STUDY ON CLAY SAMPLE AT SRIPERUMBUDUR AND KALPAKKAM AREA

Submitted in partial fulfillment of the requirements for the award of

Master of Science in Chemistry

by

S. JAYAPRAKASH

Register No: 41910011

DEPARTMENT OF CHEMISTRY
SCHOOL OF SCIENCE & HUMANITIES

SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
CHENNAI – 600119
TAMILNADU
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INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

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Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai-600 119

www.sathyabama.ac.in

DEPARTMENT OF CHEMISTRY

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of S.Jayaprakash (41910011) who carried out the project entitled **"STUDY ON CLAY SAMPLE AT SRIPERUMBUDUR AND KALPAKKAM AREA"** under my supervision from January 2023 to May 2023.

K. Chennakesavulu

Guide

Dr. K.CHENNAKESAVULU Ph.D.,

HEAD OF THE DEPARTMENT
DEPARTMENT OF CHEMISTRY
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
Jeppiaar Nagar, Rajiv Gandhi Salai
Chennai - 600 119

J. Karthikeyan 08/05/2023

Head of the Department

Dr. J. KARTHIKEYAN Ph.D.,

Submitted for Viva voce Examination held on 08/05/2023

Internal Examiner **External Examiner**

DECLARATION

I **S.JAYAPRAKASH** hereby declare that the Project Report entitled **"STUDY ON CLAY SAMPLE AT SRIPERUMBUDUR AND KALPAKKAM AREA"** done by us under the guidance of **Dr. K.CHENNAKESAVULU Ph.D.,** Associate Professor Department of Chemistry, Sathyabama Institute of Science and Technology, submitted in partial fulfilment of the requirements for the award of Master of Science degree in Chemistry.

DATE: 08/05/2023

PLACE: Chennai

S. Jayaprakash

S. JAYAPRAKASH

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I am ever grateful to the almighty for the blessings upon me to do this work in a successful way.

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S. Jayaprakash

ABSTRACT

Soil is a complex compound of minerals, water, air, organic matter, and countless other decaying fossils. It forms on the surface of the earth. The main objective of this study was to characterize the organic constituents of Clays collected on agricultural area near Kalpakkam. The samples were collected during a cold and warm season. The collected clay sample were analyzed for their content of pH, Electrical conductivity, available phosphorus, TGA, BET surface area, SEM and FTIR measurements. The chemical composition of the clay sample was determined by XRD analysis. The present study confirms the presenceof excess amount of fluoride in clay, metal or metal oxides.

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LIST OF ABBREVATION

EC	Electrical Conductivity
FTIR	Fourier Transform Infrared Spectroscopy
SEM	Scanning Electron Microscope
XRD	X-Ray Diffraction
TGA	Thermo Gravimetric Analysis
BET	Brunauer- Emmett- Teller
OD	Optical Density
UV	Ultra-Violet Ray

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CHAPTER 1

INTRODUCTION

1.1 SANDY LOAM SOIL

Sandy loam soil is a type of soil used for gardening. This soil type is normally made up of sand along with varying amounts of silt and clay. Many people prefer sandy loam soil for their gardening because this type of soil normally allows for good drainage. It is important for a person not to add too much sand.

Loam is soil composed mostly of sand (particle size > 63 micrometres (0.0025 in)), silt (particle size > 2 micrometres (7.9×10^{-5} in)), and a smaller amount of clay (particle size < 2 micrometres (7.9×10^{-5} in)). By weight, its mineral composition is about 40–40–20% concentration of sand, silt, clay respectively. These proportions can vary to a degree, however, and result in different types of loam soils: sandy loam, silty loam, clay loam, sandy clay loam, silty clay loam, and loam. [1]

The only soil that is not predominantly sand, silt, or clay is called "loam". Loam soils generally contain more nutrients, moisture, and humus than sandy soils, have better drainage and infiltration of water and air than silt and clay-rich soils, and are easier to till than clay soils. The different types of loam soils each have slightly different characteristics, with some draining liquids more efficiently than others. The soil's texture, especially its ability to retain nutrients and water, are crucial.[2] Loam soil is suitable for growing most plant varieties. Bricks made of

Fig.1.1. Sandy loam soil

loam, mud, sand, and water, with an added binding material such as rice husks or straw, have been used in construction since ancient times.

1.1.1. Soil Characteristics And Texture

Soil samples were analysed for pH with a pH meter (7.57) Electrical conductivity EC (0. 09ds.m-1) at 25ºC was determined in soil extract by using EC-meter (Hesse, 1972). Estimation of available phosphorus (73.8 ppm) was done according to the Olsen's method.

Soil texture as abiotic factor is important factors that influence distribution of minerals, organic matter retention, microbial biomass and other soil properties (Scott and Robert, 2006). Estimation of available phosphorus was done.

pH	7.57
Electrical conductivity (Ec)	26.7 mS/cm
Organic compound	0.44%
Available phosphorus	73.8ppm

Table.1.1. Characteristic and texture of my sample

1.1.2. Soil In Ancient Times

Ancient agricultural systems and soils are long-term sources of data on management strategies and land resource change. The record of early agriculture provides a deep-time perspective on land use and human environmental interaction, responses to climate change, and anthropogenic soil processes. Many past and contemporary ancient cultures have farmed the same land on scales of centuries to millennia. [2]

1.2. CLASSIFICATION OF LOAM

Ancient systems and agriculture are long-term sources of data on land management strategies and transformation. The earliest agricultural record provides an in-depth look at land use and human interactions with ecosystems, responses to climate change, and anthropogenic soil systems. Many ancient and ancient civilizations have dominated the same world over the centuries to thousands of years.

1.3. APPLICATIONS OF LOAM

Fertile soil can be divided into certain subtypes. Other examples are sandy loam, silt loam, loamy loam, and silty clay loam. The different soil types have a variety of factors such as rock erosion and erosion that are too small to affect indigenous growth but can be important for crop growth. [3]

1.3.1. In Farming

Loam is considered ideal for gardening and agricultural uses because it retains nutrients well and retains water while still allowing excess water to drain away [4]. A soil dominated by one or two of the three particle size groups can behave like loam if it has a strong granular structure, promoted by a high content of organic matter. However, a soil that meets the textural definition of loam can lose its characteristic desirable qualities when it is compacted, depleted of organic matter, or has clay dispersed throughout its fine-earth fraction.

Pea can be cultivated in sandy loam and clay loam soils, but not more compacted sandy soils [5].

Loam is found in a majority of successful farms in regions around the world known for their fertile land. Loam soil feels soft and crumbly and is easy to work over a wide range of moisture conditions.

1.4 BACTERIAL STUDY

Antibacterial Property

There is some concern that antibiotic residues in applied manure may promote the emergence of antimicrobial organisms in the environment. Soil-marketed antibiotics have been found to maintain their antimicrobial properties because both antibiotics inhibited the growth of all bacterial species.

The main characteristics of the abiotic are climate, including temperature, humidity, soil texture, soil composition, salt and pH. Climatic conditions also affect the body of soil organisms as they vary around the world and, in the same areas, during the seasons.

