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Study on Clay Deposits of Adur, Hangal Taluka, Haveri District, Karnataka, India.

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Abstract

The Geological and Geochemical Investigations of clays deposits around Adur village, Hangal taluka, Haveri District, Karnataka, India, reveal that the chemical weathering of greywacke/phyllite/argillite formations, due to leaching of hydrothermal solutions lead to the formation of clays. The minerals present were analysed with the help of Infrared studies, Thermal Gravimetric Analysis (TGA), Differential Thermal Analysis (DTA) and X-ray fluorescence Analysis (XRF) to assess the quality by identifying the presence of different minerals and to check the industrial suitability, and also estimating the quantity of Adur clay deposits.

Keywords: ***Greywacke, Phyllite, Argillite, Montmorillollite***

1. Introduction

Clay is undoubtedly the oldest ceramic raw material, which is recognised by its earthy nature, behaviour of forming a coherent sticky mass and develops plasticity when mixed with water, which can be moulded into a desired shape and further attainment of solidity at different stages of heating. The clay deposits in the vicinity of Adur village of Hangal Taluka which is in the western part of Haveri District in the central Karnataka, India, have been studied to understand the type of clay and to study their geological and geochemical properties for utilization in industrial applications. In addition to field geological and geochemical studies, the clay samples from the study area were subjected to Infrared spectroscopy, Thermal gravimetric analysis (TGA), Differential thermal analysis (DTA) and X-ray fluorescence analysis (XRF).

2. Study Area

The study area covering the clay deposits lies in the vicinity of Adur village of Hangal Taluka which is in the western part of Haveri District, the area also surrounded by Dharwad, Shimoga and Davngere districts in the central Karnataka, India. The study area covers 900 sq mts. and lies between longitude 75^{o} 10' to 75^{o} 20' and latitude 14^{o} 35, to 14^{o} 55' N. in the survey of India toposheet numbers 48N/1, 48 N/2. 48 N/5 and 48 N/6 on 1:50000 scale.

3. Materials and Methods

Detailed field investigations of the clay deposits around Adur area was carried out and during the field work 20 samples were collected from different parts of the deposit. The infrared spectroscopy analysis were carried for 10 samples using fourier transform infrared spectrometer scanning in the region of 4000-400 cm $^{-1}$ frequencies (wave number). The Thermal Gravimetric Analysis and Differential Thermal Analysis were carried for 6 samples, setting a temp range of 0-1000^{o}c.In order to find out the proportions of the major oxides present, XRF analysis were carried out for 10 samples.

4. Results and Discussion

The topography of the area shows contrasting features between western and eastern regions because of geological, physiographical and climatic conditions. The western part belongs to the Western Ghats which is a fractured edge of the peninsular India and rest is an undulating plain drained by Tungabadhra tributary system.

The general strike of the deposits is around 320^{o} and dips around 50^{o} east. The center of the hill is occupied by ferruginous chert bands, with the flanks of weathered schistose rock. The Fe content of these schistose formations appears to increase in proportion and traced towards cherty ferruginous formations. The schistose rocks have weathered into brownish shale like material and also whitish clay pockets. Both shale and clays retain the schistoscity and the typical fracture fillings of quartz. The clay deposits of Adur have been essentially derived from precursor rock of greywacke/phyllite/argillite. The greywacke/phyllite occurring in this tract are largely sand grade cherty rocks that have under gone low green -schist facies of metamorphism. The schistoscity is well developed in the greywacke/phyllites. The deposit is around 900 sq mts and the total quantity has been estimated as 50000 tonnes of greyish white coloured clayey deposits displaying good plasticity.

4.1. Infrared Spectroscopy Analysis

The Infrared Spectroscopy Analysis of 10 samples revealed that (**Fig-1 to 10**), the Kaolinite is present at wavelengths of 3297.95 cm^{-1}, 3667.38 cm^{-1}, 3620.72 cm^{-1}, 1115.57 cm^{-1}, 1009.32 cm^{-1}, 944.56 cm^{-1}, 757.44 cm^{-1}, and 423.23 cm^{-1}. Ellite is present at wavelengths of 1124.12 cm^{-1}, 3619.88 cm^{-1}, 3451.52 cm^{-1}. Montmorillollite is present at wavelengths of 1030.18 cm^{-1}, 1009.31 cm^{-1}, 1006.38 cm^{-1}. Muscovite at the wavelengths of 535.59 cm^{-1}. Feldspar at 465.57 cm^{-1} and 428.87 cm^{-1}. Quartz at wavelength of 694.39 cm^{-1} and 800.33 cm^{-1}.

