A STUDY ON BRICK MATERIAL BY REPLACING CEMENT AND SAND WITH LIMESTONE DUST AND WOOD SAW DUST

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ABSTRACT: *The majority of abandoned limestone powder wastes (LPW) and wood sawdust wastes (WSW) is accumulated from the countries all over the world and causes certain serious environmental problems and health hazards. This project a parametric experimental study which investigates the potential use of WSW–LPW combination for producing a low-cost and lightweight composite as a building material. Some of the physical and mechanical properties of concrete mixes having high level of WSW and LPW. The obtained compressive strength and water absorption values the relevant international standards. The results show that the effect of high-level replacement of WSW with LPW does not exhibit a sudden brittle fracture even beyond the failure loads, indicates high energy absorption capacity, reduces the unit weight dramatically and introduces smother surface compared to the current concrete bricks in the market. It shows a potential to be used for walls, wooden board substitute, economically alternative to the concrete blocks, ceiling panels, sound barrier panels, etc.*
Keywords:- LPW, WSW

I. INTRODUCTION

Since the expansive request has been set on building fabric industry particularly within the final decade owing to the expanding populace which causes a inveterate deficiency of building materials, the gracious engineers have been challenged to change over the mechanical squanders to valuable building and development materials. Collecting of unmanaged squanders particularly in creating nations has brought about in an expanding natural concern. Reusing of such squanders as building materials shows up to be reasonable arrangement not as it were to such contamination issue but too to the issue of financial plan of buildings. The increment within the ubiquity of utilizing naturally inviting, low-cost and lightweight development materials in building industry has brought about the have to be examine how this could be accomplished by profiting to the environment as well as keeping up the fabric prerequisites confirmed within the measures.

Numerous past inquires about attempted gotten profitable comes about to utilize the mechanical squanders in different shapes of concrete generation. For occurrence, the utilize of squander elastic, glass powder and paper squander slime in concrete blend has gotten conscribe consideration over the past a long time. A few inquires about carried out within the past utilized wood cinder squanders as a substitution for cement in concrete blends. In spite of the fact that these inquires about are giving empowering comes about, the concrete blends having both wood sawdust squanders (WSW) and limestone powder squanders (LPW) combination up to this point has not been examined. These squanders utilized in this inquire about are broadly accessible in huge sum from the woodland and limestone businesses. This paper presents a few physical and mechanical properties of the concrete blends having tall level of WSW and LPW as a substitution for aggregate. Most of the squanders utilized in this investigate are as of now arranged in clean landfills or open-dumped into uncontrolled squander pits and open ranges.

ADVANTAGES OF LIME STONE DUST AND SAWDUST AS CEMENT REPLACEMENT

- Limestone may be a profitable normal asset, utilized to form things such as glass and cement. Limestone quarrying gives business openings that bolster the nearby economy in towns around the quarry. Chemicals utilized in making colors, paints and solutions too come from limestone. Limestone is broadly accessible and is cheaper than rock or marble. It's moreover a reasonably simple shake to cut. Limestone looks alluring and fire resistant

- Sawdust is the most component of particle board. Wood tidy may be a shape of particulate matter, or particulates. Investigate on wood tidy wellbeing dangers comes inside the field of word related wellbeing science, and consider of wood clean control comes inside the field of indoor discuss quality building.

OBJECTIVE OF THE STUDY :

The objective of our project to find a substitute for cement which is more economical and durable without reducing the strength of the cement bricks. Such a substitute should comply with the existing standards stipulated for cement. It also should be available at cheaper rates in abundant quantities.The principal objective of this study is to prepare cement bricks by adding lime stone dust and wood saw dust in different volume proportions of (0%,5%,10% and 20%) of cement