CHAPTER 2

LITERATURE SURVEY

1.Title: Soil Thermal Properties at Kalpakkam in Coastal India.

Author : K. Ananda Kumar, R. Venkatesan, Thara V. Prabha

Journal and Year : *Journal of earth system and science ,*2001

Inference: Time series of soil surface and subsurface temperatures, soil heat flux, net radiation, air temperature and wind speed were measured at two locations in Kalpakkam, coastal southeast India. The data were analysed to estimate soil thermal diffusivity, thermal conductivity, volumetric heat capacity and soil heat flux.

2.**Title**: Qualitative and quantitative characterization of Brazilian natural and organophilic clays by thermal analysis.

Author : J. Dweck, Bloco E Sala

Journal and Year *: Journal of thermal analysis and calorimetry*, 2008

Inference: Differential thermal analysis (DTA) was the first thermal analysis technique, which was used to characterize and to qualitatively distinguish natural clays with a same chemical composition but with different molecular structures.

3.**Title**: Analytical characterization of natural clay.

Author: Refat El- Sheiky, Moslech Al- Shamrani.

Journal and Year *: American institute of physics,*2010

Inference: The current paper introduces the study of morphology and electronic microscopy characterization of one type of the smectite Saudi nano clay montmorillonite type. During the last decade, nanotechnology achieved a recognized progress in many fields based mainly on synthesized materials. Much attention is devoted to produce natural nanoparticles. It was found that the clay is one of the rare materials which have platelets of nano scale size. The nano clay minerals are found in different types. It is investigated that the nano clay minerals have super properties which cannot be found in the other materials. The Kingdom of Saudi Arabia has many zones having different types of good nano clays. These nano clays are found in certain mixtures with other different materials such as Mg, Ca, Fe and others. By developing an innovated technique, we could extract Saudi

Arabian nano clay with high grade purity. The results are very interesting. The produced nano clay particles are with good quality and super properties. It can be used in many fields of nanocomposites.

4. **Title** : Geo chemical and thermodynamic aspects of sorption of Strontium on Kaolinite dominated clay samples at Kalpakkam.

Authors : R. Deepthi Rani, P. Sasidhar

Journal and Year: *Environmental earth sciences,*2011

Inference : The mobility of strontium in subsurface is largely influenced by sorption on to clay minerals. In the present study, kaolinite clay samples collected from the Kalpakkam nuclear plant site were employed to understand the sorption characteristics of strontium by batch method. The effect of several parameters such as time, strontium ion concentration, pH, temperature and ionic strength was investigated.

5. **Title** : Instrumental characterization of clay by XRF, XRD and FTIR

Authors: Preeti sagar Nayak and B K Singh

Journal and Year: *Bulletin of materials science,*2007

Inference: Natural clay minerals are well known and familiar to mankind from the earliest days of civilization. Because of their low cost, abundance in most continents of the world, high sorption properties and potential for ion exchange, clay materials are strong candidates as adsorbents. Clay is composed mainly of silica, alumina and water, frequently with appreciable quantities of iron, alkalies and alkali earths (Ralph 1968). Two structural units are involved in the atomic lattices of most clay minerals. One unit consists of closely packed oxygens and hydroxyls in which aluminium, iron and magnesium atoms are embedded in an octahedral combination so that they are equidistant from six oxygens or hydroxyls. The second unit is built of silica tetrahedrons. The silica tetrahedrons are arranged to form a hexagonal network that is repeated indefinitely to form a sheet of composition, $Si4O6(OH)4$.

6. **Title:** Effects of soil texture on chemical compositions, microbial population and carbon mineralization in soil.

Authors: Najmadeen H. Hamarashid, Mohammad A. Othman, Mohamed-Amin H. Hussain

Journal and Year: *Egyptian journal of experimental biology,*2010

Inference: Soil texture plays a key role in carbon storage and strongly influences nutrient retention and availability. The objective of this study was to 1) determine the effects of soil texture on soil chemical compositions and abundance of microbial communities in soils collected from nine different localities of Sulaimani governorate, 2) The correlation between mineralization of carbon and tested parameters.

7. **Title** : Anthropogenic Soil Change in Ancient and Traditional Agricultural Fields in Arid to Semiarid Regions of the America

Authors: Sandor, Jonathan A., and Homburg, Jeffrey A.

Journal and Year: *Society of Ethnobiology,*2017

Inference: Soils form the foundation for agriculture and are changed by farming through active management and unintentionally. Soil change from agriculture ranges from wholesale transformation to ephemeral and subtle modification. The archaeological record of early agricultural systems holds information about soil change on centurial to millennial scales, with important implications for long-term soil condition and land use sustainability. Knowledge of early agricultural management can also be inferred from soils, including farming strategies in dynamic, challenging environments.

8. **Title**: How to Read and Interpret FTIR Spectroscope of Organic Material

Authors: Asep Bayu Dani Nandiyanto∗, Rosi Oktiani, Risti Ragadhita

Journal and Year: *Indonesian Journal of Science & Technology,* 2019

Inference: Fourier Transform Infrared (FTIR) has been developed as a tool for the simultaneous determination of organic components, including chemical bond, as well as organic content. The step-by-step method on how to read the FTIR data was also presented, including reviewing simple to the complex organic materials. This study is potential to be used as a standard information on how to read FTIR peaks in the biochemical and organic materials.

CHAPTER 3

AIM AND SCOPE

The clay sample near kalpakkam area were collected and characterized for the following

- Chemical entities present in the clay by FTIR
- Morphology by SEM
- Surface area of the clay by BET measurements
- Thermal stability by TGA
- The presence of minerals was further tested by XRD studies
- Antibacterial property of clay using OPTICAL DENSITY Measurement
- Amount of fluoride detection in water and ragi.

CHAPTER 4

MATERIALS AND METHOD

4.1. MATERIALS

4.1.1. SOIL SAMPLING

The sample have been collected at the month of November, sample is collected nearby village of kalpakkam the sediment sample collected at five wet areas, each weighed about 1 kilogram. The sample was also collected from a depth of 4-5 cm from the surface, after removing naked stones, plant and animal debris, these composite sample were dried and sieved through a mesh. Before analysis samples were placed in plastic pouches. Then soil was subjected to the chemical, physical and biological analysis. The location map is given below.

4.2 CHARACTERIZATION TECHNIQUE

The chemical, physical and biological characteristics of the clay are essential to identify the specific properties presence.

4.2.1. FOURIER TRANSFORM INFRARED SPECTROSCOPY - (FTIR)

FTIR is a technique used to obtain an infrared spectrum of absorption or emission of a solid, liquid or gas. An FTIR spectrometer simultaneously collects high-resolution spectral data over a wide spectral range. This confers a significant advantage over a dispersive spectrometer, which measures intensity over a narrow range of wavelengths at a time. Infrared spectroscopy exploits the fact that molecules absorb frequencies that are characteristic of their structure. These absorptions occur at resonant frequencies, i.e., the frequency of the absorbed radiation matches the vibrational frequency. The energies are affected by the shape of the molecular potential energy surfaces, the masses of the atoms, and the associated vibronic coupling. In particular, in the Born–Oppenheimer and harmonic approximations, i.e., when the molecular Hamiltonian corresponding to the electronic ground state can be approximated by a harmonic oscillator in the neighbourhood of the equilibrium molecular geometry, the resonant frequencies are associated with the normal modes corresponding to the molecular electronic ground state potential energy surface.

