canacona encompass the Southern Coast (Fig. 20.1).

Goa is a tourist paradise for both domestic and international tourists which is also the treasure of mineral wealth. It is known for some of its spectacular beaches and wildlife sanctuaries. Tourism in Goa began immediately after its liberation in 1961, since 1975 growth has been alarming (Table 20.1). Just before Covid-19 lockdowns, 80,03,795 tourists visited the fascinating beaches of Goa. Such a huge tourist footfall requires strong infrastructure such as stared hotels, resorts, pubs, shacks, housing apartments, transport network connectivity, etc. (Table 20.2).

The coastal Goa is dotted with 3900 hotels and a large number of beach shacks with 48,534 rooms and 83,706 beds. Such a huge infrastructure in a tiny state of Goa which is sandwiched between the Western Ghats and the Arabian Sea is possible only by changing land use land cover.

The study conducted by the Government of India suggests that many beaches have exceeded the carrying capacity. This has led to the adverse impact on the coastal ecosystem ((NCSCM, GOI) 2017).

The Western Ghats of Goa are known to have rich reserves of iron ore and manganese. Of the 600 square kilometres of the total area of the Western Ghats, mineral wealth is found in 350 square kilometres of area. For a very long time, mining remained as the backbone of Goan economy along with tourism. The mining that is carried out in the Western Ghats is responsible for cascading effects of flooding in low-lying areas during the monsoon season (Alvares 2002).

Of late, the Arabian Sea and the coast of Goa have been experiencing severe cyclones. According to a study conducted by the Indian Institute of Tropical Meteorology, severe cyclones have increased by 150% in the Arabian Sea with 260% rise in their duration (Deshpande et al. 2021). Climate change is a major issue in coastal areas. Rise in sea level and occurrence and intensity of cyclonic storms are the major impacts of global climate change on the coast and people (TERI 2015). The recent cyclones such as Ockhi, Maha, Kyarr, Vayu, Nisarga and Tauktae have caused irreparable damage to the coast of Goa.

Materials and Methods

This study is an outcome of both primary and secondary data. Primary data is obtained from field observations and ground-truthing. Secondary data includes satellite images from the LANDSAT Series of TM, ETM+ and OLI (Table 20.3).

Out of 30 years, data for only 21 years was available for analysis due to technical errors. In addition, several sources were considered for data validation, such as NASA's Data Access Viewer and data from India Meteorological Department (Fig. 20.2).

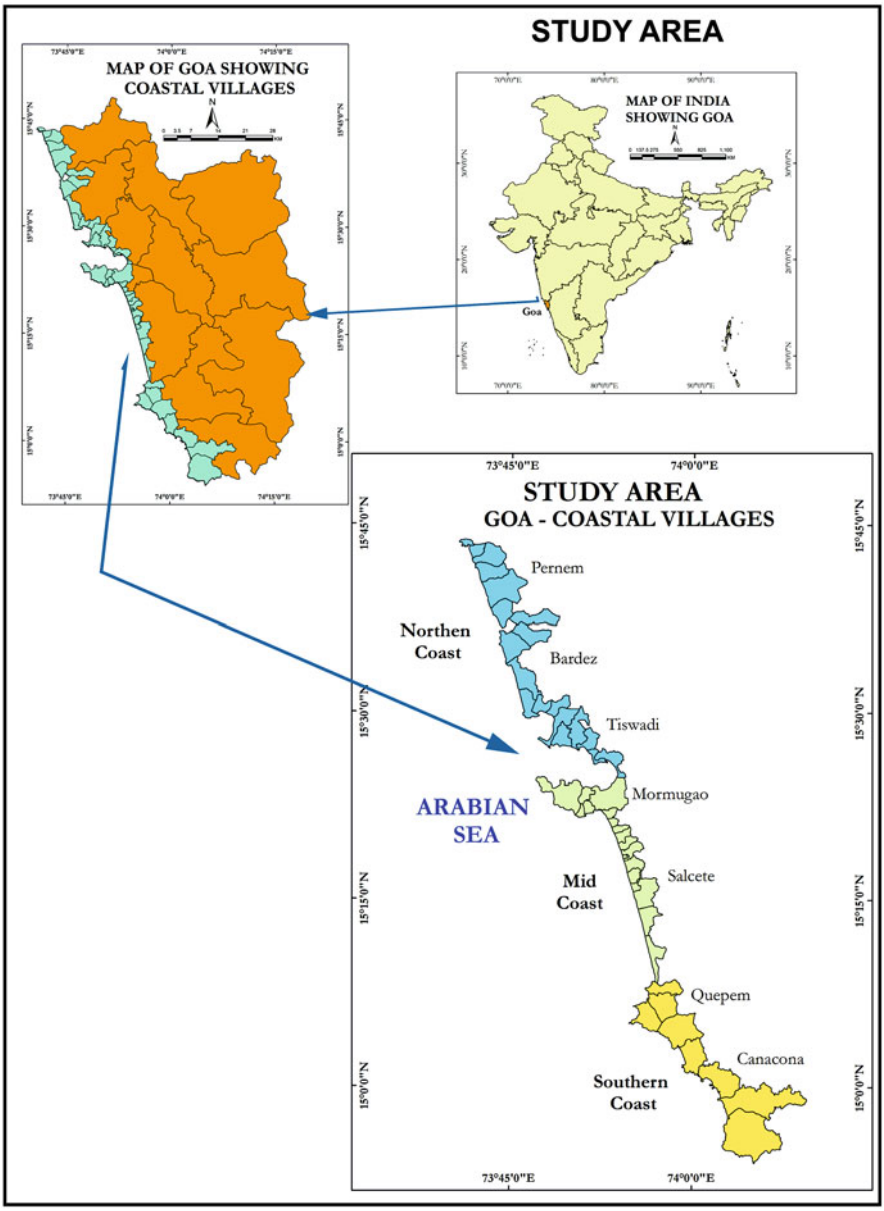


Fig. 20.1 Study area

Table 20.1 Domestic and foreign tourist arrivals in Coastal Goa

Year	Domestic tourists	Foreign tourists	Total tourists
1965	61,252	1939	63,191
1975	1,98,110	14,521	2,12,631
1985	6,64,692	87,599	7,52,291
1995	8,78,487	2,29,218	11,07,705
2010	19,94,711	3,66,940	23,61,651
2015	48,36,711	5,84,032	54,20,743
2018	69,51,467	9,22,766	78,74,233
2019	71,05,587	8,98,208	80,03,795

Source: Department of Tourism, Government of Goa & Statistical Handbooks of Goa

Table 20.2 Tourism infrastructure

Total number of Hotels/Paying Guest House, Rooms and Beds as on 31.03.2019 (including Star Category and Heritage Hotels)			
Category	No. of hotels	No. of rooms	No. of beds
A	84	9034	15,189
B	252	10,156	17,467
C	715	11,450	20,495
D	2784	12,508	20,516
Star category hotels	63	5362	10,001
Heritage hotels	02	24	38
TOTAL	**3900**	**48,534**	**83,706**

Source: Department of Tourism, Government of Goa

Table 20.3 Satellite images used in the study

Sr. No	Satellite	Sensor	Years	Resolution	Path	Row	No of bands	Cloud cover
1	Landsat	TM	1991, 1992, 1993, 1994,1995,1997, 1999	30 m Thermal band (120 m)	146, 147	49, 50	7	Nil
2	Landsat	ETM+	2001, 2002, 2005, 2008, 2009, 2010, 2011	30 m Thermal band (60 m)	146, 147	49, 50	8	Nil
3	Landsat	OLI	2014, 2015, 2016, 2017, 2019, 2020, 2021	30 m Thermal band (100 m)	146, 147	49, 50	11	Nil

DIVA-GIS was used for obtaining shapefiles for the area under investigation. For processing, Arc Map 10.7.1 version was utilized. Raster datasets were superimposed with shapefiles of the study area and then extracted. Mosaic operations were used to combine the clipped raster datasets.