II. LITERATURE REVIEW

- **UTILIZATION OF LIMESTONE DUST IN BRICK MAKING**

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The positive utilize of these squanders changes over them into valuable items that can ease the transfer and natural problems. The gotten comes about in this consider lead to the taking after conclusions: * The comes about appear that combination of limestone clean and cement can be utilized within the generation of stone work building bricks with satisfactory mechanical properties which coordinate the Egyptian Standard details of non- stack bearing walls. * The included cement within the blend influences emphatically the considered properties of the created bricks. * Sensible quality brick can be produced with expansion of around 13 % cement, within the blend, which accomplished strength of 33 kg f /cm2 and 45 kg f /cm2 individually within the two-tested arrangement. These values fulfill the necessities for buildings of non – stack bearing dividers (25 to 45 kg f /cm2). * The created bricks have the taking after properties: 20-21 %water retention, bulk thickness of 1.65-1.68 g/cm3 slake toughness of over 95 % and compressive quality of 33-45 kg

- **A Ponder OF BRICK MORTAR Utilizing SAWDUST AS Fractional Substitution FOR SAND**

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The following Conclusions are observed :

Mortar prepared with sawdust as partial fine aggregates was investigated. Standard mortar of mix ratio of 1:3 andin inadequate workability. In view of that a modified mortar of better workability with constant slump of 74.3 mm was also prepared. The compressive strength and flexural tensile strength of the mortar and masonry compressive strength of wallets were assessed from test specimens. The results showed that the sawdust possessed the characteristics of a well-graded aggregate. The dry density, compressive strength and flexural tensile strength were observed to decrease with increasing sawdust content. A more porous mortar was produced with increased sawdust content. However the modified mortar was slightly impervious compared with the standard mortar. Therefore in terms of durability the modified mortar could be presumed to be more durable. At higher percentages of sawdust the crushing of the cubes was not sudden compared to the control for both mortar types. Failure of masonry wallets for the modified mortar was characterized by cracking along the masonry units whilst that of the standard mortar was observed to fail along the brick-mortar joint. This can be observed. The better bonding in the case of the modified mortar could be attributed to the improved workability which led to better adhesion between the bricks and the mortar. On a micro-scale the better adhesion could be also be due to sawdust fibres penetrating into the block surfaces.

The densities of both mortars decreased considerably with each percentage replacement. Low density mortar could be achieved by the partial replacement of the fines with sawdust. A thorough examination of the above results and discussions showsthat there is a possibility of replacing fine aggregates with sawdust in masonry mortar preparation. With 8 and 13% percentages of replacement, the standard and modified mortars respectively produced mortars with properties which compare

adequately well with theoretical values of BS 5628:1992 Code.

- **LIMESTONE DUST AND WOOD SAWDUST AS BRICK MATERI**AL

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The majority of abandoned limestone powder wastes (LPW) and wood sawdust wastes (WSW) is accumulated from the countries all over the world and causes certain serious environmental problems and health hazards. This paper presents a parametric experimental study which investigates the potential use of WSW–LPW combination for producing a low-cost and lightweight composite as a building material. Some of the physical and mechanical properties of concrete mixes having high level of WSW and LPW are investigated. The obtained compressive strength, flexural strength, unit weight, ultrasonic pulse velocity (UPV) and water absorption values satisfy the relevant international standards. The results show that the effect of high-level replacement of WSW with LPW does not exhibit a sudden brittle fracture even beyond the failure loads, indicates high energy absorption capacity, reduces the unit weight dramatically and introduces smother surface compared to the current concrete bricks in the market. It shows a potential to be used for walls, wooden board substitute, economically alternative to the concrete blocks, ceiling panels, sound barrier panels, etc.

