



Fabrication and Analysis of Sustainable Nano-Enhanced Bricks Using HDPE Plastic Waste and Agro-Industrial Byproducts

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Abstract: The global construction sector is steadily expanding, leading to increased consumption of natural materials like sand, stone, clay etc. Traditional methods such as rocks drilling, blasting on a large-scale during mining cause major environmental damage like soil erosion, biodiversity loss, pollution and landscape instability. Red clay brick production also leads to land degradation, reducing fertile land, depleting fossil fuels and increasing pollution many folds. Population growth causes the expansion of industrial units to meet the requirements of people in every sector, particularly in construction and plastic. Nowadays plastic is used by everyone whether individual, manufacturing industry and online shopping sites for packaging, majority of it goes as waste to the landfill sites which eventually deplete the quality of soil, pollute the ground water and cause air pollution as well. Thus, growing plastic consumption with their limited recyclability and resistance to degradation contributes to an alarming increase in plastic waste accumulation in the environment. The aim of this research is to utilize plastic and construction waste for the manufacturing of bricks to minimize environmental impact and preserve ecological balance. These bricks were fabricated by using High-Density Polyethylene (HDPE) plastic waste, agro-industrial waste and nano-additives to achieve high compressive strength and sustainability. Several studies like compressive strength, water absorption, efflorescence, hardness and drop test were conducted to assess the quality of bricks and the results were compared with that of traditional clay bricks. The fabricated plastic waste bricks had a compression strength ranging from 19 MPa - 39 MPa. The results demonstrate that incorporating different waste materials has significantly increased the quality of the environmentally sustainable bricks.

Key Words: HDPE Plastic Waste, Eco-friendly bricks, Sustainable Constructional Material, Compressive Strength

1. INTRODUCTION:

Globally solid waste is increasing with the increase in population and reached to 2.4 billion tons where only 62-million-ton municipal solid waste is generated by India alone [1]. Agricultural waste which can be completely used for making compost has a potential to limit the use of pesticides in field to increase the productivity of crops but unfortunately it also goes as a waste in landfill sites [2,3]. Industrial waste like fly ash, blast furnace slag is a waste product which can be used for various purposes like road construction and bricks manufacturing [4]. The main contributor of solid waste is plastic which cannot be recycled and easily decomposed in environmental conditions; thus, it is a potential cause of air and water pollution due to the release of harmful chemicals into atmosphere upon burning as well as percolate down to the ground water and make it unfit for drinking purposes. A major portion of plastic goes as a waste in oceans through the different channels and affects the marine ecosystem [5]. Penetration of plastic is not only limited to aquatic system but reached the food chain through soil which is a great threat to all living beings [6, 7]. Plastic materials trace their roots to naturally occurring polymers like rubber and shellac, which were among the earliest substances used for their plastic-like properties [8]. In 1862 Alexander Parkes synthesized the plastic by treating cellulose with nitric acid, the plastic formed can be easily moulded into desired shapes as per the requirement [9,10]. Plastics are of different types depending upon the number of carbon atoms, unsaturation and precursors. The most commonly used plastics are Polyethylene Terephthalate (PET or PETE), High Density Polyethylene (HDPE), Polyvinyl Chloride (PVC), Low-Density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), and others like Styrofoam



[11]. Red clay bricks are commonly used in building construction in every country and its manufacturing from clay is responsible for the soil erosion, emission of greenhouse gases along with the impact on non-renewable sources of fuel particularly coal [12]. To overcome the problem of plastic waste and pollution caused by the making of red clay bricks, waste of plastic can be used along with other agricultural and industrial waste to make composite bricks which can replace the red clay bricks [13-15]. High-Density Polyethylene (HDPE) [16, 17] which generates 40 million tons of plastic each year can be used for brick manufacturing along with marble dust [18], fly ash [19], rice husk ash [20] and eggshell powder [21]. To increase the strength of composite bricks zinc oxide nanoparticles along with borax and boric acid are used to make the brick flame retardant [22-24]. This paper focused on the manufacturing of bricks from red brick powder, marble dust, zinc oxide nanoparticles, eggshell powder, cinder powder, borax and boric acid by using cement as binder.