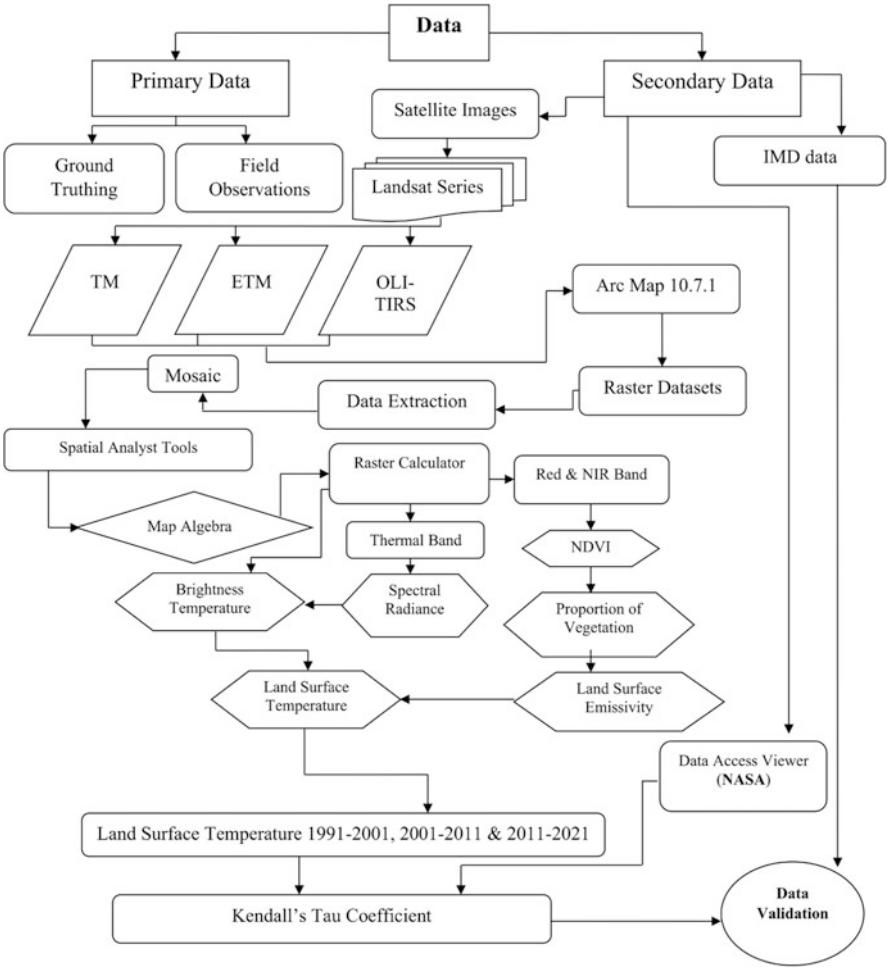


Fig. 20.2 Flowchart for LST retrieval

Spatial analyst tools were employed to conduct the analysis. To calculate various algorithms Raster Calculator was used. To derive near accurate results formulas (U.S. Geological Survey 2016) have been used to calculate surface radiance, brightness temperature, NDVI, proportion of vegetation, land surface emissivity, and land surface temperature (Carlson and Ripley 1997).

The output of spectral radiance is used to calculate brightness temperature using the thermal infrared band. On the other hand, red band and near infrared (NIR) band are applied for the Normalized Difference Vegetation Index (NDVI) and the proportion of vegetation. The proportion of vegetation is required for the determination of land surface emissivity. Finally, data validation is carried out using NASA's Data Access Viewer and meteorological data by applying Kendall's Tau coefficient.

Top of Atmospheric Radiance

The first step in the calculations of LST is a conversion of DN value to the top of atmospheric radiance. LST, as well as emissivity, have to be derived from active or passive electromagnetic radiation leaving the Earth's surface. These measurements are done by satellite sensors integrating radiating effect of various surface features (Dash et al. 2002). DN is the Digital Number value assigned to each pixel in a given raster. These values represent the intensity of electromagnetic radiation captured by the sensors onboard the satellite.

For Landsat 5 (TM) and Landsat 7(ETM+)

The following formula is taken from Landsat 7 data:

Band_6 for Landsat 5(TM) andBand_6_VCID 1 for Landsat 7 (ETM+) is selected for the calculations (Ihlen and Zanter 2019).

$$L_{\Delta} = \left(\frac{L_{\mathrm{Max}\Delta} - L_{\mathrm{Min}\Delta}}{Q_{\mathrm{cal(max)}} - Q_{\mathrm{cal(min)}}}\right) \times \left(Q_{\mathrm{cal}} - Q_{\mathrm{cal(min)}}\right) + L_{\mathrm{min}\,\Delta}$$

where

L_{Δ}= Spectral Radiance

$L_{\mathrm{Max}\Delta}$= Spectral Radiance of band 6 (Read from MetaData as RADIANCE_MAXIMUM_BAND_X)

$L_{\mathrm{Min}\Delta}$= Spectral radiance of band 6 scaled to $Q_{\mathrm{cal(min)}}$ (From Meta Data read RADIANCE_MINIMUM_BAND_X)

Q_{cal}= Quantized calibrated pixel value (While performing calculations Insert Raster file of BAND_X in the raster calculator)

$Q_{\mathrm{cal(max)}}$= Maximum quantized calibrated pixel value (Form MetaData QUANTIZE_CAL_MAX_BAND_X)

$Q_{\mathrm{cal(min)}}$= Minimum quantized Pixel value (From MetaData QUANTIZE_CAL_MIN_BAND_X)

X represents Band Number

For Landsat 8 (OLI and TIRS)

For sensor spectral radiance, the following formula is used:

Band_10 is used for the calculations (U.S. Geological Survey 2016).

$$L_{\Delta} = M_L \times Q_{\mathrm{cal}} + A_l$$

where

L_Δ= Spectral radiance.
M_L= Radiance multiplicative scaling factor for band 10 (read from MetaData RADIANCE_MULT_BAND_10)
Q_{cal}= Pixel value in DN (Insert raster of Band 10 in the calculator)
A_l= Radiance additive scaling factor for band 10 (read from MetaData RADIANCE_ADD_BAND_10)

For this study of LST, two sets of formulas are used as the data acquired is from Landsat 5 (TM), Landsat 7 (ETM+) and Landsat 8 (OLI and TIRS) is used.

Top of Atmospheric Brightness Temperature

The next step in the determination of LST is, finding Top of Atmospheric Brightness Temperature. For this, we have to convert spectral radiance values into more meaningful physical parameters such as temperature. Values obtained from the following calculations give us temperature viewed by a satellite at the top of the atmosphere considering Earth as a perfect blackbody. An ideal blackbody is a perfect absorber as well as a perfect emitter of radiation with an emissivity value of 1 (Strojnik et al. 2016; Ihlen and Zanter 2019)

$$T_B = \frac{K_2}{\ln\left(\frac{K_1}{L_\Delta} + 1\right)}$$

where

T_B= At Satellite Temperature measured in Kelvin

TIRS Thermal Constants;

K_1= Band-specific thermal calibration constant 1.
(Read from Meta Data for Landsat 8 (TIRS) K1_CONSTANT_BAND_X)
K_2= Band-specific thermal calibration constant 2.
(Read from Meta Data for Landsat 8 (TIRS) K2_CONSTANT_BAND_X)

Rectification of at Sensor Temperature Through Emissivity Correction

Considering Earth as a perfect blackbody is a crude assumption but the results of T_B obtained through the above formula can be rectified with emissivity correction by using NDVI values.