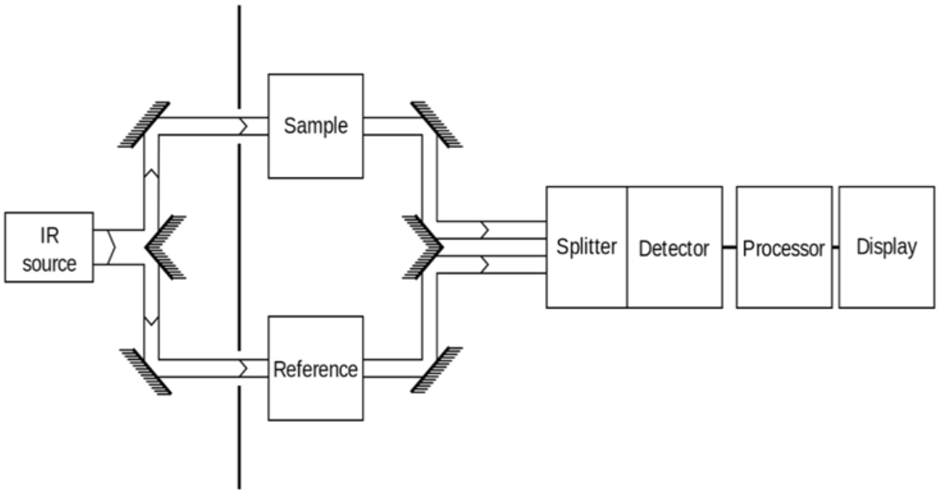

Fig.4.1. FTIR absorption spectrometer

In short, the IR spectrum is divided into three wavenumber regions: far-IR spectrum (<400 $cm^{-}1$), mid-IR spectrum (400-4000 $cm^{-}1$), and near-IR spectrum (4000-13000 $cm^{-}1$). The mid-IR spectrum is the most widely used in the sample analysis, but far- and near-IR spectrum also contribute in providing information about the samples analysed. This study focused on the analysis of FTIR in the mid-IR spectrum. The mid-IR spectrum is divided into four regions: (i) the single bond region (2500-4000 $cm^{-}1$), (ii) the triple bond region (2000-2500 $cm^{-}1$), (iii) the double bond region (1500-2000 $cm^{-}1$), and (iv) The fingerprint region (600-1500 $cm^{-}1$).

Identifying the fingerprint region (600-1500 $cm^{-}1$) This area is typically specific and unique. See detailed information in Table 1. But several identifications can be found: (1) Between 1000 and 880 $cm^{-}1$ for multiple band absorption, there are absorption bands at 1650, 3010, and 3040 $cm^{-}1$. (2) For C-H (out-of-plane bending), it should be combined with absorption bands at 1650, 3010, and 3040 $cm^{-}1$ which show characteristics of compound unsaturation. (3) Regarding vinyl-related compound, about 900 and 990 cm-1 for identifying vinyl terminals (-CH=CH2), between 965 and 960 $cm^{-}1$ for trans unsaturated vinyl (CH=CH), and about 890 cm-1 for double olefinic bonds in single vinyl (C=CH2). (4) Regarding aromatic compound, a single and strong absorption band is around 750 $cm^{-}1$ for ortho and 830 cm^{-1}. [10]

4.2.2. SCANNING ELECTRON MICROSCOPE - (SEM)

A scanning electron microscope (SEM) is a type of electron microscope that produces images of a sample by scanning the surface with a focused beam of electrons. The electrons interact with atoms in the sample, producing various signals that contain information about the surface topography and composition of the sample. Specimens are observed in high vacuum in a conventional SEM, or in low vacuum or wet conditions in a variable pressure or environmental SEM, and at a wide range of cryogenic or elevated temperatures with specialized instruments.

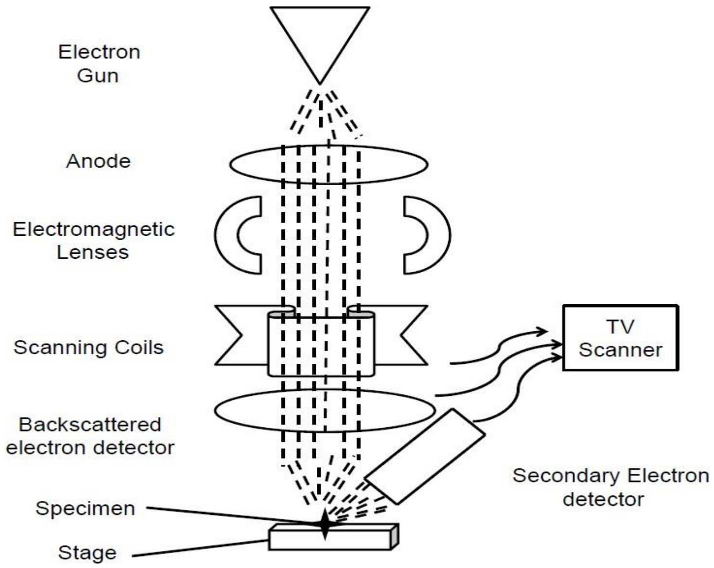

Fig.4.2.Scanning Electron Microscope

4.2.3. THERMO GRAVIMETRIC ANALYSIS – (TGA)

Thermo Gravimetric Analysis or Thermal Gravimetric Analysis (TGA) is a method of thermal analysis in which the mass of a sample is measured over time as the temperature changes. This measurement provides information about physical phenomena, such as phase transitions, absorption, adsorption and desorption; as well as chemical phenomena including chemisorption‟s, thermal decomposition, and solid-gas reactions (e.g., oxidation or reduction)

The upper temperature used for TGA is normally 1000 °C. Quantitative analysis is done from the thermal curve by measuring the loss in mass m.[12]

Fig 4.3. Thermo Gravimetric Analyzer

4.2.4. X-RAY DIFFRACTION ANALYSIS – (XRD)

X-ray diffraction analysis (XRD) is a technique used in materials science to determine the crystallographic structure of a material. It is used to study the structure, composition, and physical properties of materials. XRD works by irradiating a material with incident X-rays and then measuring the intensities and scattering angles of the X-rays that leave the material (X-ray diffractro meter).