1.1. MATERIALS REQUIRED:

- **HDPE Plastic** : Recycled HDPE plastic binds all the ingredients like marble stone powder, cinder powder, agricultural waste etc. together and increase the strength of the brick. It is purchased from the local shop in Delhi [25].
- **Cement**: Cement apart from acting as a binder increases the durability of brick by improving the compressive strength. It is procured from the nearby construction site.
- **White Stone Dust** : White stone dust helps to enhance the density and strength of brick. Is it also obtained from the nearby construction site.
- **Red Brick Powder** : Waste of red clay bricks is obtained from the construction site; it was powdered to mix with the other ingredients used for the manufacturing of bricks. It also imparts mechanical strength and dimensional stability to bricks [26].
- **Cinder Powder**: Cinder is also a waste product of burning coal, and it is collected from the local coal burners. After collecting cinder, it was grounded to fine powder and sieved through muslin cloth. It reduces the density of bricks and helps to make brick heat resistant [27, 28].
- **Rice Husk Ash** : Rice husk is collected from S. S. Impex, Delhi. It was then heated to 350°C to remove organic matter and sieved to get the fine powder. It enhances pozzolanic activity, strengthens bonding, and improves the mechanical performance of HDPE based bricks. [29].
- **Eggshell Powder**: Eggshells, collected as waste from a local shop, were cleaned, dried and ground into fine powder. It acts as a fine aggregate substitute, supplying calcium to enhance matrix bonding, structural integrity and promotes sustainable reuse of food waste in construction [30].
- **ZnO Nanoparticles**: ZnO nanoparticle addition improve bonding, durability, thermal resistance, and impart antimicrobial properties to bricks [31,32].
- **Borax**: Boric acid: Borax and boric acid, (1:1 by weight) were thoroughly blended into the mix to enhance flame resistance, thermal stability, and structural interlocking of the composite.

2. METHODOLOGY:

2.1. Collection of Materials: All materials were pre-inspected for uniformity and purity to maintain experimental consistency.

2.2. Melting of Plastic: Recycled HDPE granules of uniform size and quality were procured from the same stock and single batch; hence no further sorting or processing was required. Recycled HDPE granules were melted in a low-cost, manually built aluminium heating setup. The temperature during the process was around 140°C.

2.3. Mixing of Materials: The HDPE was melted, followed by addition of the dry mix. In this study, manual mixing was performed swiftly and thoroughly to ensure proper incorporation of additives before the plastic hardened. To investigate the effect of variations on the strength of bricks, four samples were prepared as shown in table 1 where the traditional red clay brick was considered as the fifth sample.

Sample No.	HDPE (%)	Cement (%)	White Stone Dust (WSD) (%)	Red Brick Powder (RBP) (%)	Cinder Powder (CP) (%)	Rice Husk Ash (RHA) (%)	Egg Shell Powder (ESP) (%)	ZnO NP (%)	Borax + Boric Acid (%)
1	60	5	15	4	6	4	3	1.5	1.5

2	65	5	15	4	3	3	2	1.5	1.5
3	70	4.5	13.5	3	3	2.5	2.5	0.5	0.5
4	90	2	6	0.5	0.25	0.25	0.5	0.25	0.25

Table 1: - Samples of HDPE bricks with different ratios of required material

2.4. Molding: After proper mixing, the mixture was poured for shaping into a pre-oiled mold as shown in figure 1 to prevent sticking and allow easy demolding. The mix was then firmly manually compressed to eliminate air voids, thus improving structural integrity of the brick.



Figure 1: - Molding of brick

2.5. Curing: The samples were demolded after 24 h, allowed to dry and air cooled at room temperature for 14 days.

Experimental Studies

Testing of bricks for strength, durability, efflorescence, and dimensional tolerance is mandatory to ensure their safety, quality, usability, durability [33]. These tests include Shape and Size, Hardness, Color, Soundness, Drop Resistance, Water absorption, Efflorescence and Compressive Strength Test, FTIR and SEM Analysis.

1. Shape and Size

Uniform shape and size are essential for construction of bricks. Brick dimensions were checked against the IS 1077:1992 standard size of $190 \times 90 \times 90$ mm using a scale. Although fewer than the recommended 20 samples were tested, the results provided a basic evaluation of shape consistency and size conformity.

2. Hardness Test

A scratch test was performed as shown in figure 2 by gently scratching the brick surface with a sharp tool and fingernail. Bricks resistant to surface marking were classified as hard and fit for use, while those showing visible impressions were considered unsuitable for construction.



Figure 2: - Scratch test on bricks made with 60 %, 65 %, 70 % and 90 % HDPE

3. Color test

A good brick should have a bright and uniform color across its body without any patches or discoloration.

4. Soundness Test

The soundness test is conducted by gently striking two bricks to check whether a clear ringing sound is produced or not which indicates the quality of bricks.

5. Drop Test

To assess impact resistance, the brick was dropped from a height of 1 meter onto a solid surface and examined for cracks or damage.