Determination of NDVI

NDVI is the most commonly used index to infer vegetation health; however, this index is useful for this study as emissivity estimation is based on NDVI values of a pixel (Avdan and Jovanovska 2016). For the calculations of NDVI for Landsat 5 (TM) and Landsat 7(ETM+), Red bad 3 and NIR Band 4 are used, whereas, for Landsat 8(TIR), Red Band 4 and NIR Band 5 are used. The formula for NDVI is

$$\mathrm{NDVI} = \frac{\mathrm{NIR} - \mathrm{Red}}{\mathrm{NIR} + \mathrm{Red}}$$

Here NIR and Red Band represent surface reflectance values of wavelengths in the near-infrared region averaged over (λ~0.77 − 0.90 μm) and in the visible region averaged over (λ~0.63 − 0.69μm) (Carlson and Ripley 1997).

The NDVI value of a pixel can range from −1 to +1.

The next step is to calculate Vegetation proportion (Carlson and Ripley 1997):

$$P_v = \left[\frac{\mathrm{NDVI} - \mathrm{NDVI}_{\min}}{\mathrm{NDVI}_{\max} - \mathrm{NDVI}_{\min}}\right]^2$$

where

$$\mathrm{NDVI}_{\max} = 0.5$$

$$\mathrm{NDVI}_{\min} = 0.2$$

NDVI= Insert NDVI raster image.

Above values are considered for the global conditions (Sobrino et al. 2004a, b). For the current study, we have segregated Earth's surface into three broad categories water cover, bare soil, vegetation cover and one subcategory of mixed pixels of bare soil and vegetation. NDVI threshold method provides a particular value for different surface features. The obtained values of NDVI are further used for emissivity estimation. NDVI < 0 is attributed to water bodies (Sobrino et al. 2008).

NDVI pixel values $0 \leq \mathrm{NDVI} < 0.2$ ranging between 0 and 0.2 are considered as bare soil whereas $0.2 \leq \mathrm{NDVI} \leq 0.5$ is considered as a composition of a mixture of bare soil and vegetation and NDVI > 0.5 pixels are considered as dense vegetation cover (Sobrino et al. 2004a, b). Corresponding emissivity values for Landsat 5 (TM) and Landsat (ETM+) emissivity of soil is 0.97 and for dense vegetation cover it is 0.99 and for the mixture of bare soil and vegetation emissivity is calculated by (Sobrino et al. 2004)

$$\xi_6 = 0.986 + 0.004\mathrm{P}_v$$

where ξ_6= emissivity calculated for thermal band 6 in TM and ETM+ sensor (Landsat 5 and Landsat7)

P_v= vegetation proportion

For Landsat 8(TIR) corresponding emissivity values for soil, vegetation is 0.996 and 0.973 (Wang et al. 2015)

For mixed pixels of soil and vegetation, emissivity can be calculated as (Sobrino et al. 2008);

$$\xi_{10} = \xi_s + (\xi_v - \xi_s)P_v$$

For the given values of emissivity of soil and vegetation formula becomes:

$$\xi_{10} = 0.966 + 0.007P_v$$

where ξ_{10}= emissivity calculated for thermal band 10 in TIRS sensor (Landsat 8)

ξ_s=emissivity of soil
ξ_v=emissivity of vegetation.

Values shown in Table 20.4 are used for emissivity estimation of land surface

Determination of Land Surface Temperature with Emissivity Correction (Weng et al. 2004)

$$\text{LST} = \frac{T_B}{1 + \left[\left(\frac{\lambda \times T_B}{\rho}\right) \times ln\,\xi\right]}$$

where

T_B= brightness or at satellite sensor temperature.
λ= wavelength of emitted radiance.
ξ= insert emissivity image in raster calculator.

Table 20.4 Emissivity estimation values of land surface

Surface feature	NDVI	Emissivity (ξ) TM sensor	Emissivity (ξ) TIR sensor
Water	NDVI < 0	0.991	0.991
Soil	0 ≤ NDVI < 0.2	0.970	0.966
Mixture of bare soil and vegetation	0.2 ≤ NDVI ≤ 0.5	$\xi_6 = 0.986 + 0.004P_v$	$\xi_{10} = 0.966 + 0.007P_v$
Vegetation	NDVI > 0.5	0.99	0.973

$$\rho = \frac{h \times c}{\sigma}$$

Plank's constant $h = 6.626 \times 10^{-34}$ Js, speed of light $c = 2.998 \times 10^{8}$ m/s

σ is Blotzmann constant its value is 1.38×10^{-23} J/K

For Landsat 5 (TM) and Landsat 7(ETM+) $\lambda = 11.457$ μm (Jiménez-Munoz and Sobrino 2003)

And for Landsat 8(TIR) Band10 $\lambda = 10.869$ μm (Yu et al. 2014)

Results and Discussion

Following the above-specified methodology, the LST maps of the northern coast, mid coast and southern coast of Goa are prepared for three decades, i.e., 1991–2000, 2001–2010 and 2011–2021 (Figs. 20.3, 20.4 and 20.5).

It is observed that on the Northern Coast during 1991–2000 the minimum land surface temperature was 24.02 °C, which increased to 24.19 °C during 2001–2010. In the subsequent decade, 2011–2021 there was a drop in the minimum land surface temperature that is 23.94 °C. Whereas the maximum land surface temperature during the above three decades was 32.95 °C, 34.66 °C and 33.90 °C respectively. Though there was a drop in the maximum land surface temperature in 2011–21 decade however, it was more than 1991–2000 decade (Fig. 20.3 and Table 20.5).

During 1991–2021, the Mid Coastal Region has experienced minimum land surface temperature between 24.22 °C and 24.27 °C. Similarly, the maximum land surface temperature has shown a substantial increase from 32.98 °C to 36.70 °C during 1991–2021 (Fig. 20.4 &Table 20.5).

In the Southern Coastal Region, the minimum land surface temperature during 1991–2000 was 24.79 °C. In the subsequent decades 2001–2010 and 2011–2021, the minimum land surface temperature was 23.79 °C and 24.28 °C respectively, showing a decrease with reference two the last two decades. The maximum land surface temperature has increased from 36.08 °C to 37.90 °C (Fig. 20.5, Table 20.5).

It is evident from the above figures (Figs. 20.3, 20.4, and 20.5) that the mean land surface temperature in the entire coastal Goa has increased from 28.42 °C during the decade 1991–2002 to 28.90 °C during 2001–2010. The subsequently, mean land surface temperature has further increased to 29.11 °C during the current decade 2011–2021.

It is interesting to note that in all three regions of coastal Goa, the minimum land surface temperatures have decreased, maximum land surface temperatures have increased and mean land surface temperature has shown a rise.

