Experimental Investigation on the Mechanical and Durability Properties of Light Weight Elements using Straw and Other Additives

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*Abstract:-***In this thesis, experimental investigation on mechanical properties of light weight concrete using straw and other additives have beenstudied. Studying the various properties materials has been referring various journals .From these, the various materials properties is to be used for these project has been analyzed for the suitability of these material. After the suitability of these materials the required few materials have been collected and various test such as specific gravity, fineness were conducted. The test results have satisfactory values while using these materials while comparing the standard values. According to the test results it has been decided that these additives can be successfully used for experimental analysis which in to be carried out in the forth coming. Thisexperiment evaluated the use of the material of the outer coconut shell palm tree from Brazil, for the manufacture of particleboards bonded with Portland cement. Four treatments were analysed at two target densities and two levels of addition of calcium chloride. The lignocellulosic material from babac presented a low cement inhibition index according to the hydration test. Testing of manufactured panels showed that good physical and mechanical properties were achieved at the treatment levels tested. This material is currently used in cladding, raised floors, and dropped ceilings, prefabricated houses, office containers and various supplies to the building industry such as kitchens, bathrooms and furniture. It is composed of a type of wood Pinuspinaster and/or Pinuspinea, Portland cement type II, sodium silicate and aluminium sulphate. CBPB has been the subject of several studies with the purpose of enabling the use of other types of wood or even vegetable**.

Keywords:Coir, Ferro cement board, Straw, Mortar

I. INTRODUCTION

In civil engineering, the buildings in which the walls are constructed by bricks, cement, concrete, etc. [6]. Due to the weight of these materials, the dead load acting on the structure is increased, which results in increasing the size of the structure [3]. This leads to uneconomical condition and the construction of these walls requires number of labour which further consumes a lot of time. To reduce these impacts over construction, light weight straw based beard is introduced. Straw is an agricultural waste material .It can be either from wheat, rice, barley and several grains [8]. Each of them has different material properties. When they are added with cement mortar, they act as a light weight mortar. Using these non loaded materials like partition walls and other elements. Now a days, in the construction most of the budget is utilized by the labour sector [11]. When precast lightweight wall elements are introduced, it reduces the cost of construction and saves time. In past review journals, straws are shown to have high durable properties [19]. Cement bonded particle board is a composite material consisting mainly of wood, straw , cement and additives and is currently used in cladding , dropped ceilings, raised floors, prefabricated houses, office containers and various supplies to the building industry [21]. For example, for kitchens, bathrooms and furnitures. Agricultural residues offer great promise and new challenges replacement for wood in engineering wood products. Wheat straw for example offers desirable geometric and mechanical attributes for replacement of wood in cement bonded particle board [16]. The inhibitory of wheat straw on hydration however represent the major obstacle against development of cement straw board [14]. Cement bonded straw board was new sliding product with desired aesthetic attributes, workability and engineering characteristics. The high extractive and wax content of straw present important

challenge to the production of cement bonded straw board [24]. The complementary use of these measures contributed towards development of cement bonded straw boards which met the standard requirements [20].Hence, the purpose of this study is to find out the mechanical and durability properties of light weight elements using straw and other additives

II. MATERIALS AND METHODS

The agricultural lignocellulose fibre used in this study were rice straws. After removing the top 10 cm, the rice straw stalks were cut intothree sections, top, centre and bottom, the rice straw particles were prepared by cutting each of the sections of the rice straws into 2 or 4 cm lengths. The particle width depended on the native straw stem, which was wider at the bottom than at the top. Utilization of wheat in cement-bonded particleboard was the primary focus of this investigation. Straw was received from farms within three months after production. It was hammer milled on a 6-mm screen. Straw in as-received condition (left) and after size reduction (right). In order to mitigate any adverse effectsof water- and alkali-soluble products in straw, after size reduction, straw was extracted through immersion in lime saturated water at room temperature for 48 h, followed by air drying to less than 10% moisture content. The other materials like coir has been used in this project. The coir with aspect ratio of 60 are used in the size of 2 cm. The additional strength property starch is added.

Cement

Ordinary Portland cement (OPC) grade 42.5 based on SLS107 was used in concrete as a cementitious material. The bulk density and specific gravity of the cement are 1362 kg/m3 and 3.15, respectively.

