

Sem-Eds and Tg-Dt Analysis on Coal-Bagasse Ash and Clay-Perlite Aggregates

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Abstract: An industrial waste removal process plays main roles in all production industries, in this paper discussed about the sugar industry waste i.e. bagasse used as fuel along with coal in thermal power plant. After combustion of Coal-Bagasse, it produces bulk amount of ash and clay from the local fire brick manufacturers and expanded perlite from the thermal insulation powders suppliers. Coal-Bagasse ash, clay and perlite were performed to brick manufacturing. These three constituents with different ratios (10:5:1) on weight basis, mix properly with little addition of water for required plasticity. This mixture poured into moulds for required shape of sample (120mmx60mmx50mm) according to the laboratory requirements. Prepared samples were dried in atmosphere until the removal of wet content in samples. For final curing, dried samples heated in electrical furnace, at different temperature ranges. Scanning Electron Microscope with Energy Dispersive Spectrum (SEM-EDS) was performed to study the microstructures and chemical composition (on mass & weight basis) of samples, Thermo gravimetric-Differential Thermal Analysis (TG-DTA) to study the variation in mass of samples at different temperatures with respective time. The result shown maximum weight loss obtained at more quantity of coal, high compressive strength and low thermal conductivity at more amount of clay-bagasse ash.

Key words: SEM-EDS, TG-DTA, and Coal-Bagasse ash.

I. INTRODUCTION

In this paper discussed about reuse of an industrial waste and different types of tests conducted on samples, which was prepared by industrial waste i.e. coal-bagasse ash, clay and perlite. The industry's economy will be rejuvenated by the use of such waste from the industry [1]. Presently thermal power plant ash introduced as an ingredient for the manufacturing of cement bricks. But, some of the power plants allocated in sugar industries, sugar industry waste like bagasse used as fuel, because it consist carbon content which was used for efficient combustion. So, bagasse mixed with coal, both act as fuel and also, produces maximum ash [2]. Clay act as good binder for all components and perlite consist rich amount of thermal resistive properties. So, samples were prepared for forecast of better thermal insulating and high compressive strength [3].

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This bulk quantity of industrial waste would be converting as a value added product through conduct the awareness programs among the industrial managing bodies [4]. India prefers fired clay bricks for the all types of dwelling constructions so, many of brick manufacturing industries intend to low price with good quality because of poverty conditions [5]. According to laboratory requirements specimen was prepared in the dimensions 100x50x50 mm³. Wet samples were dried at room temperature up to complete removal of moisture presented in the samples. For final querying process green samples were heated in electrical woven up to 1000°C, at rate of heating was 5°C per minute. Finally, queried samples were characterization and evaluated by SEM-EDS, TG-DTA, thermal conductivity, specific heat, bulk density, water absorption and compressive stress.