III. EXPERIMENTALWORK

Materials Used:

- Cement
- Gypsum
- Fine Aggregates- Sand
- Fly ash
- Limestone dust
- Wood saw dust
- Water

➢ **Cement:**

Portland cement is the product obtained by pulverization of clinker, which essentially consists of hydraulic calcium silicates, with a certain proportion of natural calcium sulfate that contains additions of substances to modify its properties or facilitate its use. The physical properties of the cement are listed in Table

S.No	Properties	Results	IS : 12269-1987
1.	Specific gravity	3.15	-
2.	Normal consistency	32%	-
3.	Initial setting time	60 Min	Minimum of 30min
4.	Final setting time	350 Min	Maximum of 600min
5.	Compressive strength A. 3 days strength B. 7 days strength C. 28days strength		 Minimum of 27 Mpa Minimum of 40Mpa Minimum of 53Mpa

○ **GYPSUM:**

Gypsum may be a delicate sulfate mineral composed of calcium sulfate dihydrate, with the chemical equation CaSO4· 2H2O. It is broadly mined and Is used as a fertilizer, and as the most constituent in numerous shapes of mortar, chalkboard chalk and wallboard. Gypsum employments incorporate: fabricate of wallboard, cement, mortar of Paris, soil conditioning, a solidifying retarder in Portland cement. Assortments of gypsum known as "glossy silk fight" and "alabaster" are utilized for a assortment of fancy purposes; in any case, their low hardness limits their toughness. Vent Gas Desulfurization (FGD) gypsum is additionally known as scrubber gypsum. FGD gypsum is the by-product of an discuss contamination control framework that evacuates Sulfur from the vent gas in calcium-based scouring frameworks. It is delivered by utilizing constrained oxidation within the

scrubber and is composed generally of calcium sulfate. FGD gypsum is most commonly utilized for agrarian purposes and for wallboard generation.

The properties of gypsum are listed in Table – 3.4

Properties	**Gypsum**
Chemical classification Colour Streak	Sulphate Clear, Colourless, White, Grey, Yellow, Red, Brown White
Luster Diaphaneity Cleavage Mohs hardness Specific gravity Diagnostic properties Chemical composition Crystal system	Vitreous, Silky, Sugary Transparent to translucent Perfect 2 2.3 Cleavage, Specific gravity, Low hardness Hydrous calcium sulphate Monoclinic

- **FINE AGGREGATE :**

The standard sand used in this investigation was obtained from penna River in Nellore. The standard sand shall be of quartz, light grey or whitish variety and shall be free from silt. The sand grains shall be angular; the shape of the grains approximating to the spherical form elongated and flattened grains being present only in very small or negligible quantities. The standard sand shall (100 percent) pass through 2-mm IS sieve and shall be (100 percent) retained on 90-micron IS Sieve and the sieves shall conform to IS 460 (Part: 1): 1985.

physical properties of sand are listed in Table – 3.2

Colour	Light yellow
Specific gravity	2.65
Shape of grains	Rounded

- **FLYASH:**

Fly ash can be referred as either pozzolanic or cementitious. A cementitious material is one that hardens when mixed with water. A poz zolanic material also hardens when mixed with water but only after activation with an alkaline substance such as lime. Due to cementitious and pozzolanic properties of fly ashes they are used for replacement of cement in concrete and many other building applications.

The physical properties are :

Physical properties	**Fly ash**
pH Specific gravity Bulk density(g/cc) Grain size distribution Porosity (%) Water holding capacity (%) Electrical conductivity (ds/m)	6.0 – 10.0 1.45 – 2.25 0.85 - 1.2 Silt to silty loam 45 – 55 25 – 40 0.15 – 1.10

- **LIMESTONE DUST :**

Crushed Limestone Dust. We supply Crushed Limestone Dust, available from our Ardsley and Bufford quarries. These materials are suitable for cable ducting, reconstituted stone manufacture, agricultural lime for soil improvement. The main application is for agricultural purposes, for neutralizing acidic soils.