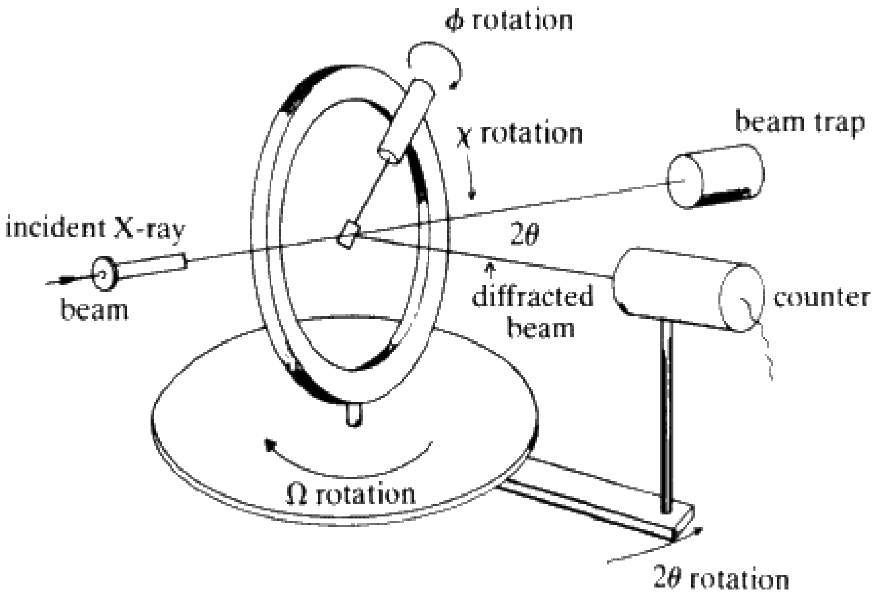

Fig 4.4. X-ray diffractrometer

4.2.5. POROSIMETRY

Porosimetry is an analytical technique used to determine various quantifiable aspects of a material's porous structure, such as pore diameter, total pore volume, surface area, and bulk and absolute densities Brunauer-Emmett-Teller (BET) theory aims to explain the physical adsorption of gas molecules on a solid surface and serves as the basis for an important analysis technique for the measurement of the specific surface area of materials.

Fig.4.5.Surface area and pore size analyser

BET method actually means the analysis of isotherm data by a method developed by Brunauer, Emmett and teller. by means of the BET equation the amount of adsorbed gas, which build up one monolayer on the surface, can be calculated from the measured isotherm. The number of molecules in this monolayer multiplied by the required space of one molecule gives the BET surface area. Besides the adsorption of nitrogen at 77 k, krypton adsorption at 77k is recommended for the determination of very small surface area.

- The choice of the measuring instrument depends on: Scope of the task (only for BET) surface area or also the pore volume and pore size distribution) 13
- The range of the surface area of the materials (the determination of very small surface areas y krypton adsorption requires a special measuring technique (Chennakesavulu et al. 2010).[13

CHAPTER 5

RESULTS AND DISCUSSION

5.1 FTIR

The main idea gained from the FTIR analysis is to understand what the meaning of the FTIR spectrum (see example FTIR spectrum in Figure 5.1 &5.2). The spectrum can result "absorption versus wavenumber" or "transmission versus wavenumber" data. In this paper, we discuss only the "absorption versus wavenumber" curves.

Olefinic (alkene): Vinyl C-H out-of-plane bend 995-985 + 915-890, Vinylidene C-H out-of-plane bend 895-885, trans-C-H out-of-plane bend 970-960, cis-C-H out-of-plane bend 700 (broad).

Aromatic ring (aryl): Aromatic C-H out-of-plane bend 900-670 (several) C-H Monosubstitution (phenyl) 770-730 + 710-690 C-H 1,2-Disubstitution (ortho) 770-735 C-H 1,3-Disubstitution (meta) 810-750 + 900-860 C-H 1,4-Disubstitution (para) 860-800.

Acetylenic(alkyne): Alkyne C-H bend 680-610 Alkyne C-H bend 630 (typical)

Aliphatic organ halogen compound: Aliphatic chloro compounds, C-Cl stretch 800-700 Aliphatic bromo compounds, C-Br stretch 700-600 Aliphatic iodo compounds, C-I stretch 600-500.

Alcohol and hydroxy compound: Primary alcohol, C-O stretch ~1050 Secondary alcohol, C-O stretch ~1100.

Ether and oxy compound: Peroxides, C-O-O- stretch 890-820[1]

Simple hetero-oxy compounds,) Phosphorus-oxy compounds:

Aliphatic phosphates (P-O-C stretch) 1050-990, Aromatic phosphates (P-O-C stretch) 1240-1190/995-850.

Silicon-oxy compounds: Organic siloxane or silicone (Si-O-Si) 1095-1075/1055-1020 Organic siloxane or silicone (Si-O-C) 1110-1080.

Thiols and thio-substituted compounds: Thiol or thioether, CH2-S-(C-S stretch) 710-685 Thioethers, CH3-S-(C-S stretch) 660-630 Aryl thioethers, ø-S (C-S stretch) 715-670 Disulfides (C-S stretch) 705-570 Disulfides (S-S stretch) 620-600 Aryl disulfides (S-S stretch) 500-430 Polysulfides (S-S stretch) 500-470.

Common inorganic ions: Nitrate ion 1380-1350/840-8155) Phosphate ion 1100-1000 Ammonium ion 3300-3030/1430-13905) Cyanide ion, thiocyanate ion, and related ions 2200-2000 Silicate ion 1100-900.

Note: 1) Normally, it is very weak in the infrared but more characteristic in the Raman spectrum; 2) Lower frequency band because of the conjugated double bond; 3) Higher frequency band characteristic of aldehydes, related with the terminal aldehydic C-H stretch; 4) Asymmetric/symmetric XO2 stretch (NO2 and SO2); 5) Normally, the first absorption is intense and broad, and the second has weak to medium intensity and narrow. The both often exist as multiple band structures, and it may be used to characterize individual compounds.