4.2. Differential Thermal analysis

The Differential Thermal analysis (DTA) results of 5 clay samples revealed exothermic peaks at around 350oc indicating the presence of Illite.

4.3. Thermal Gravimetric Analysis

The Thermal Gravimetric Analysis (TGA) of 5 clay samples revealed **(Fig-11 to 15)** presence of Illite-Montmorillolite with loss of weight due to loss of water at varying temperatures. The results of XRF analysis of 10 samples have been tabulated (Table No.1) and indicate the presence of SiO_2 between 61.23% to 65.11%, TiO_2 between 0.31% to 0.92% with an average of 0.567%, Al_2O_3 averaging at 29.46%, Fe_2O_3 of 2.51% average, CaO and MgO with an average of 0.17% and 0.36% respectively. Na_2O varies

from 0.19% to 1.15% and K_2O varies between 1.49% to 4.5%.

Fig-1

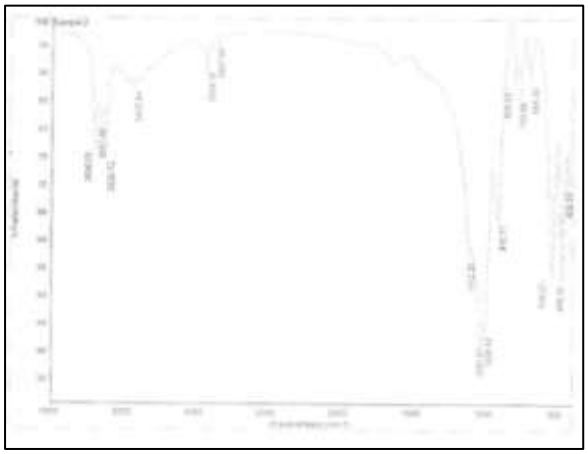

Fig-2

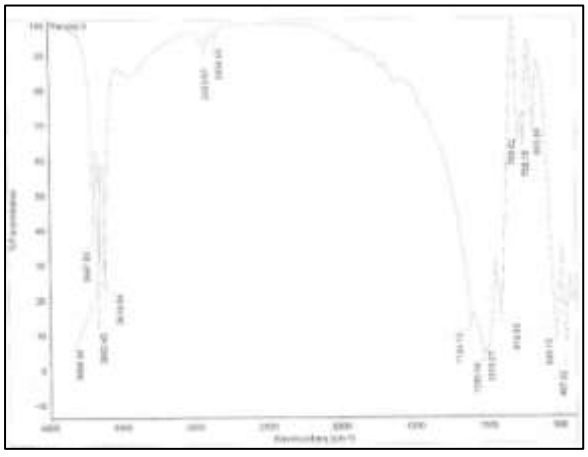

Fig-3

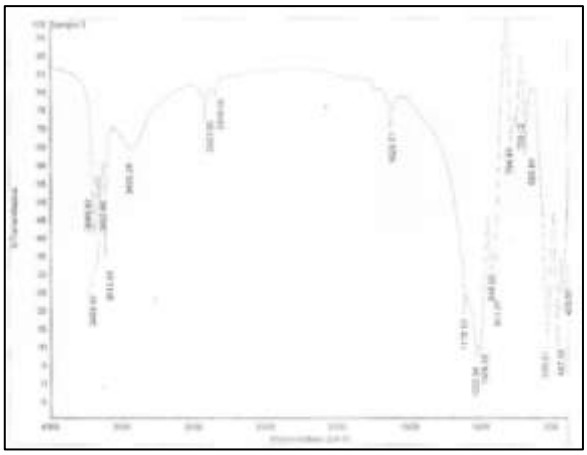

Fig -4

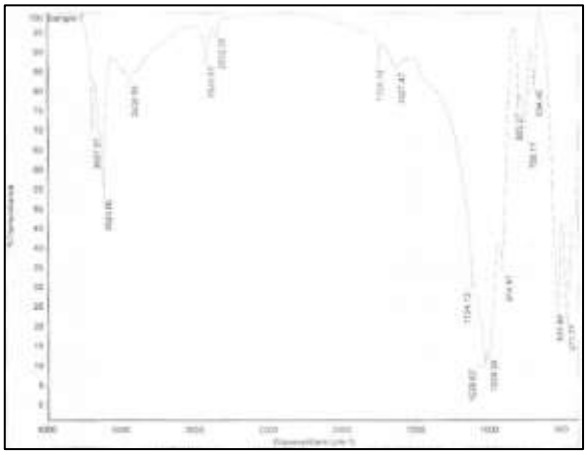

Fig-5

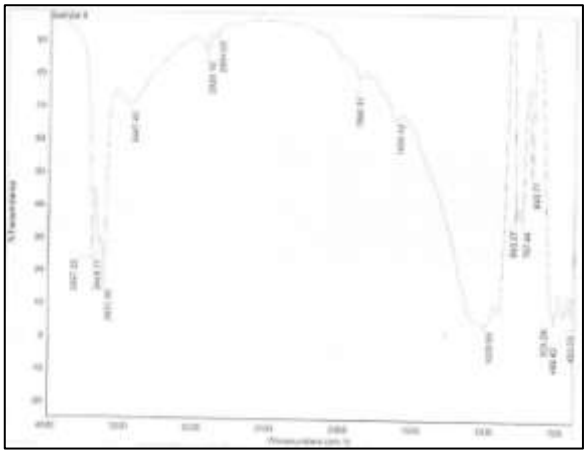

Fig -6

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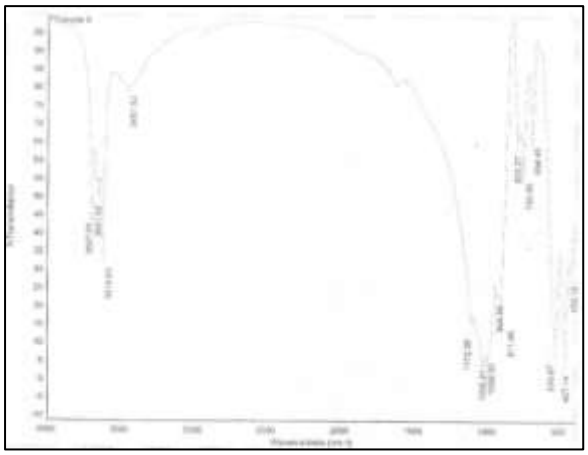