6. Water Absorption Test

Water Absorption was analyzed according to standard methods by oven-drying the bricks as shown in figure 3 at 50°C - 80°C until a constant weight (W_1) was achieved, then cooling them to room temperature. The bricks were immersed in clean water for 24 hours at $\sim 27 \pm 2^\circ\text{C}$. After wiping off excess water, the wet weight (W_2) was recorded.

Water absorption was calculated to assess porosity using:

$$\text{Water Absorption (\%)} = [W_2 - W_1] \times 100 / W_1$$



Figure 3: - Oven dried bricks

7. Efflorescence Test

Efflorescence was assessed by partially immersing the bricks in water and observing them after airdrying for white salt deposits. The presence of such deposits indicates efflorescence, reflecting lower chemical resistance.

8. Compressive Strength Test

Compressive strength of manufactured bricks was tested using a calibrated Universal Testing Machine (UTM) at NSUT, Delhi with a 600 kN capacity with gradually increasing load until failure and records the highest load capacity. This test provides a qualitative parameter of the mechanical strength and load bearing capacity of the manufactured bricks.

9. Fourier Transform Infrared Spectroscopy (FTIR) Analysis

The infrared (IR) spectra were acquired using the Nicolet iS50 FTIR spectrometer at the University Science Instrumentation Centre (USIC), University of Delhi, India to identify the functional group of chemical compounds in the fabricated bricks. All measurements were performed at ambient room temperature. The spectra were recorded from 4000 to 400 cm^{-1} , using 32 scans with a spectral resolution of 4 cm^{-1} , and data spacing of 1.928 cm^{-1} . A reference scan was performed before each sample measurement under the same instrumental conditions.

10. SEM Analysis:

A scanning electron microscopy (SEM) analysis was conducted to investigate microstructural interactions, adhesion characteristics and pore distribution of the brick samples. SEM images were acquired at an accelerating voltage of 10 kV, while EDAX spectra were collected at 20 kV for enhanced elemental detection using JEOL JSM-6610LV apparatus at the University Science Instrumentation Centre (USIC), University of Delhi, India for comparative morphological analysis.

3. RESULTS AND DISCUSSION

Shape and Size

The prepared plastic bricks were not of uniform shape and had visible surface irregularities primarily due to manual mixing, limitations in mold design and lack of mechanical compression. Though, the dimensions of plastic bricks were within acceptable limits. Whereas conventional red clay bricks exhibit uniform shapes with sharp edges and required dimension due to standard industrial machine molding and kiln firing. Dimensional details for all four plastic brick samples (1-4) and one red clay brick (5) are provided in table 2.



Sample No.	Type	Dimensions (mm)		
		Length	Breadth	Height
1	60 % HDPE	180	80	28
2	65 % HDPE	180	80	38
3	70 % HDPE	180	80	38
4	90 % HDPE	180	80	50
5	Red Clay Brick	210	65	65

Table 2: - Size of different samples of bricks

2. Hardness Test

Plastic bricks (1-4) resisted scratches from fingernails and pointed tools, showing higher surface strength and durability, while red clay bricks (5) showed visible scratches, indicating lower resistance as shown in table 3.

Table 3: - Hardness test comparison of brick samples

Sample No.	Type	Observation (Scratch Test)	Interpretation (Hardness Test)
1	60 % HDPE	No scratch marks observed	High resistance to surface damage
2	65 % HDPE	No scratch marks observed	High resistance to surface damage
3	70 % HDPE	No scratch marks observed	High resistance to surface damage
4	90 % HDPE	No scratch marks observed	High resistance to surface damage
5	Red Clay Brick	Slight scratch marks observed	Lower resistance to surface damage

3. Color test

While color doesn't impact strength, it reflects material composition and consistency. Plastic bricks varied from dark grey to blackish, impacted by the use of additives used such as Rice husk ash, cinder and ZnO nanoparticles, as shown in table 4 while red clay bricks are uniformly reddish due to Iron oxide.

Sample No.	Type	Colour
1	60 % HDPE	Dark Grey
2	65 % HDPE	Blackish Grey
3	70 % HDPE	Dark Grey Blackish
4	90 % HDPE	Light Medium Grey
5	Red Clay Brick	Reddish Orange

Table 4: - Color of brick samples

4. Soundness Test

Plastic bricks gave a sharp, ringing sound when struck, indicating good soundness and crack-free structure due to good bonding within the matrix. whereas red bricks produced a comparatively duller sound, suggesting its higher brittleness as shown in table 5 due to weaker bonding in its matrix, lower durability and lower structural integrity.

