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### RESEARCH ARTICLE

#### FTIR, XRD, SEM/EDAX ANALYSIS OF COASTAL SOIL SAMPLES OF KANYAKUMARI DISTRICT IN FULL MOON AND NEW MOON DAY.

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#### Abstract

Beaches are one of the important land forms and the most important feature of coastal morphology. Coastal soil samples contain the most economically important mineral accumulations. The total land mass of the earth we can live only on 30% of our planet. Our survival is threatened the non-biodegradable wastes were accumulated in the coastal region. Accumulation of non-biodegradable wastes also affects tides. Tides are one of the most important phenomena in the world they move in and out around twice a day. However, full moon and new moon day also affect the sea level and may cause both higher and lower tides. In this present study, concentrated the variation of coastal soil samples of kanyakumari district in full moon and new moon day. The qualitative identification of minerals were carried out by using FTIR and XRD techniques. The observed XRD patterns indicate quartz, feldspar, calcite, kaolinite, hematite and illite. SEM image of coastal soil sample was taken at 20kv with different magnification shows different morphology. Mineralogical studies in FTIR and XRD confirm the variation of minerals in full moon and new moon day. In FTIR study the absorption frequencies of the peak and band tentative assignments are different in full moon and new moon day. Elemental composition study i.e. EDAX clearly shown the elemental variations in full moon and new moon day. Morphological study (SEM) clearly showed the different structure in different magnification.

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#### Introduction:-

The Morphology of a beach is mainly controlled by wave, climate, tide and sediment characteristics. An equilibrium beach results from a balance of distractive and constructive force acting on the beach (Bagnold, 1940). Soil contamination also occurs when chemicals are released due to spill or disposal of effluents by industries. The most significant pollution of water, air and soil environment due to industrial and other waste is one of the problem faced by the developed as well as developing countries. (Prasanthan, et al., 2000). Soil contaminants are hydrocarbons, heavy metals, herbicides, pesticides and chlorinated hydrocarbons. Soil salinization is one of the most common land degradation processes, is a severe environment hazard (Ling et al., 2010). Many countries around the world the

concept of coastal soon for the future generation. Hence, these arises any to collect, analyze and assess the data for the effective monitoring and management of the coastal area (Johny et al., 2016). Soil moisture and water reaction capacity of soil may be affected by changes in soil organic carbon that occur because of both climate change and changes in land management practices (Laporte et al., 2002). Soil salinization, one of the most common land degradation processes, is a severe environment hazard (Ling et al., 2010).

Fourier Transform infrared (FT-IR) absorption spectra of soil sediments contain more information about minerals. (Ramasamy et al 2006). XRD method is the best one for mineral analysis as it is rapid, cheap, time saving and non-destructive. Power X-ray diffraction pattern gives more information about minerals present in soil or sedimentary samples (Ramasamy et al., 2006). Vinothkumar et al., (2013) suggested sediments have also been studied by EDAX analysis to evaluate the changes and occurrence of heavy minerals in beach sands. Among the various analytical techniques used for the elemental analysis, Scanning electron Microscopy is highly qualified for the identification and the quantification of different elements in various samples of geological, biological and environmental importance (Shi et al., 2003).

The FT-IR spectrum was used to determine the nature of functional groups which could possibly influence the adsorption of the soil (Sarala thambavani et al., 2014). FT-IR and XRD methods were non-destructive and can be used in the identification of mineralogical composition (Ravisankar et al., 2010). XRD studied on geological samples throw light on the mineralogical changes consequent to weathering, but also aid the determination of structural changes on the unit cell lattice of the minerals (Selvaraju et al.,2015). The morphological studies of coastal soil samples can be identified by scanning electron microscopy (Reetu Sharma et al., 2016). Scanning electron microscopy with energy-dispersed X-ray analysis (SEM/EDAX) is commonly used for single particle study. It provides useful information on the morphology and elemental composition of coastal soil samples (Tripti pachauri et al., 2013). Samples were prepared by dispersing dry power on the double sided conductive adhesive tape. Samples were coated with carbon by arc discharge method for SEM-EDAX. Samples were scanned in secondary electrons for morphology and back scattered electrons mode for compositional (Galan Marin et al., 2012).