➢ **WOOD SAW DUST :**

Sawdust is the main component of particleboard. Wood dust is a form of particulate matter, or particulates. Research on wood dust health hazards comes within the field of occupational health science, and study of wood dust control comes within the field of indoor air quality engineering

➢ **WATER :**

Portable water was used in the experimental work for both preparing and curing. The pH value of water taken is not less than 6

❑ **MIXING DESIGN :**

CALCULATION PER ONE BRICK :

An example of calculating the required quantities of different materials for a considered proportion is given below:

Dimension of the cube= 23*15*14cm

Volume of the cube= 4830 cm3 =4830*(10-2)3

Let, density of Brick=22 KN/m3= 22×1000⁄9.81= 2242.61kg/m3

We know that, mass=density × volume

=2242.61×4830×10-3

=10831.80Kg

∴ The total weight of the sample=10831.80Kg

Ratio of binder to aggregate as 1:4

The water cement ratio as 0.62

∴The weight of binder= 10831.80/3=3610.6Kg

Weight of aggregate (Quarry dust) = 3610.6×4=14442.4.8kg

Weight of water= 0.62×3610.6= 2238.57Kg

Therefore, to prepare a brick of 23*15*14 cm dimension the amount of binder, quarry dust and fluid to be taken are 3610

.6kg,14442.4 kg and 2238.57kg respectively.

After all the ingredients were ready, the mixing was done. In this project, mixing was done manually. The mixing process of cement blocks are different. The exact mix proportion was not known. So, trial proportions were used in this project

❑ **MANUFACTURING PROCESS** :

The process of manufacture of cement concrete hollow blocks involves the following 6 stages;

(1) Proportioning

(2) Mixing

(3) Moulding

(4) Curing.

(5) Drying

Proportioning :

The determination of suitable amounts of raw materials needed to produce mortar of desired quality under given conditions of mixing, placing and curing is known as proportioning.

As per Indian Standard specifications,

Mix ratio of mortar 1:4.

Water cement ratio of 0.62 by weight basis can be used for cement bricks.

Moulds size 23*15*14 cm

Mixing :

Mixing is simply defined as the “complete blending of the materials which are required for the production of a homogeneously”.

Once the appropriate mixing has been chosen, it is necessary to determine the mixing time.

Moulding :

The purpose of moulding is to fill all air pockets with mortar as a whole without movement of free water through the mortar. Excessive moulding would result in formation of water pockets or layers with higher water content and poor quality of the product.

Curing :

Bricks removed from the mould are protected until they are sufficiently hardened to permit handling without damage.

This may take about 24 hours in a shelter away from sun and winds.

The bricks thus hardened are cured in a curing yard to permit complete moisturization for atleast 21 days. When the bricks are cured by immersing them in a water tank.

The greatest strength benefits occur during the first three days and valuable effects are secured up to 10 or 14 days. The longer the curing time permitted the better the product.

Drying :

Bricks shrinks slightly with loss of moisture. It is therefore essential that after curing is over, the bricks should be allowed to dry out gradually in shade so that the initial drying shrinkage of the bricks is completed before they are used in the construction work.

Generally a period of 7 to 15 days of drying will bring the bricks to the desired degree of dryness to complete their initial shrinkage. After this the bricks are ready for use in construction work

IV. TESTS ON BRICKS & RESULTS

Following tests are conducted on bricks to determine its suitability for construction work.

1.Water absorption test
2.Crushing strength test
3.Hardness test
4. Shape and size
5. Color test
6.Soundness test
7. Structure of brick

1. Absorption Test on Bricks :

Absorption test is conducted on brick to find out the amount of moisture content absorbed by brick under extreme conditions. In this test, sample dry bricks are taken and weighed. After weighing these bricks are placed in water with full immersing for a period of 24 hours. Then weigh the wet brick and note down its value. The difference between dry and wet brick weights will give the amount of water absorption. For a good quality brick the amount of water absorption should not exceed 20% of weight of dry brick.