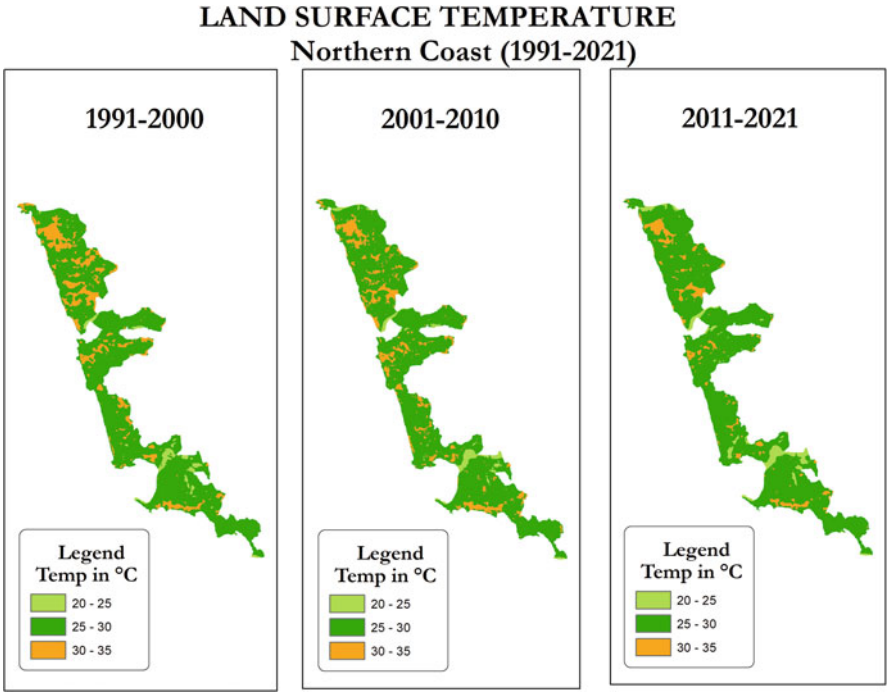


Fig. 20.3 Land surface temperatures 1991–2021 for Northern Coast of Goa

To further investigate into the impact of climate change on land surface temperature over the coastal Goa, 15 spatial pockets representing varied land surface features were identified; further mean land surface temperature was examined temporally and tabulated below (Figs. 20.6, 20.7 and 20.8).

It is observed from the above figures (Figs. 20.7, and 20.8) the rise in land surface temperature has largely occurred in those spatial pockets where much physical and anthropogenic transformations have not taken place. Further, it is important to note that the Southern Coast, which is a part of the Western Ghats has mostly witnessed rise in both minimum and maximum land surface temperatures in the past three decades in comparison with Northern and Mid Coast. Similarly, situations are also found in Northern and Mid coastal region. Hence, the rise in land surface temperature can be attributed to global climatic changes.

A change in course of the Earth's climatic trend can be identified using a non-parametric Mann-Kendall test (Mohorji et al. 2017); this trend can be either monotonically increasing or decreasing. Mann-Kendall test only identifies the existence of trend while Kendall's tau coefficient quantifies the inter-correlation and the degree of agreement between two variables, this test is immune to skewness in the data distribution (Hamed 2011). It also confirms the existence of a monotonic trend

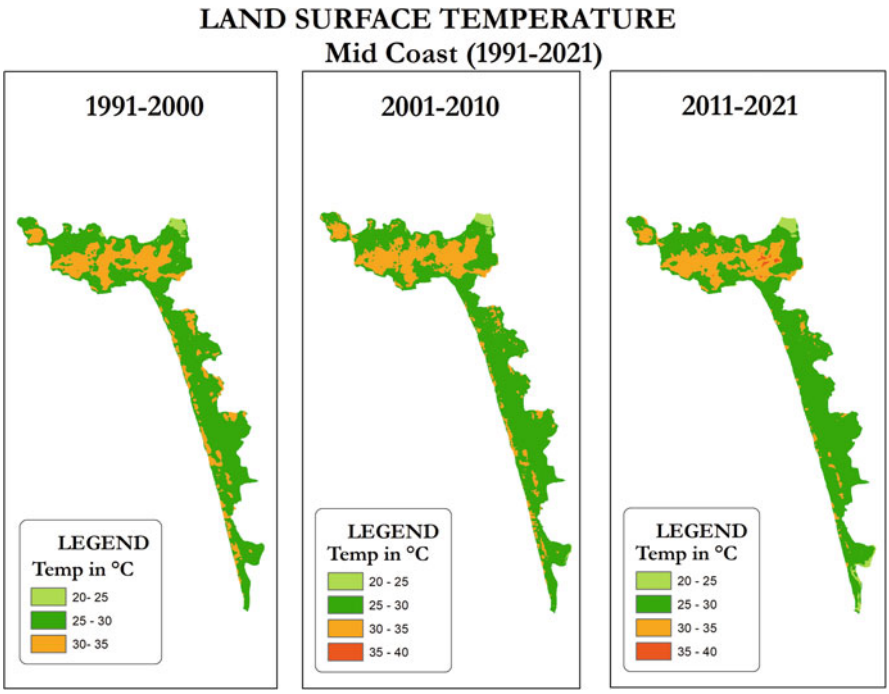


Fig. 20.4 Land surface temperatures 1991–2021 for Mid Coast of Goa

in time series data. It acts as a test of trend and gives the direction of the trend as well (El-Shaarawi and Niculescu 1992). In this study, the trend significance is studied for mean land surface temperature over the past three decades from 1991 to 2021.

A statistical trend test is necessary for this scenario to determine univariate trend significance with ordered time series (Mann 1945). The trend of decadal mean land surface temperatures was assessed. The mean land surface temperatures were calculated using a raster calculator in ArcMap software. A local operation 'average' by using multiple rasters (Dixon 2016) allows us to take an average of the same pixel having identical spatial extent over different rasters. A map is generated with each pixel being loaded with mean land surface temperature values for a given spatial extent. Each raster should have identical pixel size and map extension while taking an average of pixel values of multiple rasters (Dixon 2016).

A Kendall's tau correlation coefficient value is found to be 1 at the significance level of 0.01; this indicates a perfect relationship between mean decadal land surface temperature and the time order.

A positive trend for mean temperature with time is verified using the Data Access Viewer portal provided by NASA. 30 years of annual mean temperature data from 1991 to 2020 was obtained. This portal provides Earth surface temperatures at 2 meters. The data is utilized to find Kendall's tau. Data access viewer uses remotely sensed data and meteorological data to estimate the temperature (Stackhouse 2020).

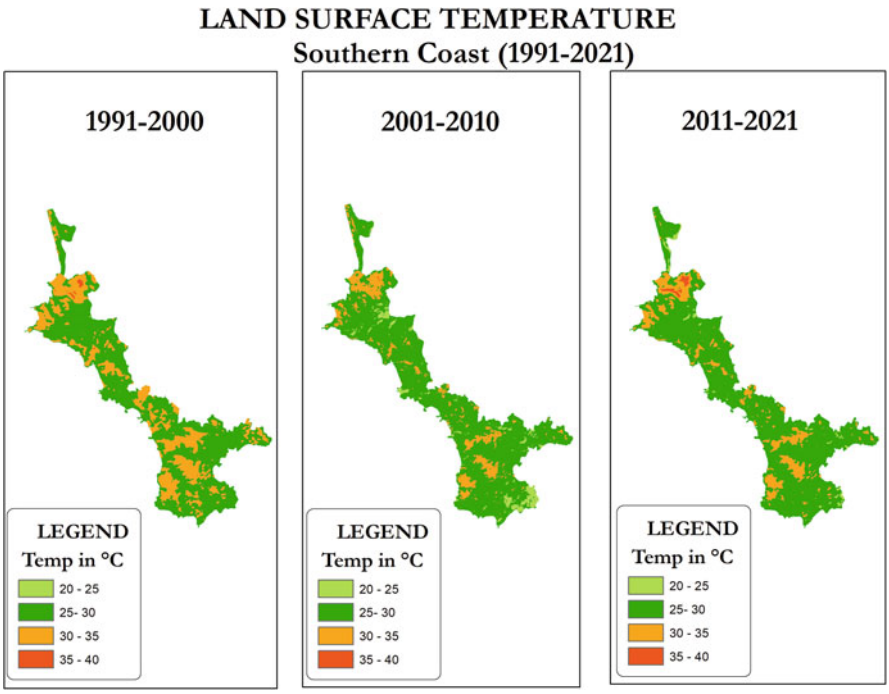


Fig. 20.5 Land surface temperatures 1991–2021 for Southern Coast of Goa

Tau value for the average temperature of three decades was found to be 1 at a significance level of 0.05; this value agree with observations made in this study (Table 20.6).