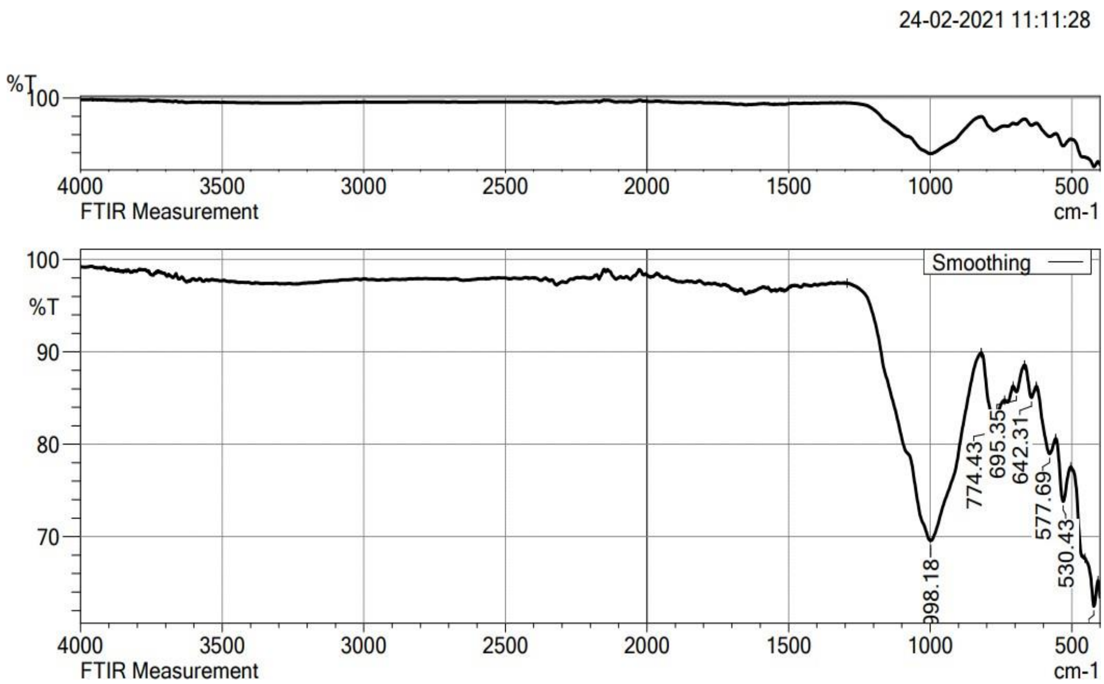

Fig 5.1.a FTIR peak of sample 1

	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	422.42	62.47	3.58	453.28	406.99	1611.042	58.005
2	530.43	73.82	5.29	556.47	503.43	1242.964	133.406
3	577.69	78.97	3.39	624.95	556.47	1266.057	131.745
4	642.31	85.06	2.16	666.42	624.95	565.321	43.407
5	695.35	85.70	1.24	706.92	666.42	530.508	21.356
6	774.43	82.27	4.83	819.76	736.82	1259.824	209.203
7	998.18	69.56	23.16	1293.29	819.76	7925.885	4920.708

Table 5.1.b Major peak value of sample 1

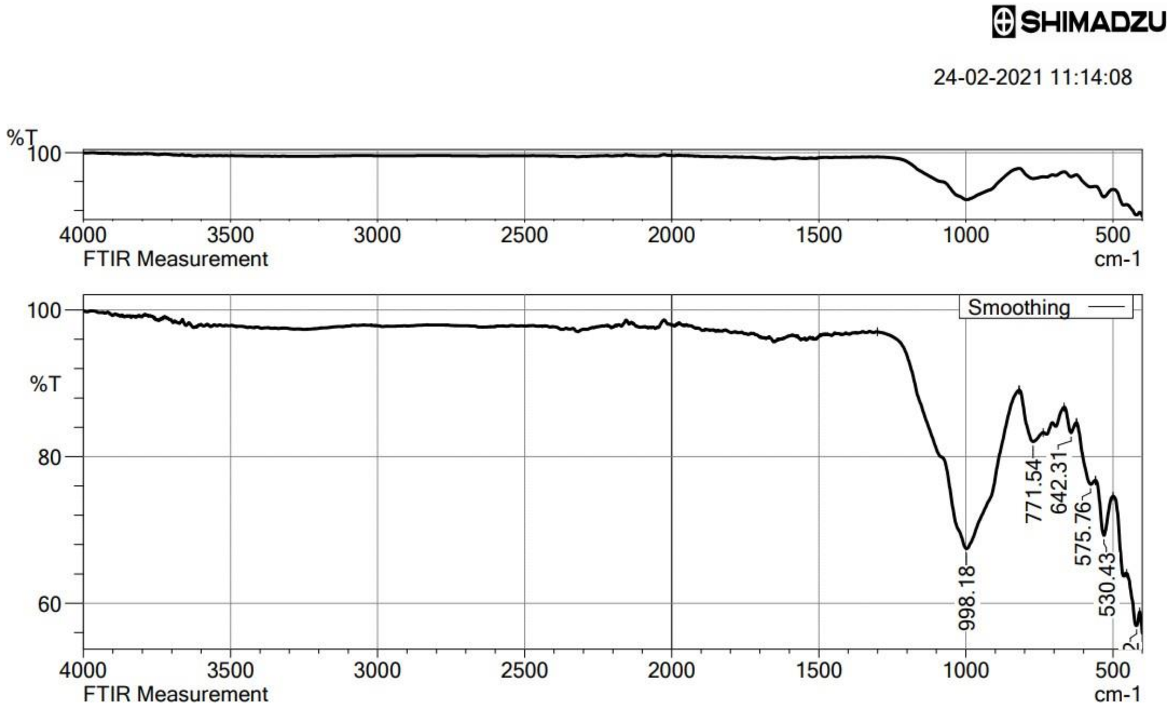

Fig 5.2.a FTIR peak of sample 2

	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)	Area	Corr. Area
1	419.52	56.95	3.12	453.28	408.92	1773.691	63.323
2	530.43	69.27	6.44	559.37	499.57	1627.065	172.363
3	575.76	76.23	2.52	623.98	559.37	1353.555	106.011
4	642.31	83.26	2.30	665.45	623.98	638.924	45.533
5	771.54	82.06	3.68	818.80	736.82	1304.856	172.046
6	998.18	67.44	24.60	1301.01	818.80	8346.039	4995.766