II. MATERIALS AND METHODS

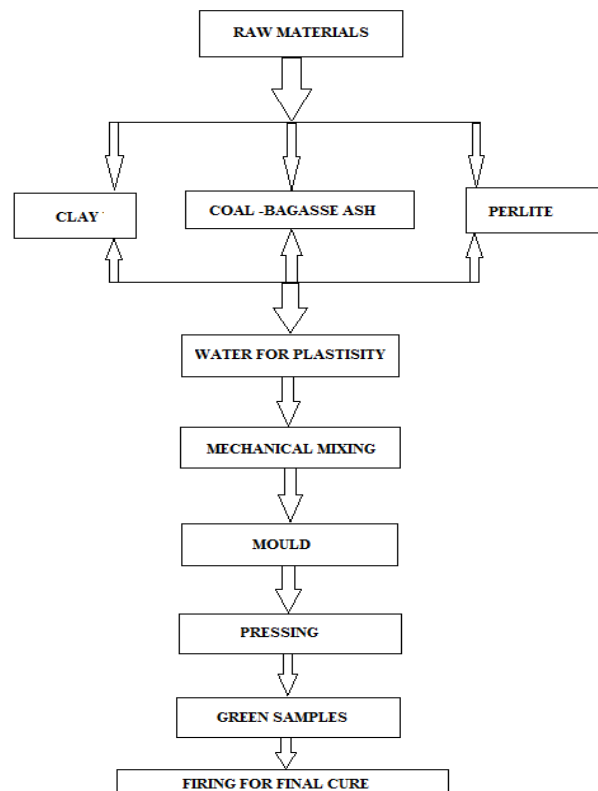