## Materials and methods:-

### Study Area:-

Full moon and new moon day coastal soil samples were collected from five different sea shore sites of Kanyakumari district during the month of November in the year 2017.

**Table .1:-** a and b represent Full moon and New moon day

SIa -Ib	Vattakottai
SIIa-IIb	Rajakamangalam
SIIIa-IIIb	Manavalakurichi
SIVa-IVb	Kurumpanai
SVa-Vb	Thoothoor



**Fig .1:-** Ariel view of coastal regions in kanyakumari district

### Minerological And Morphological Analysis Of Coastal Soil Samples:-

The nature of adsorption on soil, identification, estimation of Mineralogical composition, various functional groups present in the coastal soil, and morphological characterization of samples of Kanyakumari district were carried out by different methods like FT-IR, XRD, SEM and EDAX methods.

The infrared spectra were recorded in the mid IR region 400-4000  $\text{cm}^{-1}$  using **Shimadzu Fourier Transform Infrared Spectrometer** (IR-Affinity-1). The KBr pressed pellet was used to record the spectrum. The crushed samples were grounded before making the KBr pellet. The samples were mixed with KBr in the proportion of 1:20 and pressed to 5 tons for one minute in preparing the disc. To identify the mineral phases in the samples, X-ray diffractograms for the shreds in the powdered form recorded using **Schimadzu XRD 6000** 25 $^{\circ}$ c of  $y = 1.5405 \text{ \AA}$ . Microstructures were examined by Scanning Electron Microscope (**SEM**) with **JEOL JSM 6390** model. The chemical composition was determined by an Energy Dispersive X-ray Spectroscopy (**EDAX**) attached to SEM.

### Results and discussion:-

For understanding the nature of coastal soil samples of kanyakumari district in full moon day and new moon day, FT-IR, XRD, SEM and EDAX were performed, which are described in the following sections.

#### FTIR characterization:-

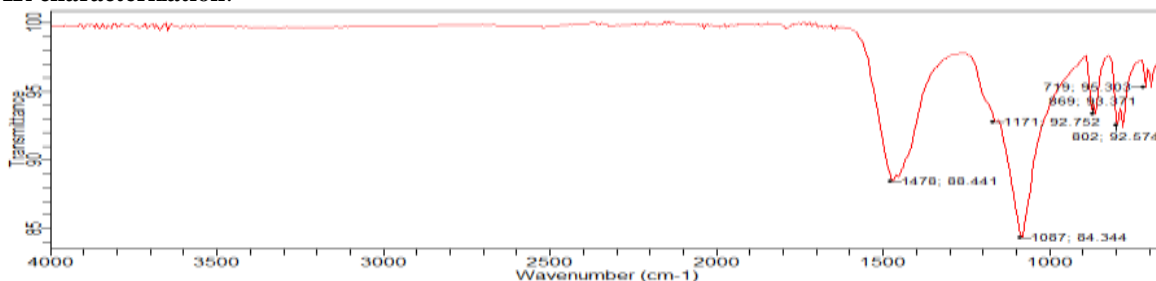


Fig 2:-FTIR spectrum full moon day sample

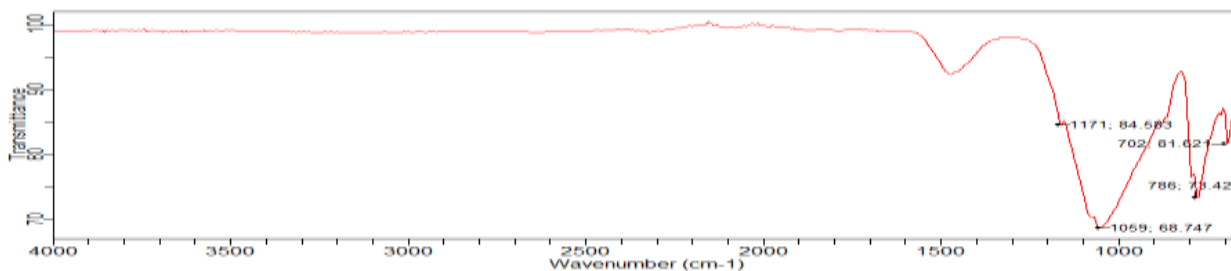


Fig 3:-FTIR spectrum new moon day sample

**Table 2:-**A mineralogical investigation of coastal soil samples of five different sites of Kanyakumari district in full moon and new moon day