Sample No.	Type	Sound Produced	Interpretation
1	60 % HDPE	Clear ringing sound	Good soundness - No internal cracks
2	65 % HDPE	Clear ringing sound	Good soundness - No internal cracks
3	70 % HDPE	Clear ringing sound	Good soundness - No internal cracks
4	90 % HDPE	Clear ringing sound	Good soundness - No internal cracks
5	Red Clay Brick	Slightly dull sound	Lower soundness

Table 5: - Sound produced by brick samples



5. DropTest

In drop test all plastic bricks show high resistance to damage when dropped from a height as shown in table 6 whereas red clay brick exhibits minor damage. Plastic bricks showed better resistance to cracking upon accidental drop.

Sample no.	Type	Observation post Drop	Interpretation
1	60 % HDPE	No visible change	High impact resistance
2	65 % HDPE	No visible change	High impact resistance
3	70 % HDPE	No visible change	High impact resistance
4	90 % HDPE	No visible change	High impact resistance
5	Red Clay Brick	Minor edge/corner damage	Lesser impact resistance

Table 6: - Drop test of brick samples

6. Water Absorption Test

Samples 1–2 in table 7 and figure 4 shows lowest water absorption, samples 3–4 slightly higher, and Sample 5 the highest, indicating maximum porosity and least durability.

Sample No.	Type	Dry Weight (W ₁ Kg)	Wet Weight (W ₂ Kg)	Water Absorption (%)	Interpretation
1	60 % HDPE	0.485	0.49	1.03	Less water absorption
2	65 % HDPE	0.55	0.556	1.09	Less water absorption
3	70 % HDPE	0.665	0.674	1.35	Less water absorption
4	90 % HDPE	0.775	0.784	1.16	Less water absorption
5	Red Clay Brick	2.58	2.89	12.01	Higher water absorption

Table 7: - Water absorption test of brick samples

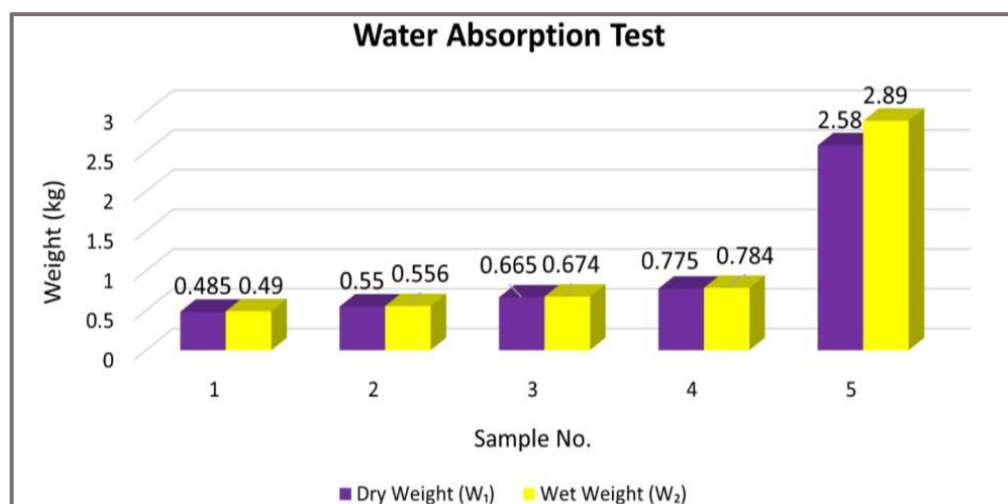


Figure 4: - Graphical representation of water absorption capacity of bricks

The water absorption test revealed that plastic bricks absorbed significantly less water indicating higher density and reduced porosity. Red bricks absorbed more water, making them less durable for moisture-prone environments.

7. Efflorescence Test

In Table 8, Samples 3, 4 and 5 showed no efflorescence, indicating good chemical stability and weather resistance. Samples 1–2 showed slight white deposits, suggesting mild efflorescence and need for composition adjustment or treatment for damp conditions.



Sample No.	Type	Observation after Drying	Efflorescence Rating	Interpretation
1	60 % HDPE	Slight white patches	Slight efflorescence	Low salt content
2	65 % HDPE	Slight white patches	Slight efflorescence	Low salt content
3	70 % HDPE	No white deposits observed	Not efflorescent	Chemically stable
4	90 % HDPE	No white deposits observed	Not efflorescent	Chemically stable
5	Red Clay Brick	No white deposits observed	Not efflorescent	Chemically stable

Table 8: - Efflorescence test of bricks

In the efflorescence test, plastic bricks showed little-to-no white salt deposits, indicating very low moisture absorption and does not contain soluble salts. Surprisingly, red clay bricks used in this research did not show any visible signs of efflorescence, indicating better firing, good raw material quality. However, red bricks commonly develop efflorescence over time due to presence of salt in raw material.