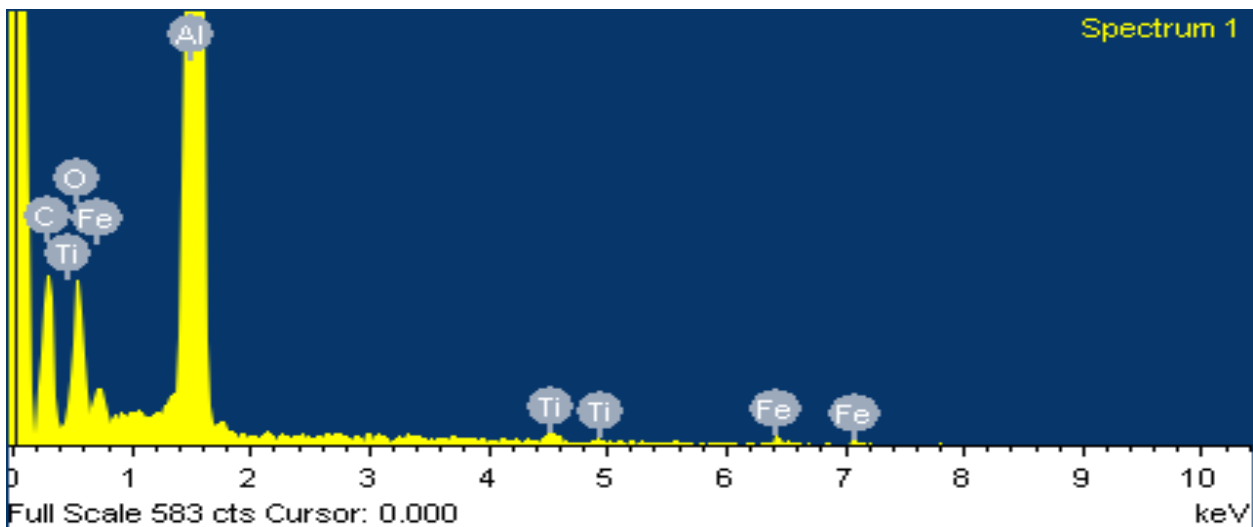
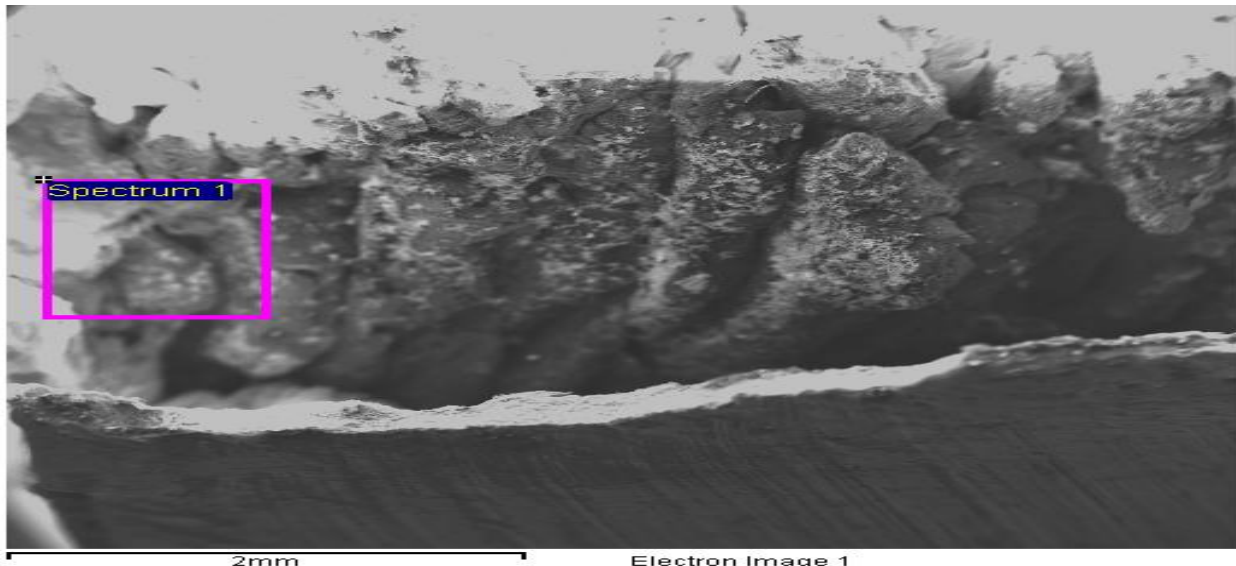