Sample site Number	Silicate minerals	Feldspar			Clay minerals		Carbonate minerals		Organic carbon
	Quartz	Microcline	Orthoclase	Albite	Kaolinite	Montmorillonite	calcite	Aragonite	
SIa	719,780,784	742,1059,1087	786,1059	720,869	3420	860,1650	1450,875	1460,1760	2855
SIb	695,700,780	740,742,1051,1055	1040	-	-	860,1640	875,880,1795	-	2925
SIIa	869,795	740,1171,1087	786	719	935,908	869	1444	860,1790	2930
SIIb	777,778,795	1050	-	785,790	1115,1016	-	-	-	2930
SIIIa	695,775,786,	719,1187,	1040	869	-	869	880,	1480	2850

	1800	1171					1800		
SIIIb	697,775,1092,1125	-	765	787	1016,1030,1116	-	878	1480,1479	2885
SIVa	702,780,1087,1810	1053	780	720,787	1053	864	1810,865	855	2925
SIVb	720,797,1087,1092	1065	765	-	-	-	1488	855	-
SVa	621,695,702,1059,786	745,1059,1171	780	788	1171	-	1795	-	2850
SVb	695,700,795,800,802	742,1050	765	785	-	880	875,1455	-	-

By comparing the observed frequencies with available literature, the minerals such as quartz, microcline, orthoclase, albite, kaolinite, montmorillonite, calcite and aragonite have been identified. Table 2 clearly shown the minerals are enriched in full moon day compare to new moon day.

#### X-Ray Diffraction (XRD):-

Qualitative mineralogy of the coastal soil samples were determined with the standard interpretation procedures of XRD. Quartz, albite, orthoclase, kaolinite, calcite, aragonite were identified from the peaks in diffractogram. Major minerals in the samples are quartz, feldspar, Hematite, Aragonite and calcite.

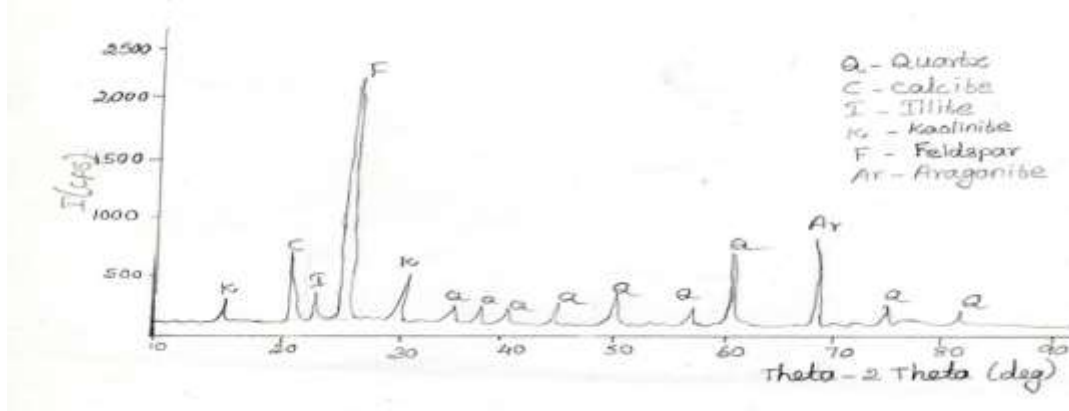


Fig.4:-Table 3.XRD parameters of sample in full moon day

No	Peak no	2Theta (deg)	d (Å)	I/II	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	7	26.8355	3.31955	100	1.53512	701	2662
2	33	68.4408	1.36972	46	0.31240	319	1067
3	28	60.2361	1.53512	33	0.27390	234	721
4	3	21.2208	4.18346	26	0.26440	183	587
5	9	29.7657	2.99910	22	0.30940	155	505

The XRD parameters d and 2 theta values are completely different in full moon and new moon day samples.