Fig-7

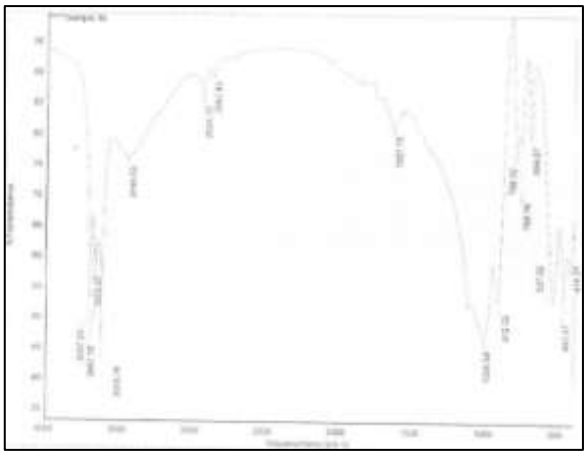

Fig-10

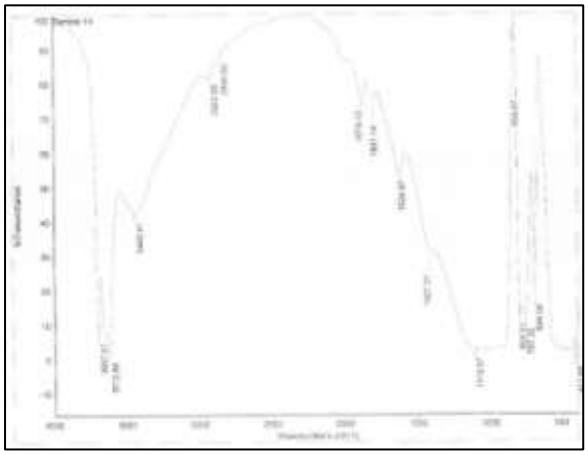

Fig-8

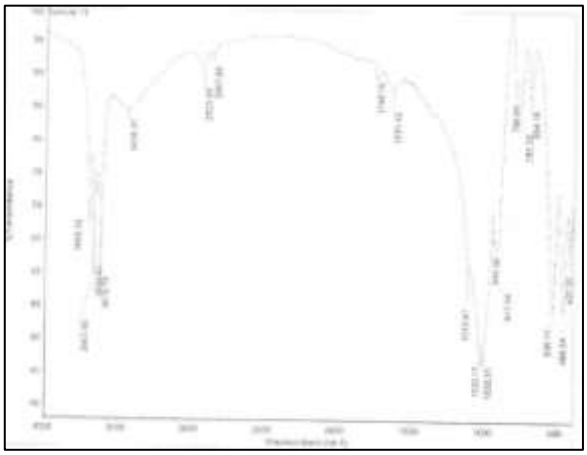

Fig-11

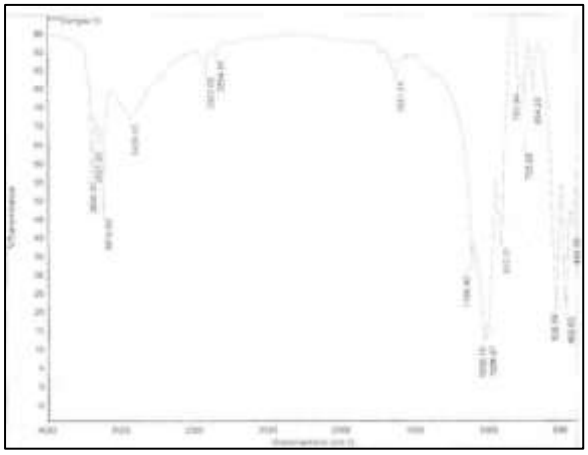

Fig -9

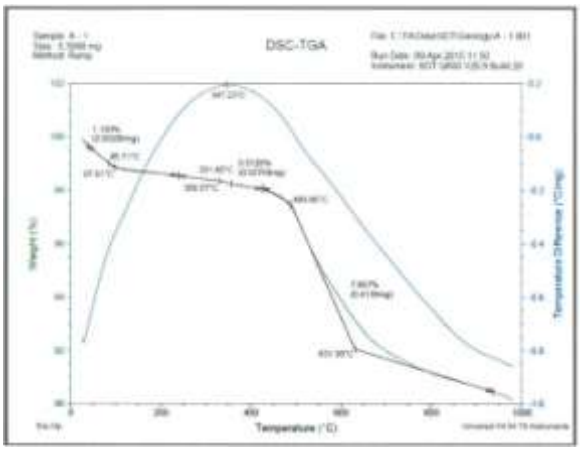

Fig-12

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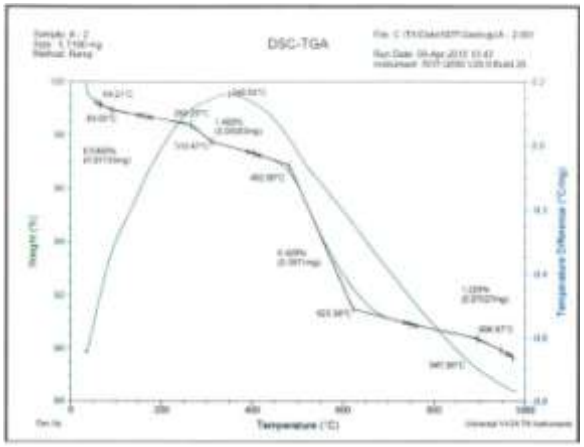

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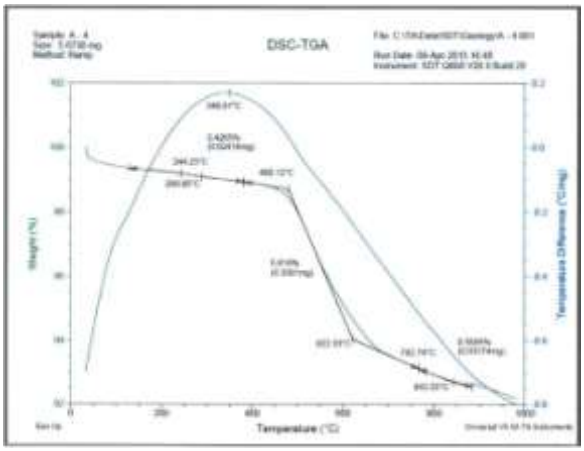