Fig.1: Flow chart for sample preparation

The following flow chart shows the required raw materials and manufacturing process of the samples. Coal - bagasse ash was one of the residues, Coal - bagasse was used as a fuel in thermal power plant, which was located at sugar production industry. Clay from the local brick manufacturers, it consist adhesive nature and easily penetrate with other materials and perlite from the suppliers, it consist hug amount of thermal insulating properties and easily bind with clay and perlite. Coal-bagasse ash, clay and perlite, these three materials are mixed with proper ratios (i.e. 2:1:1) and little addition of water for plasticity. Moulds prepared as for the laboratory requirements, after completion of proper mixing process of raw materials, fine mixture poured into the moulds for proper bonding of mixture has to apply the pressure with help of hydraulic rammers on the surface of the mould.

III. RESULTS AND DISCUSSIONS

SEM-EDS Analysis

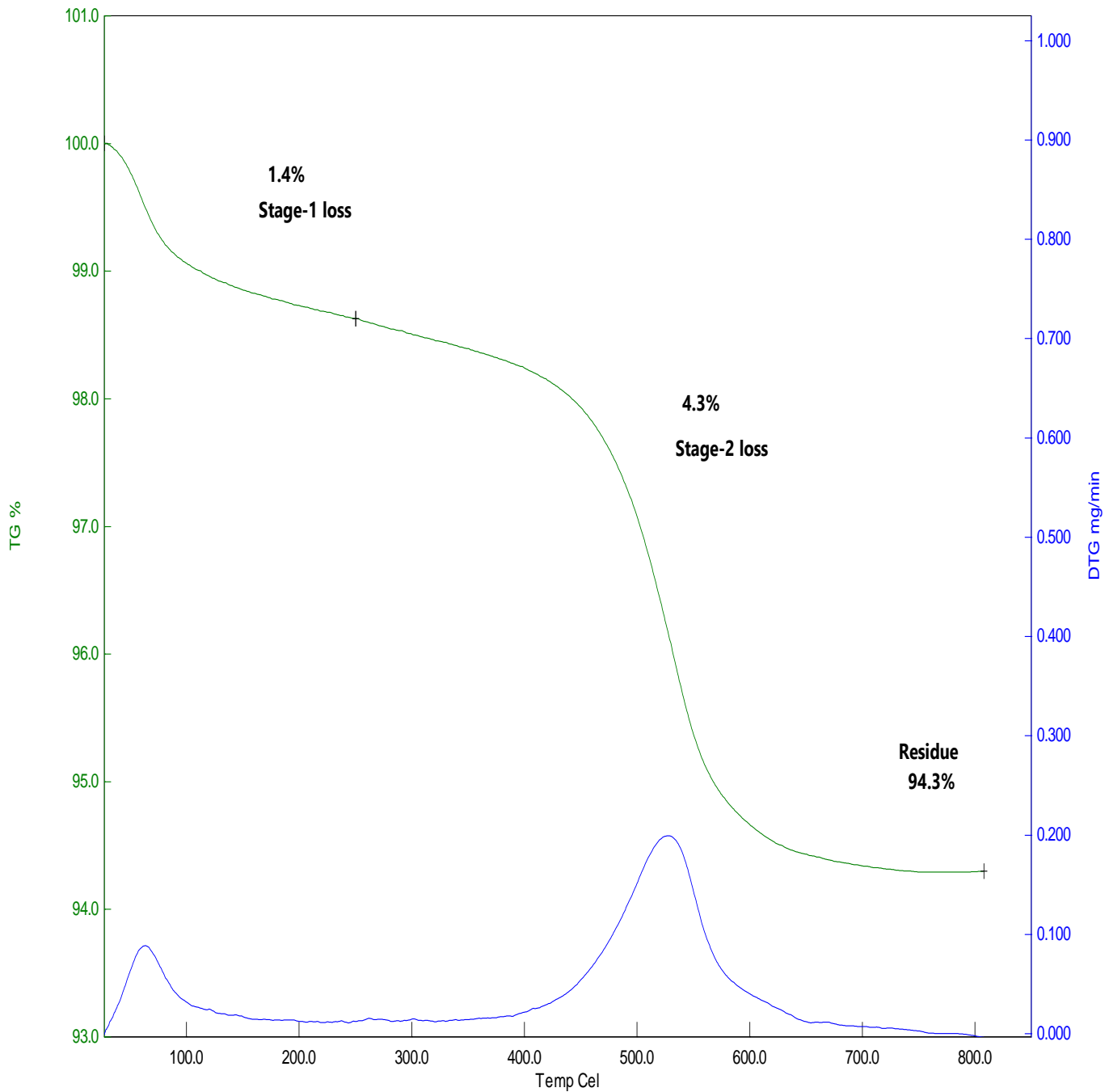


Element	C	O	Al	Ti	Fe
Weight %	25.59	10.70	54.19	1.64	7.88
Atomic %	42.76	13.42	40.30	0.69	2.83

Fig: 2.SEM-EDS and chemical composition

The above figures and table represent the elemental chemical composition percentage of the samples. According to an atomic percentage basis Carbon and Weight basis Aluminum both are shows more quantity, when compared with other elements.