8. Compressive Strength Test

Differences in material composition led to variations in the compressive strength values of the tested bricks. Bricks made with higher HDPE Plastic (i.e. Sample 3 and 4) were able to bear more load before breaking. This shows that they have better strength than sample 1 and red clay brick as given in Table 9.

Sample No.	Type	Maximum Load (kN)	Compressive Strength (MPa)	Interpretation
1	60 % HDPE	277.7	19.28	Good performance
2	65 % HDPE	474.4	32.94	High strength
3	70 % HDPE	565.2	39.25	Peak strength
4	90 % HDPE	488.8	33.94	High strength
5	Red Clay Brick	121.49	8.9	Weakest strength

Table 9: - Comparison of compressive strength of brick samples

Brick Sample 1 (60% HDPE Plastic):

Sample 1 showed a peak load of 277.7 kN, indicating moderate-to-good strength. Lower plastic content limited bonding, making it stronger than red clay bricks but weaker than higher-HDPE samples, suggesting 60% HDPE is not optimal.

Brick Sample 2 (65% HDPE Plastic):

Sample 2 showed a peak load of 474.4 kN, greater than sample 1. Improved filler–matrix interaction and higher plastic content enhanced cohesion and load distribution which increase the significant structural efficiency.

Brick Sample 3 (70% HDPE Plastic):

Sample 3 (70% HDPE) showed a peak load of 565.2 kN, which is the highest strength among all samples. It confirms that 70% HDPE is highly suitable for the construction of bricks.

Brick Sample 4 (90% HDPE Plastic brick):

Sample 4 (90% HDPE) showed a peak load of 488.8 kN, slightly lower than Sample 3. Excess HDPE reduces bonding and compactness, indicating very high plastic content can weaken strength, though it is still more than traditional clay bricks.

Brick Sample 5 (Red clay brick):

Sample 5 showed the lowest strength at 121.5 kN. Its brittle structure cracked under load, confirming the superior mechanical performance and durability of HDPE plastic bricks as a sustainable alternative. Figure 5 shows the comparative strength of different brick samples and red clay bricks and figure 6-9 shows peak load versus displacement of different samples of manufactured bricks.