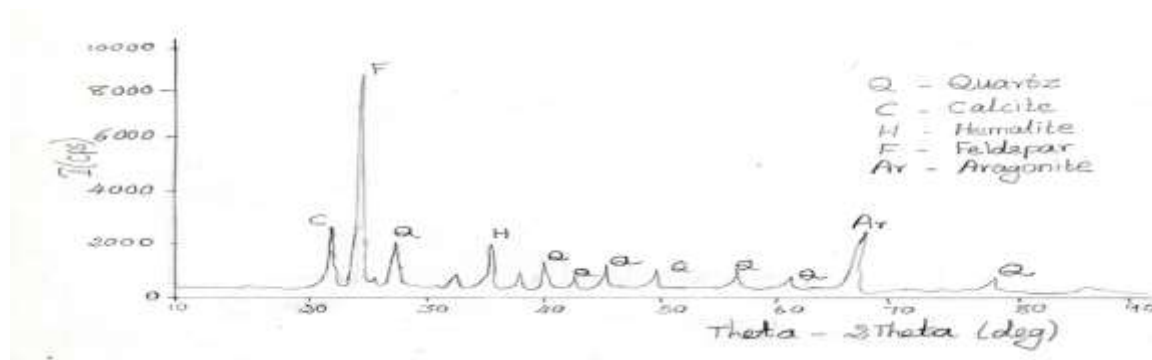


Fig 5:- XRD pattern of sample in new moon day

No	Peak no	2Theta (deg)	d (Å)	I/II	FWHM (deg)	Intensity (Counts)	Integrated Int (Counts)
1	2	26.6385	3.34365	100	0.24700	2426	6622
2	1	20.8805	4.25087	29	0.24210	698	1842
3	13	68.2944	1.37230	16	0.29280	395	1375
4	7	40.3100	2.23560	11	0.23330	265	657
5	8	42.4427	2.12807	10	0.26050	239	687

**Energy Dispersive X-ray Analysis (EDAX):-**

EDAX characterization was performed to know the chemical composition of coastal soil. In this present study collected coastal soils elemental concentration data given in the table 5 and 6 and fig6 and 7 shows the different elemental composition of coastal soils in the Kanyakumai district in full moon and new moon day.

Element (K)	Applied concentration	Weight%	Atomic%
O	18.44	67.70	82.08
Si	4.05	11.09	7.66
Ca	8.89	21.21	10.27

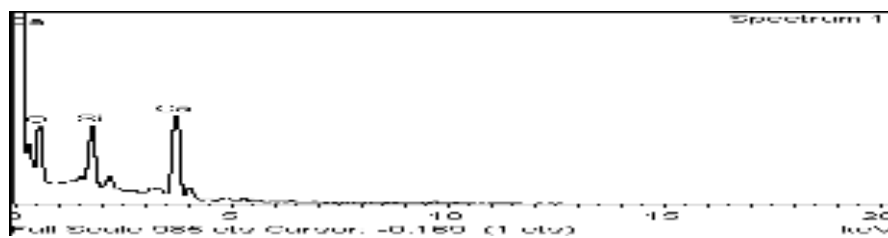
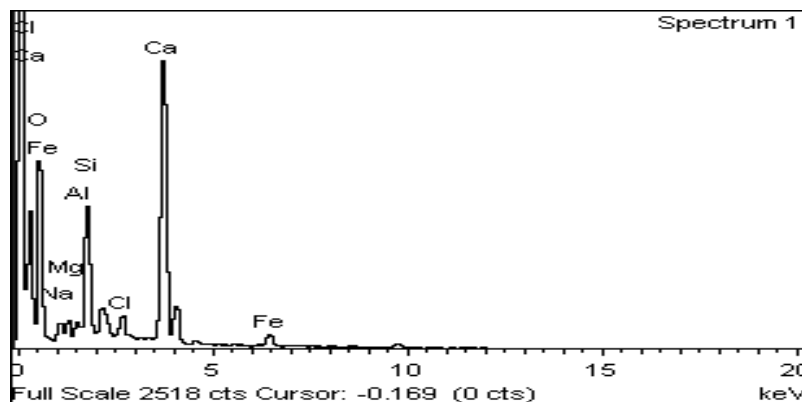