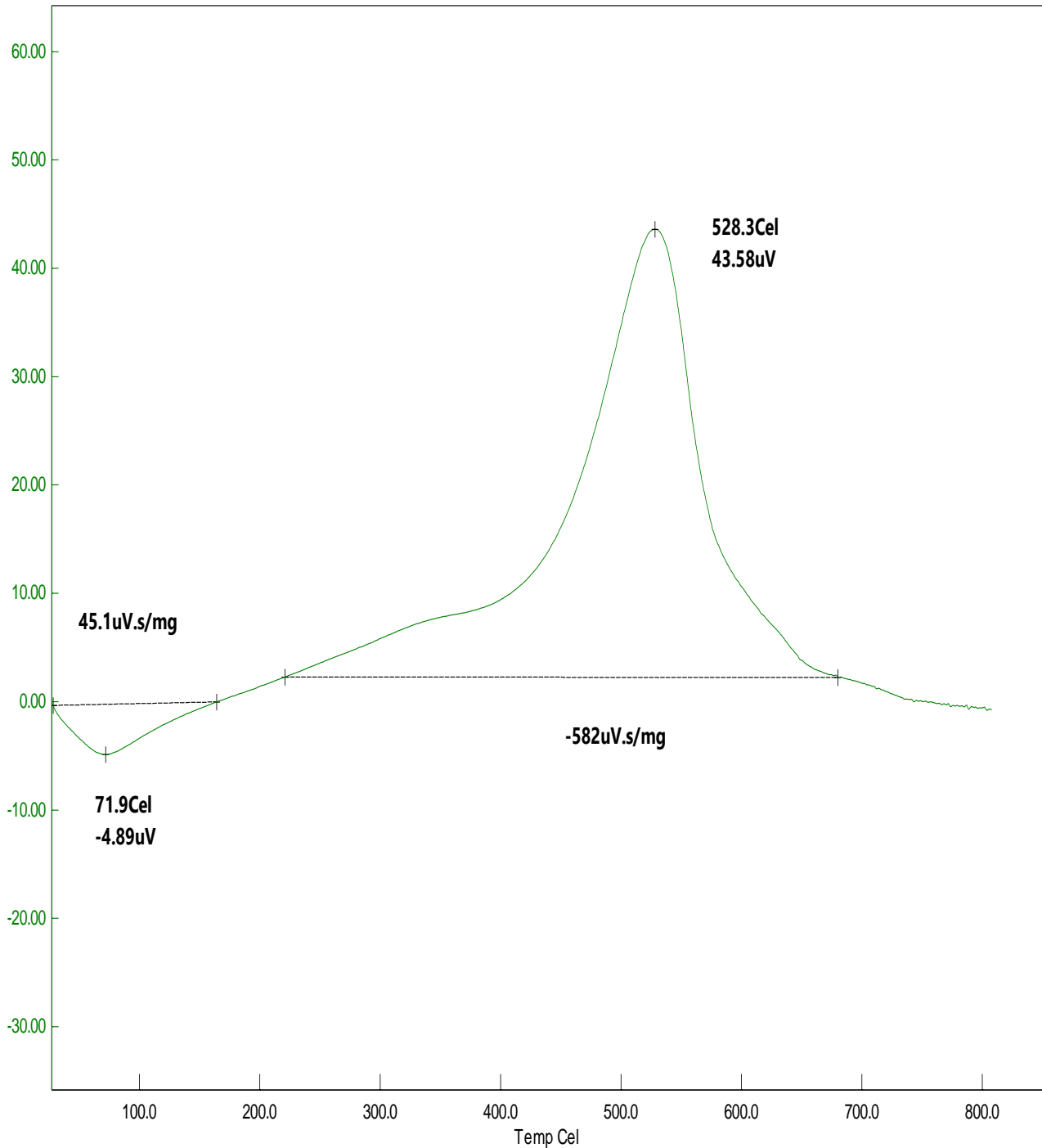
Thermo Gravimetric (TG) Analysis



Graph.1: Thermo Gravimetric (TG) Analysis of sample

The above graph represents the change in the mass of the sample with respective temperature variations. At stage-1 represents loss of mass occurs 1.4 % and differential thermal gravimetric 0.730 mg/min, which is corresponding to the temperature at 250 °C. Stage-2 represents loss of mass occurs 4.3 % and differential thermal gravimetric 0.550 mg/min, at temperature 550 °C. So, finally remained residue 94.3% and differential thermal gravimetric 0.180 mg/min be at 800°C. In this analysis operating temperature range maintained between 100°C to 800°C. Maximum weight loss occurred between the temperature ranges 400°C to 600°C.

Differential Thermal (DT) Analysis



Graph.2: Differential Thermal (DT) Analysis of sample

The above graph shows the differential thermal effects of the sample with respective time and electron beam emission intensity according to temperature variation. Positive value recorded i.e. $45.1 \mu\text{V}\cdot\text{s}/\text{mg}$ between the temperature ranges 0°C to 180°C and negative value recorded as $-4.89 \mu\text{V}$ at temperature 71.9°C . Negative value been recorded as $-582 \mu\text{V}\cdot\text{s}/\text{mg}$, temperature range between 215°C to 690°C . Peak positive value recorded as $43.58 \mu\text{V}$ at temperature 528.3°C . So, it represents the maximum mass loss of the sample.

IV. CONCLUSION

In this paper, the mechanical and thermal characteristics of the coal – bagasse ash and clay-perlite aggregate based samples were investigated. In SEM analysis microstructures of samples were studied, structures shown different void formations according to the composition quantity. Due to increase the quantity of the coal-bagasse ash void formation tends to decreased, but bonding strength slightly decreased. According to EDS analysis chemical composition of specimens were studied, in this analysis Al_2O_3 quantity noted as maximum percentage based on mass and weight. From thermo gravimetric analysis total weight loss occurs 5.7 percentages between temperature ranges of $100^\circ C$ to $700^\circ C$. Differential Thermal (DT) Analysis, maximum positive value represented as 43.58uV at temperature $528.3^\circ C$. So, it shows the maximum mass reduction of the sample.

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