Table 5.2.b Major peak value of sample 2

5.2 SEM

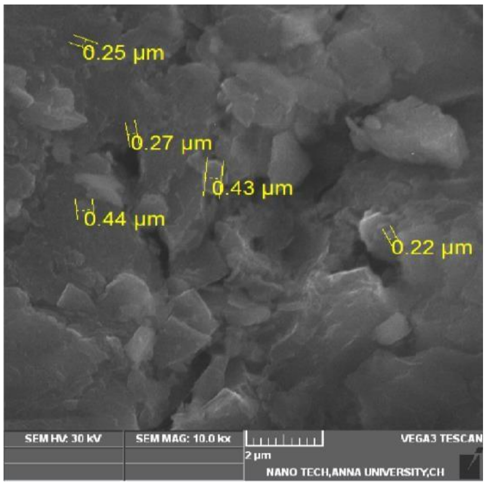

Fig 5.3 Morphology of clay at 2µm

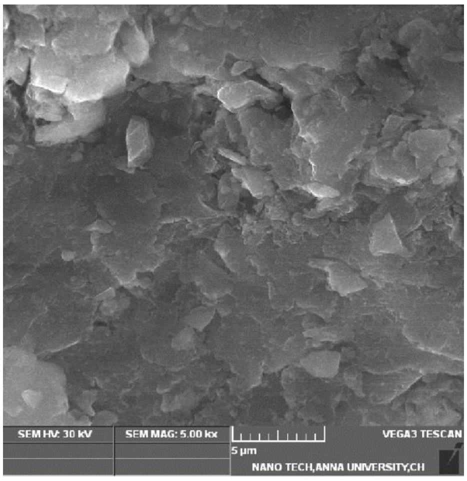

Fig 5.4 SEM image at 5µm

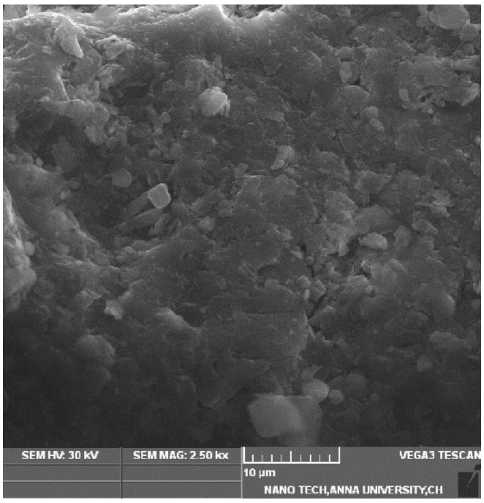

Fig 5.5SEM image at 10µm

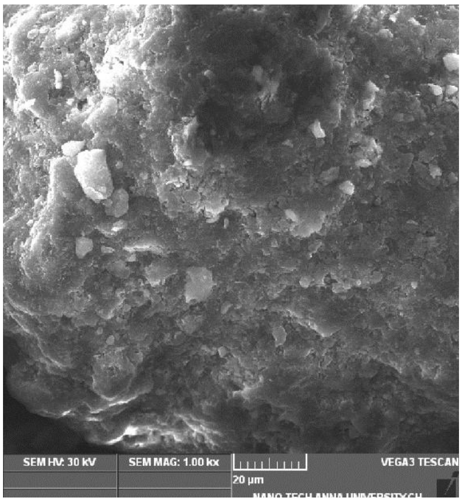

Fig 5.6 SEM image at 20µm

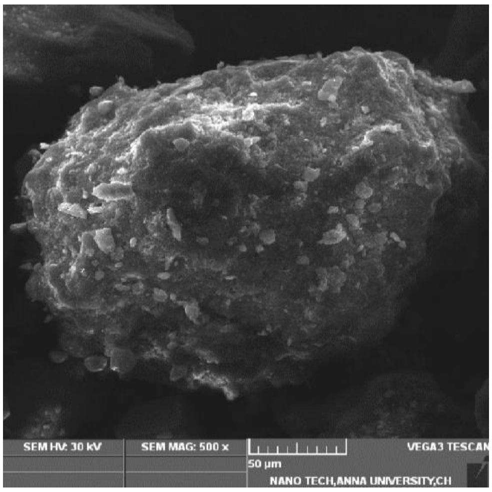

Fig 5.7 SEM image at 50µm

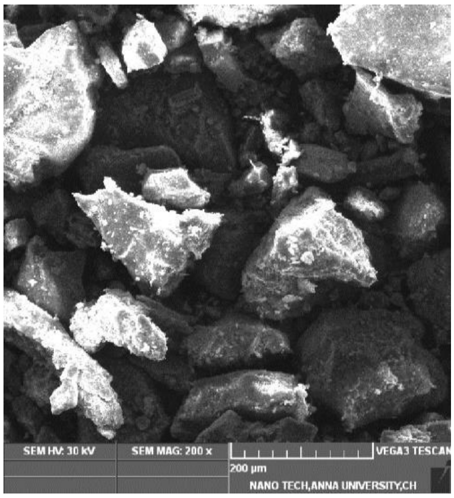

Fig 5.8 SEM image at 200µm

The SEM result reveals that the presence of micro and macro scale materials due to presence of metal or metal oxide in clay it shows brighter SEM images.

5.3 TGA

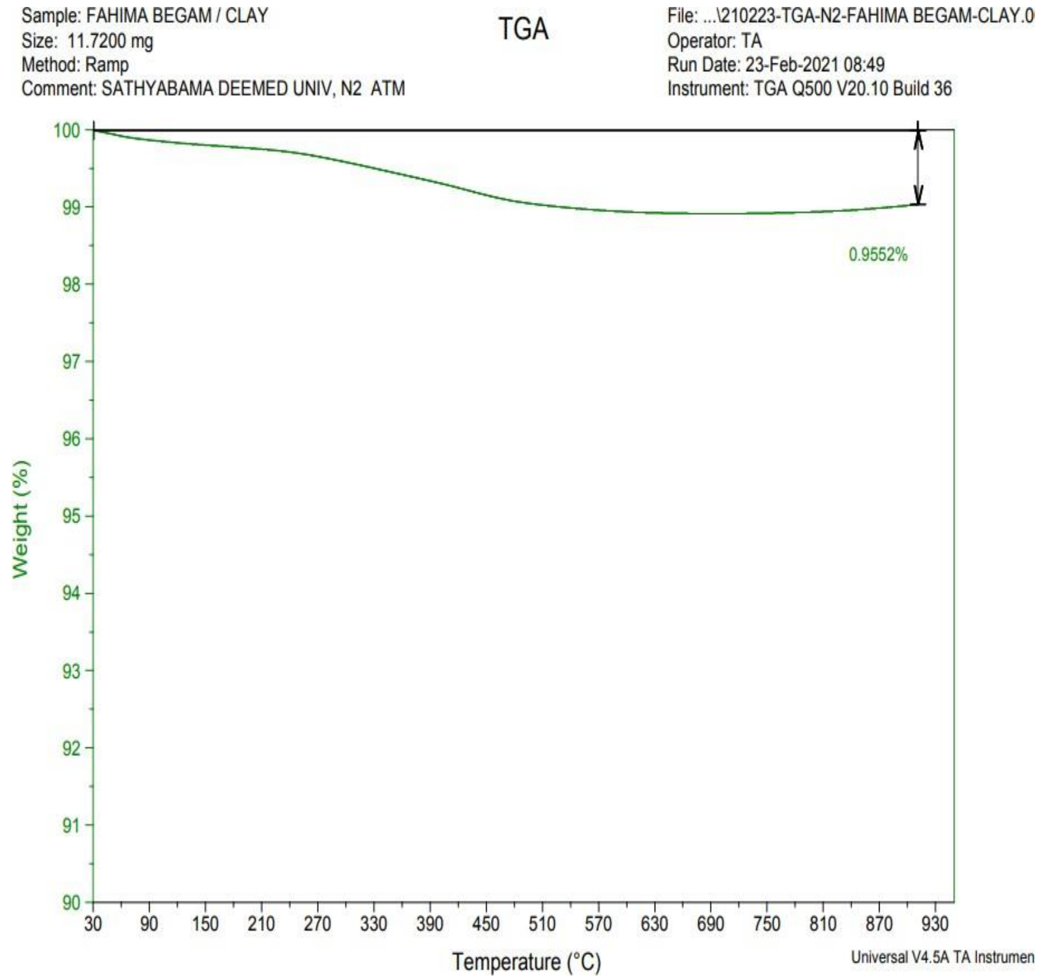

Fig 5.9 TGA of clay sample collected at Kalpakkam

Thermo Gravimetric Analysis of clay sample was done in Nitrogen (N_2) atmosphere. The result was shown in Fig 5.9. It is observed that the clay was thermally highly stable. It reveals that the 90% of the material is stable even above 900 ^oC.