Sand

The sand used for the masonry block is local natural river sand. It is classified as silica sand and supply as bulk. The bulk density and specific gravity of the sand are 1476 kg/m3 and 2.67, respectively. A sieve analysis was carried out in order to determine this local river sand complies with the ASTM C136 / C136M. The fineness modulus of the local river sand was calculated.

Agricultural wastes

Based on availability of waste materials in Sri Lanka, five types of agricultural wastes were selected as rice husk, sawdust, peanut shell, straw, and coconut shell Rice husk, sawdust and peanut shell are used as raw without any pre-preparation or treatment. Coconut coir are crushed into 2 cm×2 cm pieces and straw are cut into pieces which length less than 25mm before added to mortar mix.

III. RESULT AND DISCUSSION

Compression Test:

The compressive strength test for cubes was conducted in compression testing machine as per IS 516 : 1964. The bearing surface of machine was wiped off clean and the surface of the specimen was cleaned. The specimen was placed in machine in such a manner, load was applied to opposite sides of the cubes such that casted side of specimen was not top and bottom. The axis of the specimen was carefully aligned at the centre of loading frame. The load applied was increased continuously at a constant rate until the resistance of the specimen to the increasing load breaks down and no longer can be sustained. Maximum load applied on specimen was recorded. Compression strength for different percentage of straw is tabulated in table 1. The variation of Compression strength for different percentage of straw is shown in chart 1.The variation of Compression strength for different percentage of coir is shown in chart 2.

Table 1:Compression strength for different percentageof straw

Sl.No	% Replacement of straw	Strength (N/mm^2) 7 days	Strength (N/mm^2) 28 days
1	0	23.4	28.08
2	0.5	20.39	26.08
3	1	16.05	23
4	1.5	12.37	17

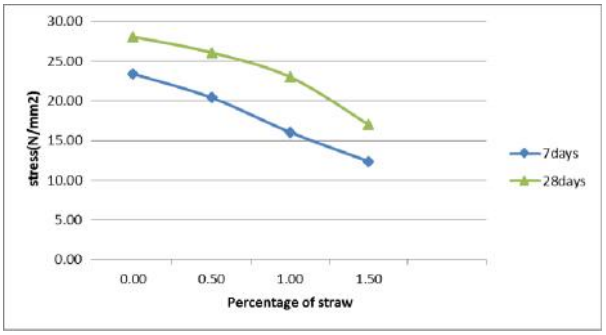

Figure 1: Compressive strength for different % of straw

Table 2: Compression strength for different percentageof coir

Sl.No	% Replacement of coir	Strength (N/mm^2) 7days	Strength (N/mm^2) 28 days
1	0	23.4	28
2	0.5	21.06	33.1
3	1	18.05	37
4	1.5	16.04	31

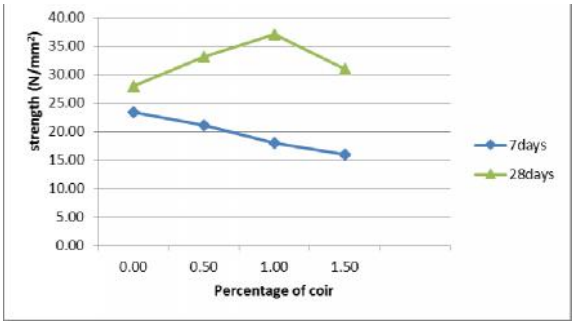

Figure 2: Compressive strength for different % of coir

Split Tensile Test

The split tensile strength test for cylinders was carried out as per IS 516 : 1964. This test was carried out by placing a cylinder specimen horizontally between the loading surfaces of a universal testing machine and the load was applied until failure of the cylinder along the vertical diameter. When the load was applied along the generatrixan element on the vertical diameter, the cylinder is subjected to a horizontal stress.Split tensile strength for different % of straw is tabulated in table 3. The variation of split tensile strength for different % of straw is shown in chart 3.