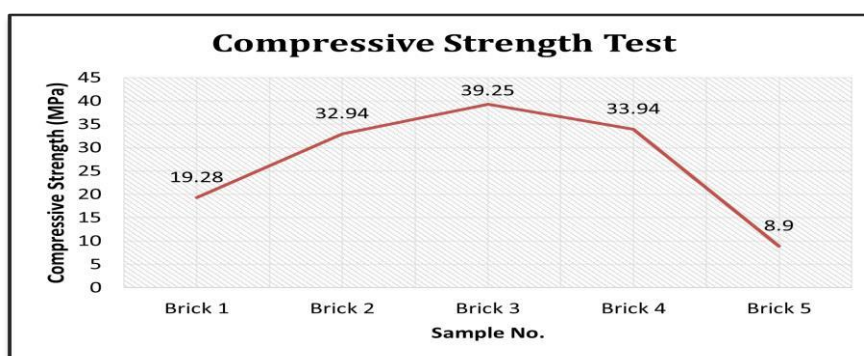


Figure 5: - Compressive strength of brick samples and red clay brick



Figure 6: - Peak load vs Displacement graph for 60% HDPE Sample

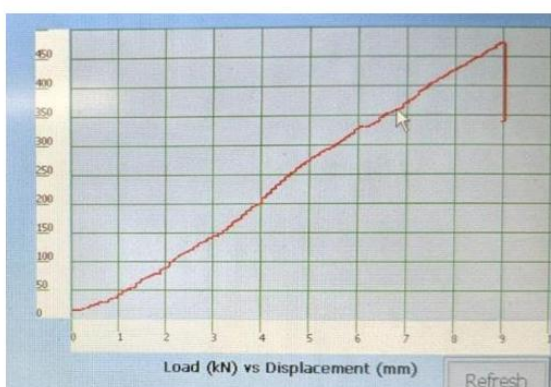


Figure 7: - Peak load vs Displacement graph for 65% HDPE Sample

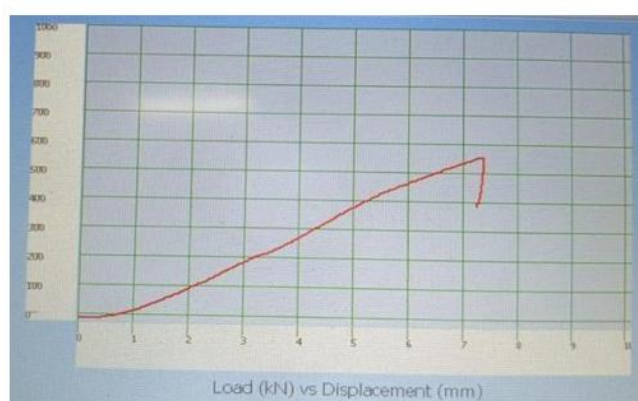


Figure 8: - Peak load vs Displacement graph for 70 % HDPE Sample

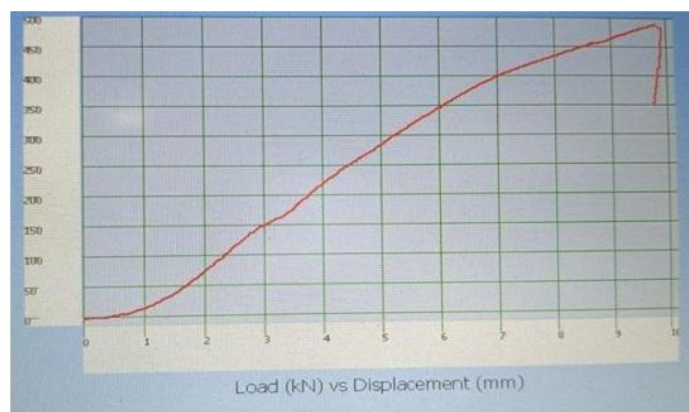


Figure 9: - Peak load vs Displacement graph for 90 % HDPE Sample

The compressive strength of plastic bricks was significantly higher, with values ranging from 19 MPa - 39 MPa. Red clay bricks typically showed lower strength, i.e. 8.9 MPa.

9. FTIR Analysis:

FTIR spectra of the HDPE composite bricks (60%, 65%, 70%, 90%) in figure 10 shows consistent polymeric and inorganic vibrational features, confirming uniform incorporation of all constituents. The broad band at $\sim 3940\text{--}3520\text{ cm}^{-1}$ corresponds to O–H stretching from silanol (Si–OH) groups in stone dust and RHA, structural hydroxyls in silica and clay, layered-silicate/kaolinite OH from brick/cinder and bound water from C–S–H phases. The HDPE matrix is clearly evidenced by methylene stretching and bending modes. In the 65% HDPE sample, strong asymmetric and symmetric stretching vibrations of methylene ($\text{--CH}_2\text{--}$) groups appeared at $\sim 2914\text{ cm}^{-1}$ and $\sim 2847\text{ cm}^{-1}$, respectively, confirming the crystalline polyethylene chains. These peaks are relatively weaker in the 60%, 70%, and 90% HDPE samples, possibly due to greater embedding of polymer chains within the mineral matrix or partial surface masking during ATR measurement. The methylene bending and scissoring vibrations identified at $\sim (1515\text{--}1450)\text{ cm}^{-1}$ in all HDPE-containing bricks serve as reliable fingerprints of the polyethylene structure, even when CH_2 stretching peaks appear less distinct in certain samples. Overtone bands at ~ 2160 and $2016\text{--}2036\text{ cm}^{-1}$ arise from carbonate–silicate interactions, arising from eggshell-derived CaCO_3 and mineral fillers. Absorptions at ~ 1423 , 1388 , and 1362 cm^{-1} correspond to carbonate stretching from CaCO_3 in eggshell powder, cement and the $\sim 1338\text{ cm}^{-1}$ absorption is attributed to Si–O–Al and B–O vibrations of aluminosilicates (brick/cinder) and borates (borax/boric acid). FTIR bands in the metal–oxygen region, $591\text{--}406\text{ cm}^{-1}$ correspond to Zn–O, Ca–O, Fe–O, Al–O, and Si–O vibrations. Zn–O confirms ZnO nanoparticle incorporation, Ca–O arises from eggshell-derived CaO and cementitious phases, Fe–O and Al–O bands arise from cinder components, while Si–O modes originate from stone dust, RHA, and brick powder. These results show that ZnO nanoparticles are well mixed with the other fillers, making the material stronger and proving that the nanoparticles are properly embedded.