5.4 SURFACE AREA

Full Report Set

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Sample: FAHIMA BEGAM / CLAY
Operator: A N
Submitter: SATHYABAMA UNIVERSITY
File: E:\2019\E21-015.SMP

Started: 3/6/2005 5:19:16PM
Completed: 3/7/2005 12:16:55AM
Report Time: 3/7/2005 8:12:12PM
Sample Mass: 0.4569 g
Cold Free Space: 45.6735 cm³
Ambient Temperature: 25.00 °C
Automatic Degas: Yes

Analysis Adsorptive: N2
Analysis Bath Temp.: -195.608 °C
Thermal Correction: No
Warm Free Space: 15.5330 cm³ Entered
Equilibration Interval: 10 s
Low Pressure Dose: None

Comments: Sample outgassed at 100 C overnight.

Notes:

Summary Report

Surface Area

BET Surface Area: 1.2870 m²/g

Pore Volume

Single point adsorption total pore volume of pores
less than 2013.548 Å width at p/p° = 0.990307757: 0.003098 cm³/g

Pore Size

BJH Desorption average pore width (4V/A): 51.604 Å

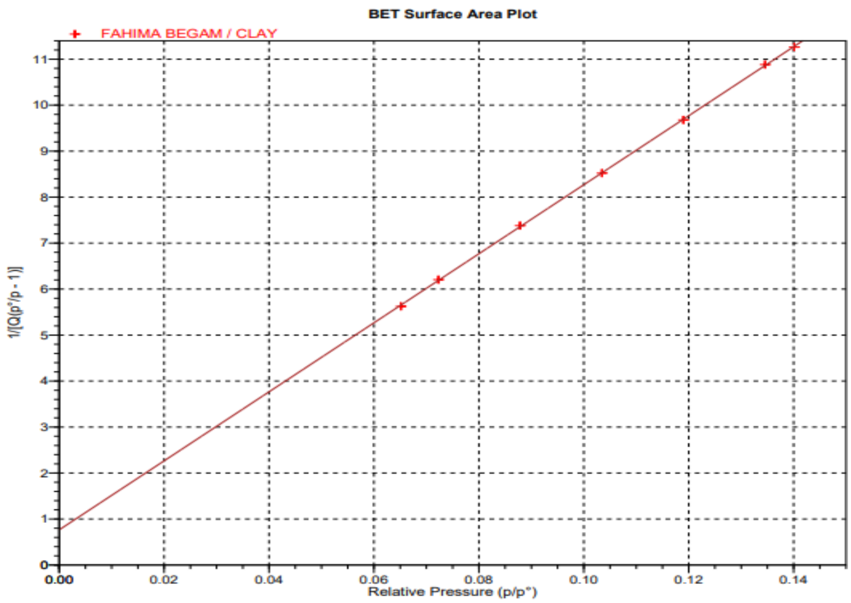

Fig 5.10 BET surface area

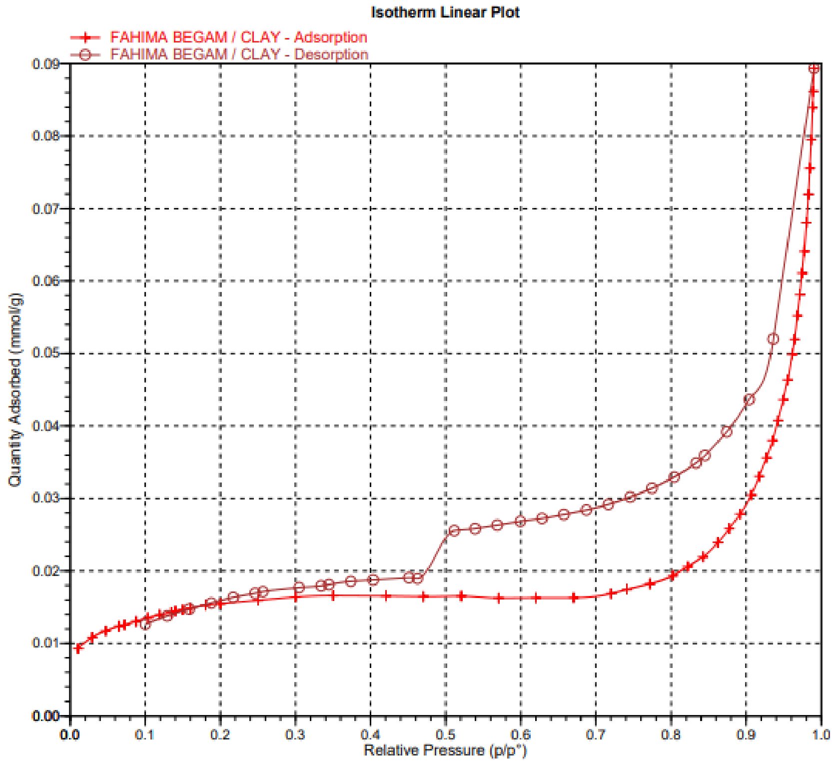

Fig 5.11 Isothermal linear plot

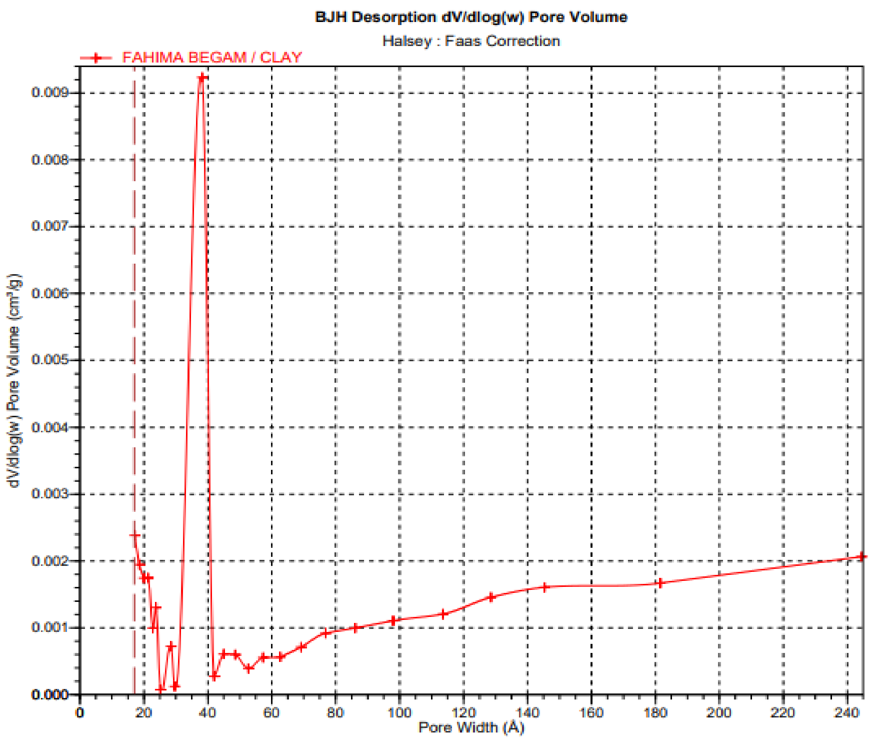

Fig 5.12 Pore volume

The adsorption and desorption isotherm were shown in Fig (5.11 &5.12). The BET surface area was measured to 1.280 m^2/gm though the expected the surface area of clay is less, as particle size decreases, the surface area per unit volume increases.