Table 3: Split tensile strength for different % of straw

Sl.No	% of replacement of straw	Strength (N/mm^2) 7days	Strength (N/mm^2) 28 days
1	0	2.94	3.1
2	0.5	2.3	1.27
3	1	2.3	1.75
4	1.5	1.745	1.59

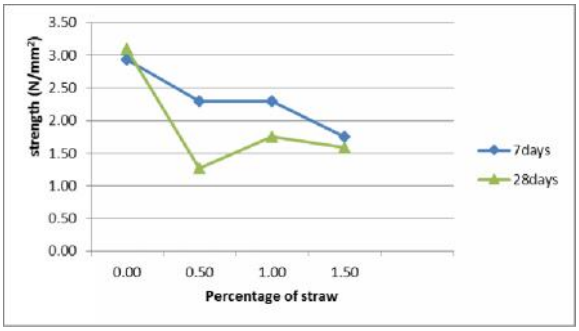

Figure 3: Split tensile strength for different % of straw

Split tensile strength for different % of coir is tabulated in table 4. The variation of split tensile strength for different % of coir is shown in chart 4.

Table 4: split tensile strength for different % of coir

Sl.No	% of replacement of straw	Strength (N/mm^2) 7days	Strength (N/mm^2) 28 days
1	0	2.94	3.1
2	0.5	2.54	3.18
3	1	2.06	2.54
4	1.5	1.51	1.9

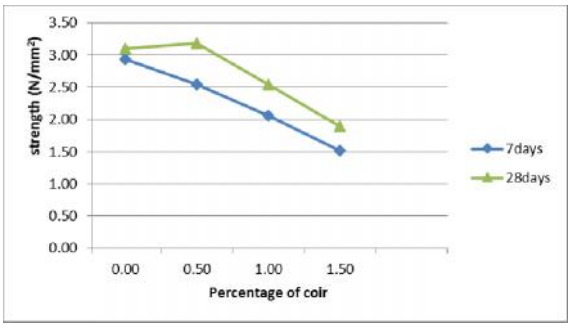

Figure 4: Split tensile strength for different % of coir

Bending Test:

Bending load for different % of straw is tabulated in table 5. The variation of Bending load strength for different % of straw is shown in chart 5.

Table 5: Bending load for different % of straw

Sl.No	% of replacement of straw	load (KN) 7days	load (KN) 28 days
1	0	9.2	9.2
2	0.5	8.8	13.6
3	1	9.2	12.8
4	1.5	9.2	12.8

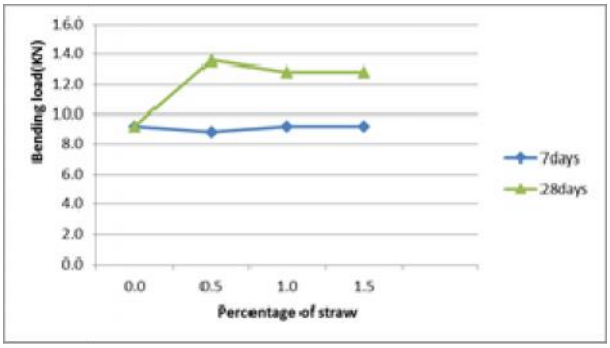

Figure 5: Bending load for different % of straw

Bending load for different % of coir is tabulated in table 6. The variation of Bending load strength for different % of coir is shown in chart 6.

Table 6: Bending load for different % of coir

Sl.No	% of replacement of straw	load (KN) 7days	load (KN) 28 days
1	0	9.2	9.2
2	0.5	10	10.4
3	1	9.6	12
4	1.5	10	12

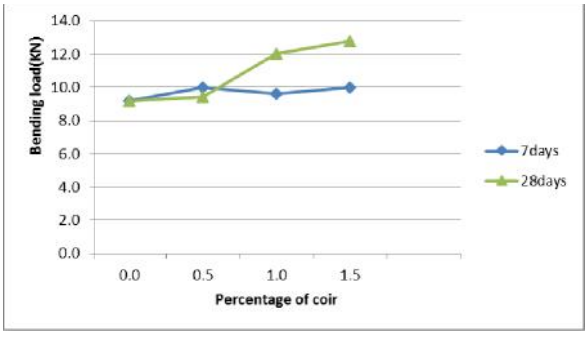

Figure 6: Bending load for different % of coir

IV. CONCLUSION

- The effect of saturated straw is positive, both when the straw has a size between (1-2) cm and when it was chopped, mechanical strength having experienced decreases.
- Slab strength gets increase while adding 1.5% of straw and coir in addition with the concrete.
- Addition of coir in concrete gives better results when comparing with straw.
- Compressive and tensile strength gets gradually decreases when increasing coir and straw in concrete.

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