Similarly, the FTIR spectrum of the traditional red clay brick exhibits absorption bands corresponding to functional groups and mineral phases present in the clay matrix. The broad band at $\sim (3820\text{--}3566)\text{ cm}^{-1}$ is attributed to O–H stretching vibrations of surface hydroxyl groups and adsorbed water. Sharp bands at $\sim (1748\text{--}1647)\text{ cm}^{-1}$ correspond to C=O stretching and H–O–H bending vibrations, associated with moisture or minor carbonate phases. The absorption band around $\sim 1516\text{ cm}^{-1}$ further confirms water-related bending modes. A strong peak at $\sim 984\text{ cm}^{-1}$ corresponds to Si–O–Si asymmetric stretching, while the band at $\sim 777\text{ cm}^{-1}$ is due to symmetric stretching of Si–O bonds in silicate minerals. The lower region $\sim (591\text{--}406\text{ cm}^{-1})$ shows Si–O–Al and Si–O–Si bending vibrations, confirming the presence of an aluminosilicate framework typical of clay-based materials. FTIR studies suggest that HDPE based composite brick structure is more integrated and stable compared to traditional red clay bricks.

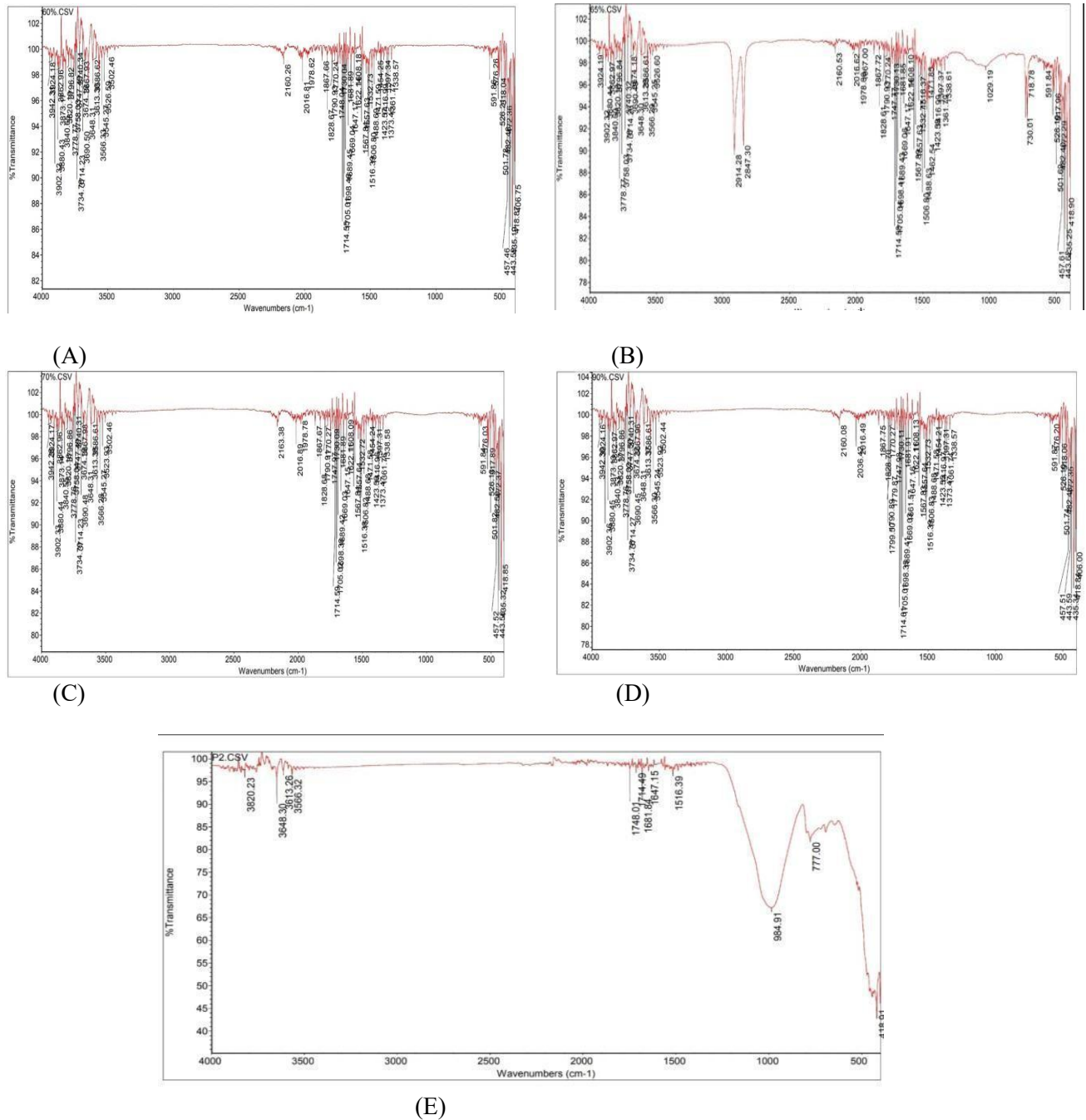


Figure 10: - FTIR Spectra of different brick samples (A) 60% HDPE Sample, (B) 65% HDPE Sample, (C) 70% HDPE Sample, (D) **90% HDPE Sample**, (E) Red clay brick sample.