For a very long time Indian Meteorological department has been monitoring weather conditions at Panjim and Mormugao weather stations, these two stations are considered for aggregation of weather parameters for the entire state. Hence to identify the trend with reference to meteorological data, same stations are used (Table 20.7).

The mean temperature of Panjim has consistently increased from 27.50 °C to 27.72 °C from 1990 to 2019, showing an increase by 0.22 °C. Similarly, Mormugao has shown a slight increase in temperature that is 27.8 °C to 28 °C during the same period, indicating an increase of 0.20 °C. The mean temperature for the entire state has increased from 27.65 °C to 27.86 °C during 1990–2019. It is evident from the above table that the mean temperature for all the three decades for both Panjim and Mormugao stations is showing a positive trend.

Table 20.5 Minimum and maximum land surface temperature for coastal Goa

	Decades					
Region	1990–1999		2000–2010		2011–2021	
	Minimum temperature in °C	Maximum temperature in °C	Minimum temperature in °C	Maximum temperature in °C	Minimum temperature in °C	Maximum temperature in °C
Northern coast	24.02	32.95	24.19	34.66	23.94	33.90
Mid coast	24.22	32.98	24.27	35.09	24.22	36.70
Southern coast	**24.79**	**36.08**	23.79	**35.45**	**24.28**	**37.90**

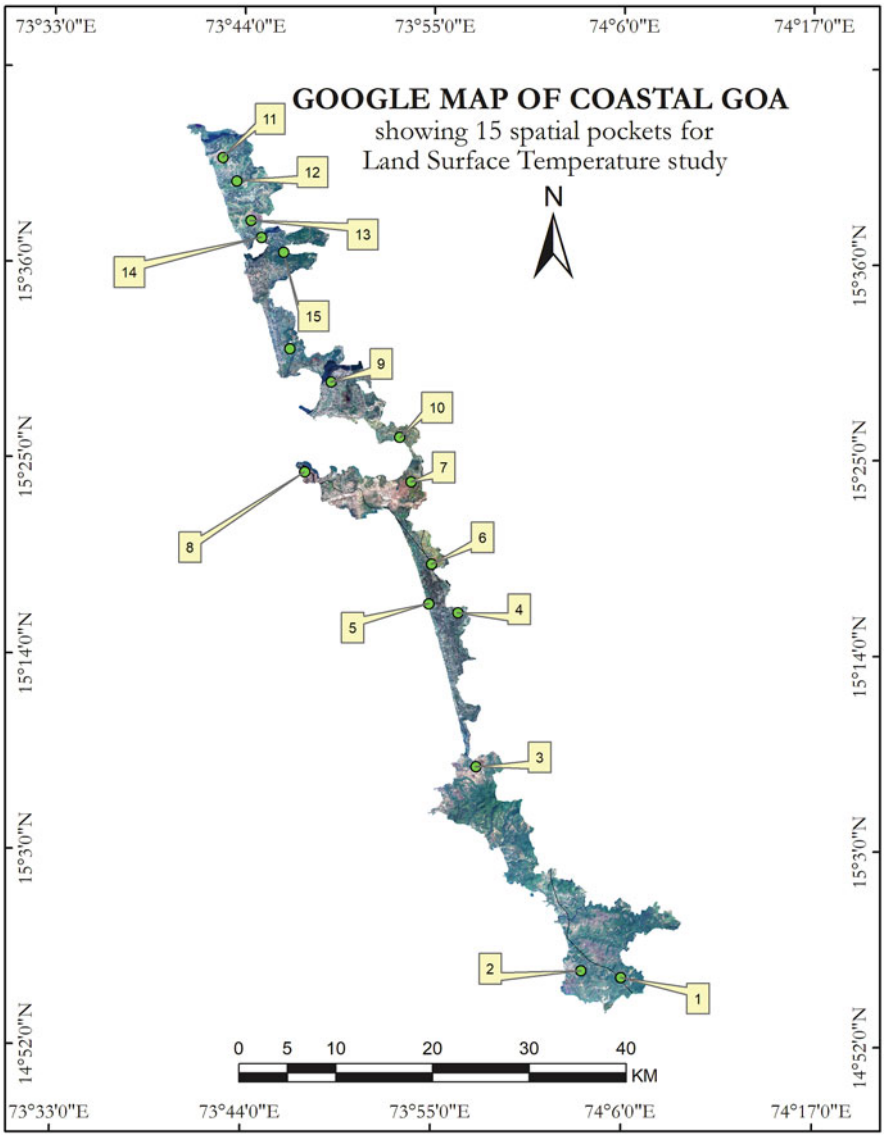


Fig. 20.6 Google map of coastal Goa showing 15 spatial pockets

Zoomed Spatial Pockets of Google Map indicating rise in LST due to Climate Change (Areas least affected by Land Use Land Cover Change)

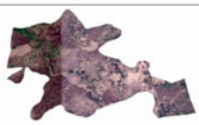
Spatial pockets	Google Image 2003	Google Image 2021	1991-2000	2001-2010	2011-2021
			Temperature in °C		
1			33.16	31.68	32.73
2			33.67	32.57	33.96
3			33.75	32.17	34.18
4			26.72	27.07	27.02
5			28.69	29.52	29.08
6			29.12	29.32	29.58

Fig. 20.7 Identified Google locations indicating the rise in LST

Zoomed Spatial Pockets of Google Map indicating rise in LST due to Climate Change (Areas least affected by Land Use Land Cover Change)

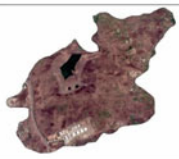
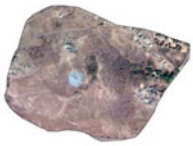
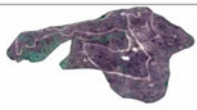
7			30.78	32.39	33.32
8			30.63	32.18	32.32
9			27.14	27.94	28.22
10			26.18	27.12	26.92
11			31.98	32.15	32.38
12			27.76	28.06	27.97
13			30.94	30.84	31.37
14			27.31	27.54	28.30
15			25.15	25.53	25.71

Fig. 20.8 Zoomed spatial pockets of Google map of coastal Goa

Table 20.6 Kendall's tau test result

Kendall's tau correlation coefficient for decadal mean land surface temperature: 1991–2021				
			Decades	Mean_Temperature
Kendall's tau_b	Decades	Correlation coefficient	1.000	1.000
		Sig. (2-tailed)	.	.
		N	3	3
	Mean_Temperature	Correlation coefficient	1.000[a]	1.000
		Sig. (2-tailed)	.	.
		N	3	3

[a]Correlation is significant at the 0.01 level (2-tailed)

Table 20.7 Mean temperature data of Panjim and Mormugao stations

Station	Decades		
	1990–1999	2000–2009	2010–20,219
	Temperature in °C	Temperature in °C	Temperature in °C
Panjim	27.50	27.6	27.72
Mormugao	27.80	28.00	28.00
Mean temperature of Goa state	27.65	27.8	27.86

Source: Statistical Handbooks of Goa and India Meteorological Data

Conclusion

Goa is a coastal geographic entity. Coastal areas are the most sensitive and highly productive ecosystems on Planet. These areas are the tourist heavens on Earth. They are known to experience unique atmospheric conditions leading to special climates. The coastal areas are attaining a catastrophe due to global climatic changes and anthropogenic meddling, which is also true in the case of Goa.