Fig-14

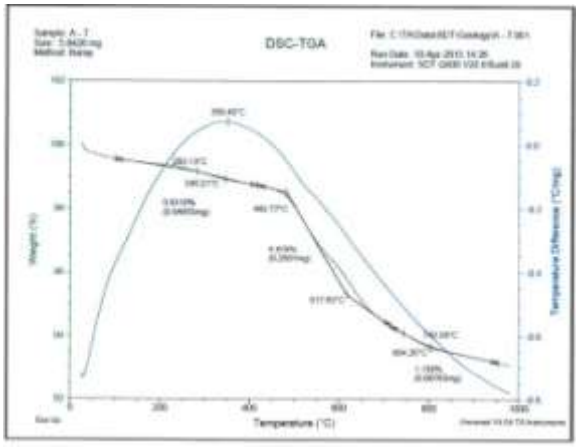

Fig-15

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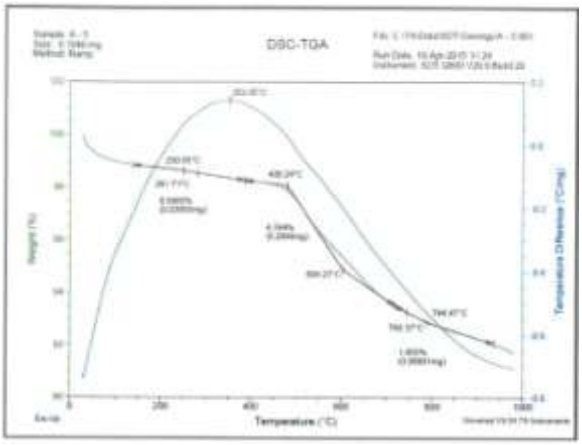

4.4 Analytical Data of XRF

The analytical data of XRF studies also reveals on the genesis aspects of these clay formations indicating leaching of silica due to chemical alteration of alumina rich formations. On comparing the XRF analysis data with industrial specifications it can be said that the Adur clays could be utilized for paper, rubber, textiles, electrical, fertilizer, paints and other industries

Table-1: Results of X-ray fluorescence of 10 clay samples

Sample No	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
SiO_2	61.38	62.38	62.50	63.79	64.18	65.11	62.45	61.23	61.36	63.55
TiO2	0.61	0.39	0.77	0.92	0.31	0.67	0.56	0.41	0.45	0.58
Al_2O_3	32.89	26.98	29.06	29.34	28.81	28.64	30.11	29.37	29.85	29.92
MnO	ND	0.02	ND	ND	ND	ND	ND	ND	ND	ND
Fe_2O_3	0.55	8.04	1.09	1.39	1.65	0.88	1.11	492	3.97	1.55
CaO	0.05	0.05	0.46	0.04	0.04	0.19	0.63	0.06	0.06	0.17
MgO	0.28	0.29	0.41	0.63	0.33	0.26	0.33	0.37	0.27	0.35
Na_2O	0.60	0.19	0.88	0.18	0.69	1.15	1.01	0.36	0.31	0.53
K_2O	3.33	1.49	4.59	3.43	3.77	2.88	3.72	3.08	3.26	3.11
P_20_5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total	99.68	99.83	99.76	99.71	99.77	99.77	99.92	99.80	99.63	99.75

5. Conclusion

The clay deposits of Adur have been derived from the Precursor rocks of greywacke/phyllite/argilites due to in-situ chemical weathering. The chemical character of Adur clays as investigated by XRF analysis reveals that the silica and

alumina content are on the higher side with minor amounts of ferric oxide, titanium oxide, calcium and magnesium oxides, sodium and potassium oxides. The infrared studies reveal the presence of Kaolinite, Illite, Montmorillollite, Chlorite, Muscovite, Feldspar and Quartz. The Differential Thermal Analysis (DTA) indicates a presence of Illite in the clay deposits also Thermal Gravimetric Analysis (TGA) reveals admixture of Illtie and Montmorillollite minerals. Thus the above studies and observations reveal that the Adur clay deposits could be used in various industries such as Paper, Rubber, Textile, Electrical, Fertilizer, Paints, Electrodes and Ceramics etc., enhancing their quality by way of various beneficiations techniques.

Acknowledgments

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