10. SEM ANALYSIS

Brick Sample 1 (60% HDPE Plastic):

SEM micrographs in figure 11 show interfacial gaps due to the voids in discontinuous polymeric structure. It results in weak bonding and responsible for the low strength of bricks.

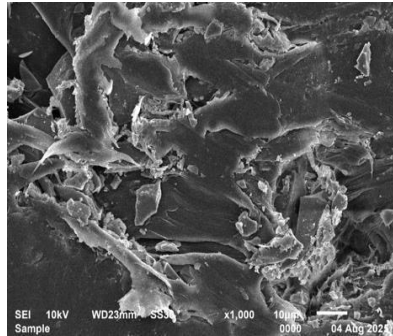


Figure 11: - SEM Micrograph of 60% HDPE brick sample

Brick 2 (65% HDPE Plastic):

SEM image in figure 12 shows improved polymer structure with less voids and more continuous, it has more strength as compared to brick sample 1.

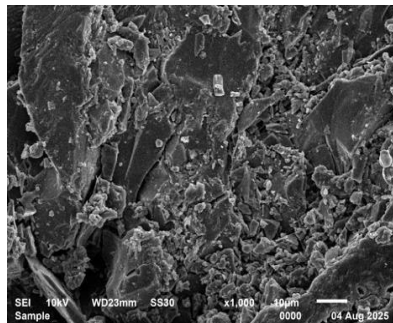


Figure 12: - SEM Micrograph of 65% HDPE brick sample

Brick Sample 3 (70% HDPE Plastic):

SEM micrographs in figure 13 show a polymer structure with least interfacial defects with micro voids. It suggests the structure is more integrated with high strength and durability.

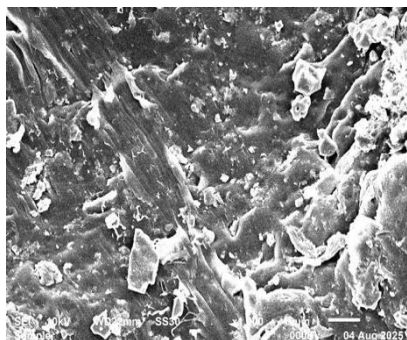


Figure 13: - SEM Micrograph of 70% HDPE brick sample

Brick Sample 4 (90% HDPE Plastic):

SEM image in figure 14 shows the microstructure with a minimal porosity and free of defects which makes it more durable and resistance to damage.

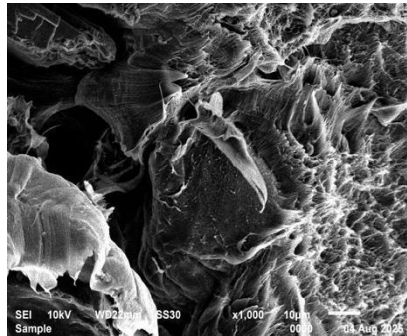


Figure 14: - SEM Micrograph of 90% HDPE brick sample

Red clay brick

SEM micrographs in figure 15 show a heterogeneous porous microstructure which is a characteristic of less strength of red clay brick, thus it has less durability in building construction.

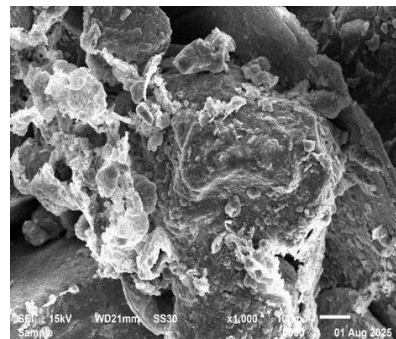


Figure 15: - SEM Micrograph of Red Clay brick sample

It has been concluded from SEM micrographs that plastic bricks are denser with less porosity and interfacial defects which impart more strength to it. These bricks are more durable and resistant to environmental conditions. In contrast, red clay bricks exhibited a coarse, porous microstructure with angular mineral grains and extensive void networks, explaining their lower strength and durability.

4. CONCLUSION:

Plastic waste is a major environmental concern since it does not easily degrade into soil or water. In this study, recycled HDPE plastic and agro-industrial by-products in varying proportions were used to manufacture construction bricks. All the results confirmed that plastic and agricultural based bricks are denser with high compressive strength, do not break easily and more durable as compared to red clay bricks. This method reduces plastic pollution, air pollution, fuel consumption and conserves natural clay soil by using 100% recycled HDPE granules in brick manufacturing without using water. Bricks prepared fit best into the parameters required for assessing the quality of the bricks.

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