The oceans have a great impact on the weather and climate. The effects of the Arabian Sea are felt on the Bay of Bengal vice versa. The geographic expanse of about 100 km offshore to 100 km inland is greatly influenced by Coastal Meteorology. Hence, comprehending coastal meteorology needs the proper understanding of the interaction layers between the hydrosphere, lithosphere and atmosphere, interplay between air and sea, large-scale dynamics of the atmosphere, and the oceanic circulation (Hsu 1988).

Among all the problems faced by human society, climate change is by far the most complicated one since it is threatening the livelihood of the people irrespective of place, country and region. This has promoted us to assess variations in land surface temperature as it serves as an indicator of global climate change (World Meteorological Organization 2021).

It is apparent from the present study that the processed mean land surface temperatures, data obtained from data access viewer as well as meteorological data exhibit a similar trend. Hence, it can be concluded that the rising temperature is primarily because of global climatic changes.

Various reports of expert committees on climate change suggest that the climate change is going to stay here for long. Hence, adapting to climate change is going to be a new norm. People need to be sensitized on the ways and methods of adapting to climate change.

Further research needs to be conducted on the impact of climate change on land surface temperature particularly in the Goan context.

- Farmers in the affected areas need to modify agricultural practices such as seeds, and irrigation methods that will suit the change in climatic conditions.
- We must encourage citizens to use nature-based mitigations.
- Mangroves afforestation program must be carried out on a large scale because mangroves are believed to provide a defence system against coastal erosion.
- The areas that have undergone deforestation due to mining and other activities are required to undergo a reforestation program to control flooding in the low-lying coastal areas. While reforestation, care must be taken to plant indigenous trees to avoid ecological disasters.

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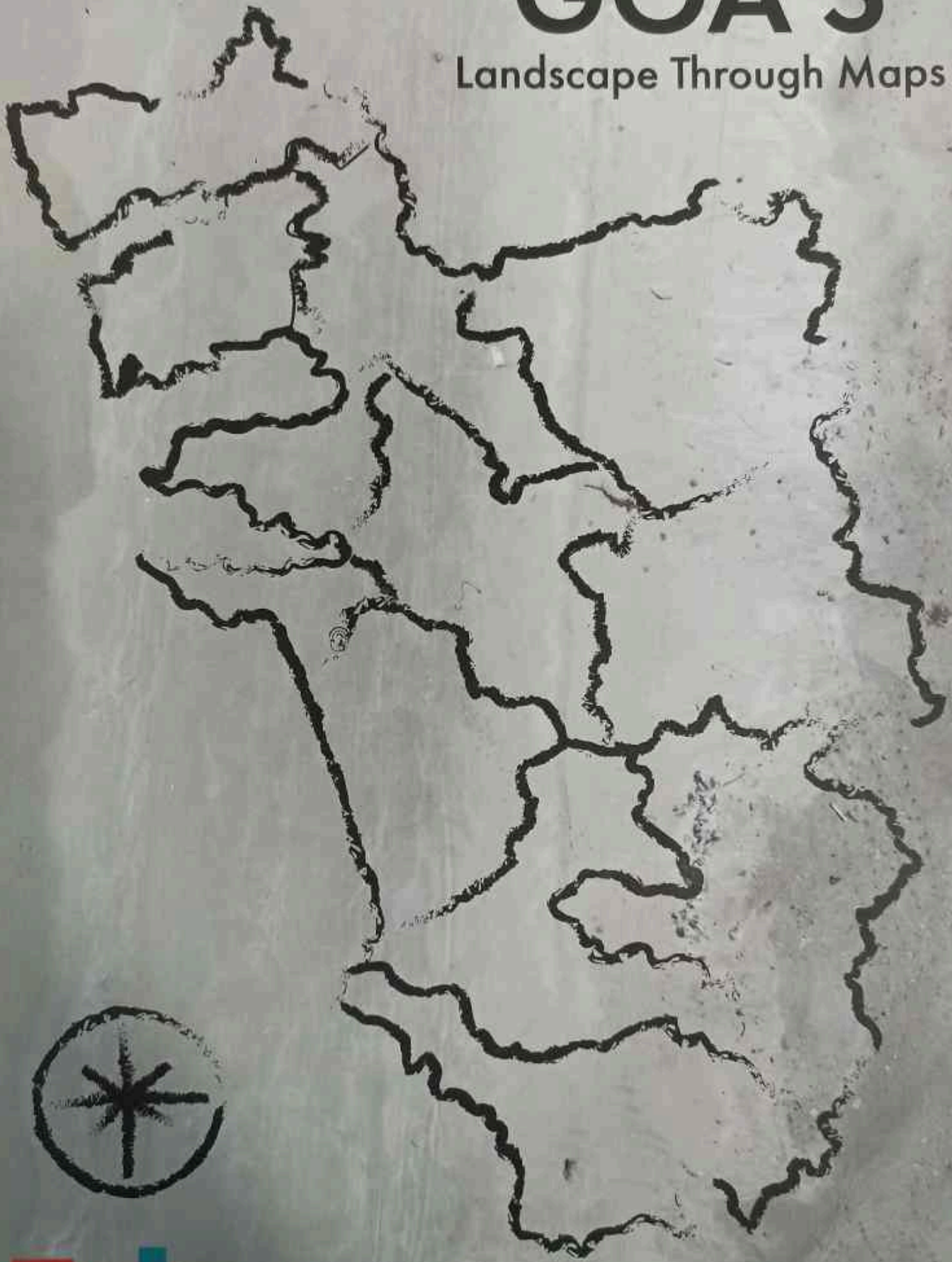

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ABOUT THE BOOK

This book provides an insights of various dimensions of Goa through maps. These maps are supported with write ups to provide readers with basic information of emergence of Goa as a region from historic times to present, encompassing physical. economical and demographic attributes. This books can be widely used by students, researchers and people keen to know about Goa.

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Indian Medicinal Plants: Advancement in the Traditional Medicine, Sustainable Utilization and Conservation

By : *Dr. Sunita Verma*

Contents

This book aims to introduce some important medicinal plants found in India. Many medicines are prepared by mixing useful components of medicinal plants. The process of obtaining herbal components, their quantity, and the process of making medicines are also important. At the same time, correct diagnosis, the time, and the dosages of the medicine are critical in the process of treatment. All these issues are discussed in the sixth section. The chapters are written by reputed researchers working in the field. A uniform chapter structure has been designed to maintain consistency. This book will be useful for academicians, agriculturists, biotechnologists and researchers, as well as for industries involved in manufacturing herbal drugs and supplementary products.

This book comprises of six sections: Bio-Prospection, Ethno-medicine and Ethnoveterinary, Pharmacology, Antimicrobial and Antiviral, Conservation and Agropractices, and Protection of Traditional Knowledge and Other Issues.

Prof. (Dr.) Sunita Verma, Department of Botany Christ Church College, Kanpur; She has over 25 years of teaching and research experience. She has also qualified NET and GATE. She has published various research papers. She has also organized various seminars and Workshops. She has also delivered numerous invited lectures on various national and international platforms. She has two Ph.D scholar registered in her guidance. She has visited foreign 3 times in academic concerns. She is life member of SBBS(SBBS-116) GESA, ABRF

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Advancement in the Traditional Medicine, Sustainable Utilization and Conservation

Dr. Sunita Verma

INDIAN MEDICINAL PLANTS

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Dr. Sunita Verma

Contemporary and Modern Trends in English Language and Literature

Edited by Dr. Sonia Fernandes Da Costa

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Foreword

I am glad to publish the proceedings of the National Conference on Contemporary and Modern Trends in English Language and Literature held on 2ndand 3rd April, 2018 under the auspice of the Department of English, Parvatibai Chowgule College of Arts & Science (Autonomous), Goa.