5.5 XRD

Graphics

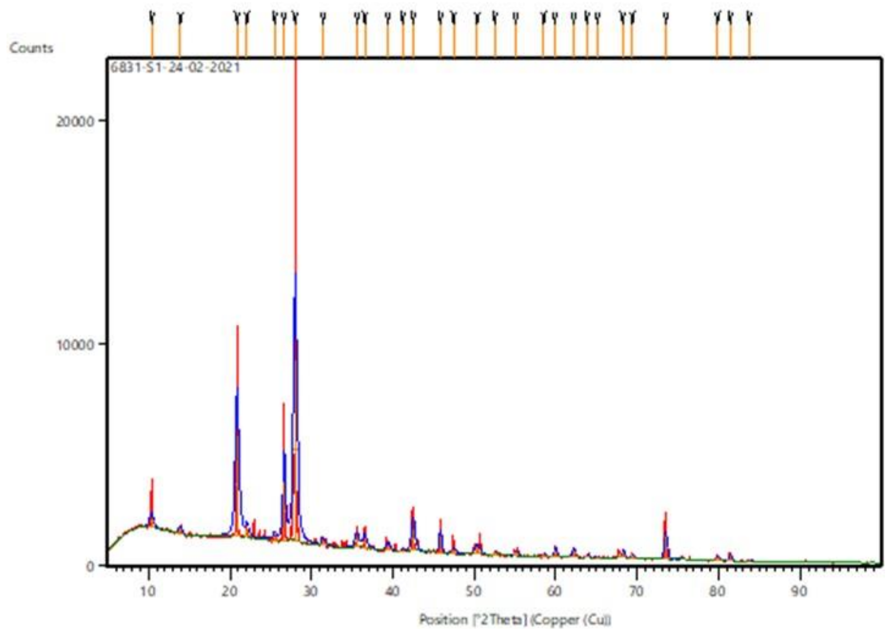

Fig 5.13 XRD value

The presence of above minerals was further tested by XRD studies. XRD is used to determine the mineralogical composition of the raw material components as well as qualitative and quantitative phase analysis of multiphase mixtures. The occurrences of minerals in clay were identified by comparing „d" values (Selected Powder Diffraction Data for Minerals 1974; Powder Diffraction File Search Manual Minerals 1974). The possible minerals with their „d" values present in the adsorbents are given in Fig.13. No quantitative estimation phases in these adsorbents have been made but their characterization of XRD patterns indicates the presence of quartz, kaolinite, hematite, illite, and tridymite as the major phases. Further the occurrence of the above minerals in the aforesaid adsorbents was confirmed by FTIR study

CHAPTER 6

SUMMARY AND CONCLUSION

Fluoride plays an important role in human metabolism within the permissible limit. But it is exceeded by many activities mainly by the human activities. High level of fluoride causes major impact in human health. It can replace calcium ion in bones and teeth, which can lead to fluorosis. The highest areas of fluoride contamination of groundwater were identified.

Fluoride level of soil, grains and water should be adjusted to an optimum level. Soil has positive correlation with respect to uptake of fluoride by ragi grains. So, ragi grains with optimum fluoride content should be made available in the commercial markets so that oral and general health can be benefitted.

Endemic fluorosis has remained a major public health problem throughout the world, especially in India. Absolute treatment is difficult; hence prevention and control of fluorosis is important, thus changing the water source, reducing the fluoride concentration of drinking water and decreasing the consumption of fluoride rich food are the main strategies that can effectively diminish the incidence of fluorosis. It is the total amount of Fluoride absorbed in a human body that needs to be considered i.e., the sum of fluoride intake from water, food, and air. Therefore, determining dietary fluoride intake is also useful and important for estimating the retention of fluoride in man. This provided an impetus with the aim to estimate the absorption of fluoride to edible grains from soil and water.

REFERENCE

1. Jump up to: ***a b*** *Kaufmann, Robert K.; Cutler J. Cleveland (2008). Environmental Science. McGraw-Hill. pp. 318–319. ISBN 978-0-07-298429-3.*

2. R. B. Brown (September 2007). "Soil Texture" (PDF). Agronomy Fact Sheet Series: Fact Sheet SL-29. Cornell University, Department of Crop and Soil Sciences. Retrieved May 2, 2017.

3. United States Department of Agriculture Soil Survey, 1943

4. B. Rosie Lerner, "What is Loam?", Purdue University Consumer Horticulture, 6 January 2000. Retrieved 5 March 2017.

5. "Field Pea: Agronomy".

6. Schittich (Ed), Christian Schittich (2001). Building Simply. Birkhäuser Architecture. pp. 38–42. ISBN 3764372710*.*

7. Gerhard Koch, "Loam Construction – from a niche product to an industrial building system". Tokyo: Action for Sustainability – The 2005 World Sustainable Building Conference in Tokyo, Japan, September 2005. Retrieved 17 December 2012.

8. https://en.wikipedia.org/wiki/Pseudomonas

9. https://en.wikipedia.org/wiki/Klebsiella

10. https://en.wikipedia.org/wiki/Fouriertransform_infrared_spectroscopy#:~:text=Fourier%2Dtransform%20infrared%20spectroscopy%20(FTIR,over%20a%20wide%20spectral%20range.

11. https://en.wikipedia.org/wiki/Scanning_electron_microscope

12. https://en.wikipedia.org/wiki/Thermogravimetric_analysis#:~:text=Thermogravimetric%20analysis%20or%20thermal%20gravimetric,time%20as%20the%20temperature%20changes.

13. https://en.wikipedia.org/wiki/BET_theory#:~:text=Brunauer%E2%80%93Emmett%E2%80%93Teller%20(BET,specific%20surface%20area%20of%20materials.

14. https://serc.carleton.edu/research_education/geochemsheets/techniques/XRD.html

15. https://www.google.com/search?q=optical+density+in+biochemistry&rlz=1C1CHBF_enIN918IN918&sxsrf=ALeKk00gD1LrHloSxzN_WCbrcvmg9c1nvA%3A1618210018892&ei=4uxzYPH-Nc6w9QPj2J_IDw&oq=optical+density+in+&gs_lcp=Cgdnd3Mtd2l6EAMYATICCAAyAggAMgIIADICCAAyAggAMgIIADICCAAyAggAMgIIADICCAA6BwgAEEcQsAM6BwgAELADEEM6BAgAEEM6BwgAEIcCEBRQqUNYnFRg-3RoAXACeACAAbACiAHaCZIBBzAuMS4zLjGYAQCgAQGqAQdnd3Mtd2l6yAEKwAEB&sclient=gws-wiz

16. https://en.wikipedia.org/wiki/X-ray_fluorescence

17. https://www.thermofisher.com/blog/ask-a-scientist/what-is-xrf-x-ray-fluorescence-and-how-does-it-work/#:~:text=composition%20of%20materials.-,XRF%20(X%2Dray%20fluorescence)%20is%20a%20non%2Ddestructive,a%20primary%20X%2Dray%20source