Fig 6:- and Table.5:-EDAX Analysis of new moon day sample

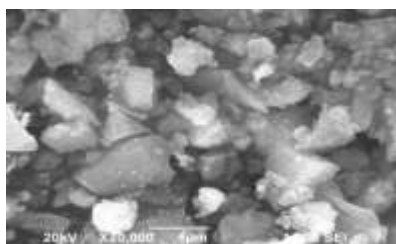
Element (K)	Applied concentration	Weight%	Atomic%
O	53.93	62.31	78.36
Na	1.81	1.95	1.70
Mg	1.22	1.37	1.14
Al	0.83	0.79	0.59
Si	8.59	7.28	5.22
Cl	1.74	1.52	0.87
Ca	32.14	22.64	11.37
Fe	2.44	2.13	0.77



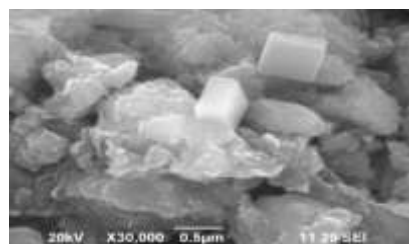
**Fig 7:- and Table 6:-EDAX Analysis of full moon day sample**

#### SEM Analysis:-

Soil structure is defined as the size, shape and spatial arrangement of individual soil particles (aggregates). Soil structure is a dynamic property and it is subjected to genesis and degradation processes. The main factors that affect the genesis of soil structure are represented by the effect of cations interaction between clay particles under the influence of soil water content and temperature. Scanning Electron Microscopy gives an insight of morphological analysis of coastal soil samples. SEM picture of coastal soil sample was taken at 20 Kv with different magnification



**Fig 8:-SEM image of Full moon day**



**Fig 9:-SEM image of New moon day**

and presented in Fig 8 and 9. It depicts the tubular, spherical, Platy shape, triangular, rectangular, and nearly triangular and sun flower like appearance of the soil samples.

#### Summary:-

Our survival is threatened the non-biodegradable wastes were accumulated in the coastal region. It is affecting our coastal soil fertility when the water gets warmer; it expands and occupies more space. The rate of the rise of our global temperature is accelerating and 80% of heat is being absorbed by ocean. The rising sea level can become a danger to our civilization. Accumulation of non-biodegradable wastes also affects tides. Tides are one of the most important phenomena in the world they move in and out around twice a day. However, full moon and new moon day also affect the sea level and may cause both higher and lower tides. Full moon and new moon happen as the moon is around its closest point to earth is called perigee it leads to even larger variation between high and low tides are known as perigean tides.

In this present study, concentrated the variation of coastal soil samples of kanyakumari district in full moon and new moon day. Collected the coastal soil samples from five different sea shores during full moon and new moon day. Collected soil samples were processed with suitable methods. The processed soil samples were placed in polythene jars and sealed tightly to protect the sample from air and laboratory fumes. The jars containing the soil sample were dispatched for analysis to various laboratories. The qualitative identification of minerals were carried out by using FTIR and XRD techniques. Mineralogical studies in FTIR and XRD confirm the variation of minerals in full moon and new moon day. In FTIR study the absorption frequencies of the peak and band tentative assignments are different in full moon and new moon day. In XRD study indicates the d values are different in full moon and new moon day. Elemental composition study i.e. EDAX clearly shown the elemental variations in full moon and new moon day. The enrichment of elements in full moon day. Morphological study (SEM) clearly showed the different

structure in different magnification. The above results clearly showed the accumulation of minerals, concentration of elements and morphological variation in full moon and new moon day.

### Conclusion:-

Coastal areas are one of the important coastal landforms and beach sands contain the most economically important mineral accumulations, wave action deposit sand on the beach and the heavy minerals are concentrated when backwash carries some of the lighter minerals such as quartz back into the sea. Mineral deposits are formed as a result of the selective concentration of valuable minerals derived from the weathering of pre-existing rocks, and accumulated by wind or water. In this present study concludes that the full moon day samples show the accumulation of minerals than the new moon day samples because energy is little higher on the full moon day. The tides are rise on the full moon day because of the gravitational pull of the moon. Humans have dumped so much non-biodegradable pollutants in the ocean it is affected the coastal soils. Accumulation of non-biodegradable wastes also affects tides. The soil is in poor organic matter it enhances the process of soil erosion. The rate of the rise of our global temperature is accelerating and 80% of heat is being absorbed by oceans, the sea level rises. The rising sea level effects can become a danger to our civilization. Enhanced human awareness can improve the soil quality in the coastal region.

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