The conference was organized with the objective of not only broadening the sphere of research of English Literature in Goa, but also to push the young minds down the road of critical thinking. The conference provided an opportunity for students, researchers and academicians for learning and growth. Through the five parallel sessions which brought together participants from various states, conceptual issues were discussed and information was disseminated. The response to the conference was overwhelming.

The research papers presented ranged from Indian Literature, Subalternity, Non-Fiction, Children's Literature, Translation, Gender Studies, World Literature, Visual Literature, English Language and Literature Teaching. There were about 40 presentations in the conference out of which 09 papers were selected for publication. The conference was inspirational and motivating for the students and researchers. The discussion was lively and stimulating. I am thankful to the presenters and the participants for their valuable contributions. This book is an attempt to preserve the stimulating proceedings of the conference.

Dr Sonia Fernandes Da Costa
Assistant Professor, Department of English
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TRANSFORMATION OF HIGHER EDUCATION
LIBRARIES IN THE DIGITAL ENVIRONMENT

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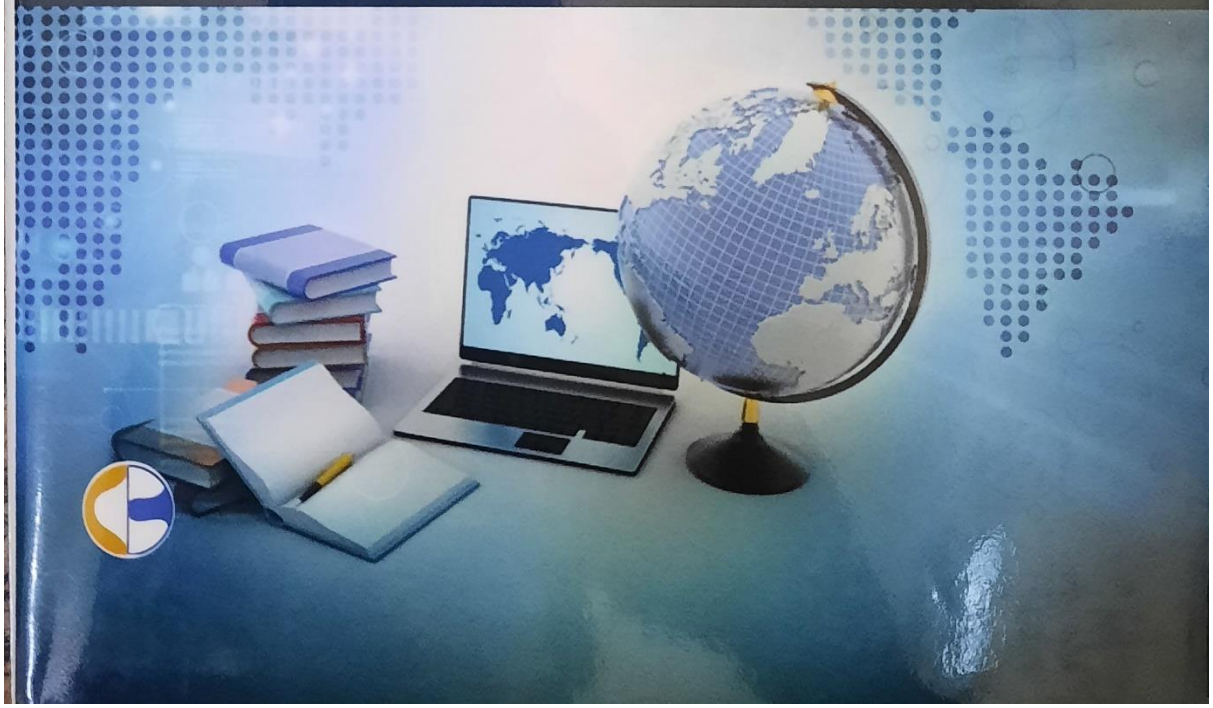


III. Impact of Social Media Platforms and Libraries

IV Technological Developments in Libraries

V. Open Access Initiatives and Indian Libraries

CHAPTER 25

MOOCS AND LIS EDUCATION

Poonam M. Joshi

ABSTRACT

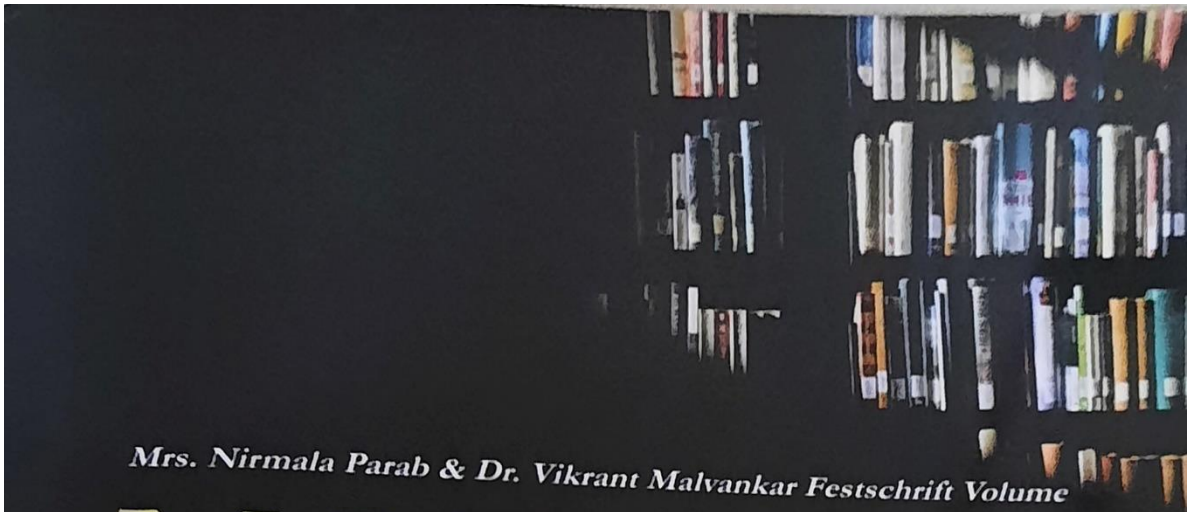
MOOCs is growing widely in the field of Higher education. It provides learning opportunity to aspirants, students and faculty in various subject areas including Library and Information Science. It reflects on Traditional education to online mode of education from the time of Independence. There are technological advances and changing nature of their services in the field of Library. We find that libraries have immensely–transformed themselves to present technological environment. And this would have not been possible without an additional advantage of MOOC platform. This paper focus on Definition of MOOC and its features. This paper intends to put forth an impact of MOOCs on LIS education, different types of MOOCs in India, changes in curriculum and how MOOCs is giving an opportunity for the library professionals. The paper also gives a brief idea on changing scenario in LIS Education in India. Paper provides the list of courses in the field of LIS and others.

KEYWORDS: MOOC, SWAYAM, LIS, E-Learning, Flipped-Classroom.

INTRODUCTION

Massive Open Online Course (MOOCs) is a new and trending term in the field of Education. It is an online portal offering various courses under various fields of Education. It is an online course which can be accessed on Smartphone, Laptop and Desktop, at any time and from anywhere using Internet. MOOCs is offered by Study Webs of Active-learning for Young Aspiring Minds (SWAYAM), initiated by Indian Government. It can be seen as a way to equalize education, as it tries to provide the same education to the learner regardless of whether being accessed from U.S. or from India.