The water absorption of bricks after immersing 24 hours in water is given by

$$W = \frac{M_2 - M_1}{M_1} X\ 100$$

Where M1= weight of brick before immersing

M_2=weight of brick after immersing

Sl. No.	% of LPW and WSW added	Oven Dry wt. of specimen (M1)	Wet wt. of specimen (M2)	Water Absorption (%)
1.	0%	2.95	3.334	12.33
2.	5%	2.87	3.310	15.33
3.	10%	2.85	3.335	17.01
4.	15%	2.82	3.150	11.70

Table:Water Absorption Test Results

2. Crushing Strength or Compressive Strength Test on Bricks :

Crushing strength of bricks is determined by placing brick in compression testing machine. After placing the brick in compression testing machine, apply load on it until brick breaks. Note down the

value of failure load and find out the crushing strength value of brick. Minimum crushing strength of brick is 3.50N/mm2.if it is less than 3.50 N/mm2, then it is not useful for construction purpose.
The compressive strength of bricks is given by

$$\text{Compressive strength} = \frac{\text{Maximum load at failure (N)}}{\text{Average area of bed face (mm}^2\text{)}}$$

Sl. No.	% of lime added	Avg.area of bed face(Cm2)	Compressive strength (kg/cm2)
1.	0%	410	35.5
2.	5%	410	36.5
3.	10%	410	37.1
4.	15%	410	35.9

3 HARDNESS TEST :

In this test, a scratch is made on brick surface with the help of a finger nail. If no impression is left on the surface, the brick is sufficiently hard.
From the results of hardness test, as the percentage of lime added to bricks increases, hardness also goes on increases upto 10% after that at 15% hardness is decreased. This is because of percentage increase in lime will makes the brick brittle. This was clearly observed, at 15% of lime content, the scratch is easily made by finger nail.

4. SHAPE AND SIZE :

In this test, a brick is closely inspected. It should be of standard size and its shape should be truly rectangular with sharp edges. For this purpose, 20 bricks of standard size (24cm x 15cm x 14cm) are selected at random and they are stacked lengthwise, along the width and along the height.
For good quality bricks, the results should be within the following permissible limits
From the examination of bricks with increasing lime content, all bricks had clear shape and size

5. COLOR TEST :

A good brick should possess bright and uniform color throughout its body.
From the examination of bricks with increasing lime content, all bricks had same colour, With the increasing of lime content the reddish color turns into pale color

6. SOUNDNESS TEST :

In this test, the two bricks are taken and they are struck with each other. The bricks should not break and a clear ringing sound should be produced.
From the examination of bricks for soundness test with increasing lime content, all bricks had better ringing sound.

7.STRUCTURE OF BRICK :

A brick is broken and its structure is examined. It should be homogeneous, compact and free from any defects such as holes, lumps, etc.
Randomly four bricks were selected from the group and the structure of each brick was examine

V. CONCLUSION

Based on the result of both experimental and filed investigation on cement bricks and stabilized LPW and SWS bricks, the following concluding remarks can be drawn :

* The physical and mechanical properties of brick tests with WSW and LPW are explored. The test comes about appear that the WSW and LPW combination gives comes about which are of potential to be utilized within the generation of lighter and conservative unused brick material.
* The perceptions amid the tests appear that the impact of 10–30% WSW substitutions in WSW and LPW lattice does not display a sudden delicate break indeed past the disappointment loads.
* The compressive quality of bricks increments with lime extent up to 10% after that in the event that the % of LPW & WSW increments the compressive quality diminishes
* Major utilization within the world for development is cement bricks; many researchers are by and by trying to find more current options because they require moo taken a toll materials, which are

too naturally inviting. The method of fabricating cement bricks .

* LPW & WSW included cement squares incorporate; formally dressed building component sizes, utilize of locally accessible materials and lessening of transportation. Consistently, measured building components can result in less squander, quicker development and the plausibility of utilizing other pre-made components or secluded made building components.
* The utilize of common, locally-available materials makes great lodging accessible to more individuals, and keeps cash within the nearby economy instead of investing it on imported materials, fuel and substitution parts.

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