Library and Information Science Education is vastly growing and developing, it is no more bound to only learning organization of



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CYBER SECURITY AND LIBRARY

Poonam M. Joshi

ABSTRACT

Cyber threat is not limited to Computer or technology. It is a fundamental issue comprising of technology and human behaviour. It is a problem that has entered almost all the aspects of our lives. Cyber security when applied to libraries have many risks as libraries have moved from Paper to electronic medium and providing access to E-resources using Internet is a risky task.

This paper examines cyber threat in its various forms. It focuses on definition of Cyber security, different methods that attacker's use and some strategies that can be implemented to control the risk of Cyber attack.

Keywords: Cyber, Cyber Attack, Threat, Phishing, Encryption, Firewall.

INTRODUCTION

The introduction and implementation of technology in new era has led to the advances in the Technology. Question is where to start? The term "Cyber" is very vast; it becomes inclusive as we use it in our day to day life. Almost every aspect of our life is related to cyber. It is a familiar to us though we do not much accept it nor we appreciate it. Take anything for that matter from Refrigerators to Smartphone's to Laptops to Air conditioners to Smart watch, all of these are Internet-enabled which means we are linked. The services that we use, Hospitals, Government offices, Retail stores, Insurance companies everything seems connected to everything and is connected to by the Internet.

But with the utility comes the threat, it is become essential to have the knowledge of how safely these can be used, maintained and protected from Cyber Threats.

DEFINITION:

Cyber means relating to Computer or Computer network. A Computer is a machine that can perform operations like copying, moving, comparing and other arithmetic, non-arithmetic operations. It stores, and retrieves data. The computer manipulates the symbols in the desired way by following certain set of instructions i.e. program. Computer consists of

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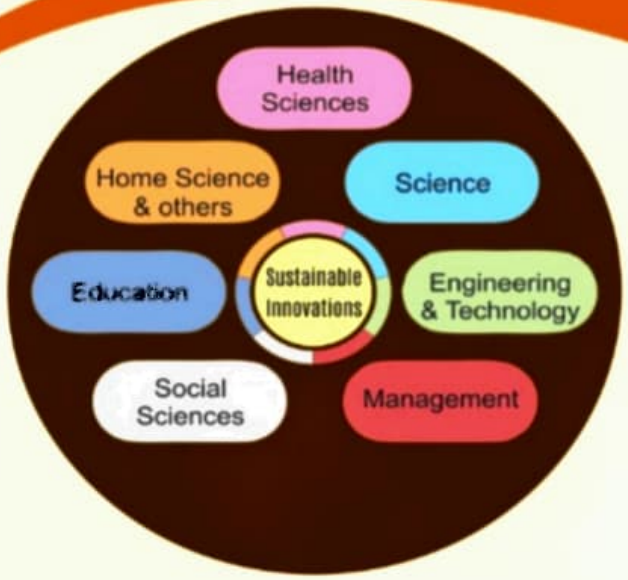

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Production of Versatile Bio-Enzyme

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ABSTRACT

Horticulture wastes are accumulated in large amounts in markets that comprise a basis of problem for disposal. Hence, other environmentally safe approaches for horticulture wastes are critically required to turn the wastes into value added products, thus minimizing the pollution problems created by them. Naturally obtained goods are fetching a new drift in the domestic market. Presently, while there are many laundry products available on the market made of plant extracts and enzymes, yet they cannot satisfy people's requests for safety and low cost, and are not reusable. In the present research, the bio-enzyme was produced from organic household wastes by the process of fermentation aided by yeast cells and tested for wide variety of applications. The fermentation was completed at the end of three months; the liquid was filtered and the filtrate was treated as bioenzyme. Screening of hydrolytic enzyme activities such as protease, lipase, cellulose and amylase in the bioenzyme revealed the following pattern: Protease >Amylase > Lipase > Cellulase. The bioenzyme showed the presence of secondary metabolites like Flavonoids, Quinone, Saponins, Alkaloids and Terpenoids confirmed by the standard qualitative tests. Owing to the positive experimental results for the presence of hydrolytic enzymes and secondary metabolites, further the applications of bioenzyme in plant growth promoting efficiency, treatment of grey water and cleaning of the greased vessel were carried out. The plant growth promoting study results showed the bioenzyme treated green gram seeds revealed faster germination in comparison with the control seeds that did not receive bioenzyme during the growth study. The grey water treatment indicated the reduction in Biological Oxygen demand of the waste water mixed with 5% and 10% bioenzyme to 20 % and 58% respectively. The cleansing efficacy of the greased vessel with bioenzyme solution was in par with that of the commercial cleansing agent.

Keywords: Bioenzyme, grey water, versatie, organic wastes, secondary metabolites

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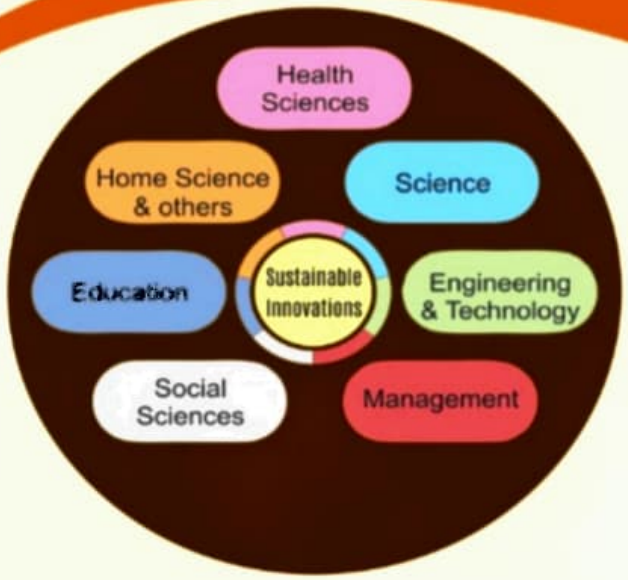

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Production of Eco-Friendly Bio-Plastic

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ABSTRACT

Conventional/synthetic non-biodegradable plastics have adverse effects on the environment. Therefore, the production of bio plastics is the breakthrough innovation to solve the environmental issues by using renewable and degradable natural resources and to provide more cost-effective bio plastic. In the present research, bio-plastic were produced from organic household wastes and tested for wide variety of applications. This study focused on the production of bio-plastic from corn-starch. The bioplastic produced were characterized in terms of thickness, swelling percentage, water absorption percentage, film transparency and chemical resistance and compared with the synthetic plastic. The thickness of the corn-starch bio plastic was found to be 0.01925cm, Swelling percentage of 23.6 and Water absorption percentage 14.28 which are moderately higher than the synthetic plastic. Chemical resistance study with various solvents (0.1 N HCl, 0.1 N NaOH, saturated NaCl solution and 50% Ethanol) for 48 h revealed that the bio plastic showed no change in HCl, partial/complete disintegration in NaOH, NaCl and Ethanol. The biodegradability test by soil burial method revealed the complete degradation of corn-starch bio plastic within two weeks, thus, the eco-friendly products made in the present study will be the choice to replace their synthetic counterparts.

Key words: Biodegradability, Bioplastic, Conventional, Corn-starch, Eco-friendly

1. Introduction

Nearly 90% of plastic is derived from fossil stocks. Presently, plastic production need roughly 4–8% of oil consumption, and this is projected to attain 20% by 2050. From the time their extensive manufacturing, plastics have penetrated the society due to their wide applications. The sustained progress of plastics can be credited to their low cost, durability, strength to weight ratios and easy application in everyday life. Although conventional petrochemical plastic products have enhanced the quality of