International Journal of Recent Trends in Engineering & Research
ISSN (ONLINE) : 2455 – 1457
IMPACT FACTOR : 4.101

"ENHANCE THE PROPERTIES OF CONCRETE USING WASTE MATERIALS"

Ms Kalpana Sutrakar[1], Er. Vinod kumar modi [2]

[1]M.Tech. Scholar, [2]Asst. professor, department of civil engineering, Kautilya Institute of Technology and Engineering, Jaipur

Abstract: In this study waste sawdust ash and rice husk ash were used. Sawdust ash was use as partial replacement of cement at 10%, 20%, and 30% by weight in concrete mix. Rice husk ash was use as partial replacement of cement at 10% and 20% by weight in concrete mix. A total 15 number of concrete mix was prepared, in each mix 12 cubes of size 150 x 150 x 150 mm and 4 cylinder of size 100 x 200 mm were prepared. Compressive and splitting tensile strength of concrete mix was increasing at 10% replacement of saw dust ash with respect to control mix. At 20 and 30% replacement strength was decreasing. Compressive and tensile strength of concrete mix was decreasing as increasing rice husk ash percentages.

I. INTRODUCTION

Waste material are the by-product of any product after which product cannot be utilized in further use and it will be throw as a waste, these waste material are solid waste, biological waste, construction and demolition waste, industrial waste, domestic waste, green waste and electronic waste type. These waste materials are not in use so it can be throw into open environment, otherwise it will dump into land and sea. Due to increase in population demand of products are rapidly increase, due to this a large amount of waste materials are produced every year. These waste materials are causes serious environment pollution and hazards to health of human life.

1.1 RICE HUSK ASH (RHA) The Food and Agriculture Establishment's approximation of global rice production was 678 million tons in 2009, of which around 20% is rice husk, which is usually a unused material from the perspective of industrial and agricultural procedures. Even after its incineration, 20% of rice husk in the form of rice husk ash (RHA) remains in the form of waste.

1.2 SAW DUST ASH (SDA) Most attempts to utilize sawdust have included the application of sawdust as fuel either directly used in boilers for steam and heat generation, in co-firing in power stations and cement kilns, and in production of fuel briquettes and pellets subsequently used as fuel; in composting; in cement boards; and in poultry form for animal bedding, surface products e.g. in children's playgrounds and equestrian arenas.

II. LITERATURE REVIEW

Zerbino et al (2010) Fresh and mechanical properties were studied and analysed the permeability of water in concrete instead of cement by residual rice husk ash (RHA). Natural rice husk ashes (NRHA) and grinding rice husk ashes (GRHA) were changed to three water cement ratios (0.45, 0.55 and 0.65, respectively) in 15% and 25%, respectively. Control of concrete without ash and concrete, instead of 15% of cement by NRHA, receives similar mechanical and durability properties.

Ferraro et al (2010) studied the use of off white rice husk as partial replacement of white cement. White rice husk ash was changed to different percentages (according to weight of 0, 7.5 and 15%) in different ages. Comparison of results obtained from white rice husk ash mixed white concrete with literature related to RHA shows that compressed and divided tensile strengths are not negatively affected by using this by-product. White rice husk ash increases compressed strength of mixed white concrete with cement replacement percentage and sample age.

Habeeb and Fayyadh (2009) studied the effect of rice husk ash (RHA) on the mechanical properties of concrete and drying shrinkage. RHA with three deferent Average Particle Size (APS) i.e., 31.3, 18.3, and 11.5 µm, respectively were used to replace cement by 20 % of its weight. Workability of concrete mix were within constant range and as Average Particle Size of RHA increased, doses of superplastizer were also increased. At the age of 28 days, finer RHA exhibited higher strength than the sample with coarser RHA.

Andres Salas et al (2009) studied the properties of high performance concrete (HPC) using two types of treated rice husk ash (RHA). RHA was treated chemically before burning, which improves the effectiveness of RHA. As a result, ash (ChRHA) was compared to ashes generated by traditional incineration (TRHA) and silica fume (SF) percentages. Since the water demand of both RHA materials was also increased for proper functioning. With great responsiveness, a significant increase of high content of concurrent SiO2, concurrent power in ChRHA was evaluated.

III. EXPERIMENTAL WORK

3.1 MATERIAL

3.1.1 CEMENT

During the investigation, ordinary Portland cement (OPC) was used from a single lot. Physical properties of cement have been determined by various tests according to Indian standard IS: 1489-1991 (Part-1)

3.1.2 FINE AGGREGATE The sand was used as a fine total. Before use in concrete, clusters of soil and other foreign substances were separated.

Physical properties of fine aggregates are:

Fineness Modulus = 2.75

3.1.3 COARSE AGGREGATE

Localized available crushing stone aggregates of 12.5 mm nominal maximum size was used as thick total. The sieve analysis of thick set is listed in Table 3. To remove dirt and other inaccuracies, the first 50 µm was collected through the sieve.

The Physical properties of coarse aggregates as following:

Fineness Modulus = 7.56

Specific gravity = 2.65

Bulk Density = 1691 kg/m^3

3.2 WATER

Portable water worth drinking was used for the investigation. This water was used for mixing concrete mixture. It was free of harmful amounts of scandalous materials

3.3 RICE HUSK ASH

Rice husk ash was used locally available from boiler plant, they have use rice husk as a fuel in the plant and rice husk was converted into ash. They dumped this rice husk ash in land fill or throw into open environment. Rice husk ash was seems in black colour, it was very light in weight and physically the particle of rice husk was seen to be same size after burning.

3.4 SAW DUST ASH

Saw dust ash was also collected from locally available source. It was collected from poultry farm; they used the saw dust as a fuel and burning it into open drums for the heat production in winter season to leave the children of hens. Saw dust ash was light brown in colour.

3.5 SUPER-PLASTICIZER

The Super Plasticizer SP430 used in the study was Conplast SP430 is based on Sulphonated Napthalene Polymers and is supplied in the form of a fluid spreading fluid in water. Compliance with the Conplast SP430 IS: 9103: 1999 and BS: 5075 Part 3. Conplast SP430 depends on the dosages used in the ASTM-C-494 type 'F' and type 'A'. Recommended dose of super-plasticizers was 0.5 - 2.0% cement from weight. Due to the weight of cement, SP supplement was kept constant for all the blends at 0.6%; Rice husk ash concrete mixture is expected.

Properties: Specific gravity - 1.220 to 1.225 at 300C

3.6 TESTING THE FRESH PROPERTIES OF CONCRETE MIXES

3.6.1 COMPRESSIVE STRENGTH TEST

Cubes were tested for compressive strength using 2000 KN gauge in the usual manner as per Indian Standard guidelines. The cubes were tested in a compression testing machine of 2000 KN capacity manufactured by Heico. For compressive strength, concrete cube was tested as shown in fig.13.

3.6.2 SPLITTING TENSILE STRENGTH TEST

For determination of split tensile strength of samples, 200 kN gauge was used. The split tensile strength was determined by using the following formula.

Split tensile Strength (MPa) = 2P / ΠDL

P = Splitting Load in KN

D= diameter of cylinder sample

L = length of cylinder sample

IV. RESULTS AND DISCUSSTION

4.1 COMPRESSIVE STRENGTH

Compressive strength of concrete mixes was checking out at 7, 28, 56 and 90 days of water curing.

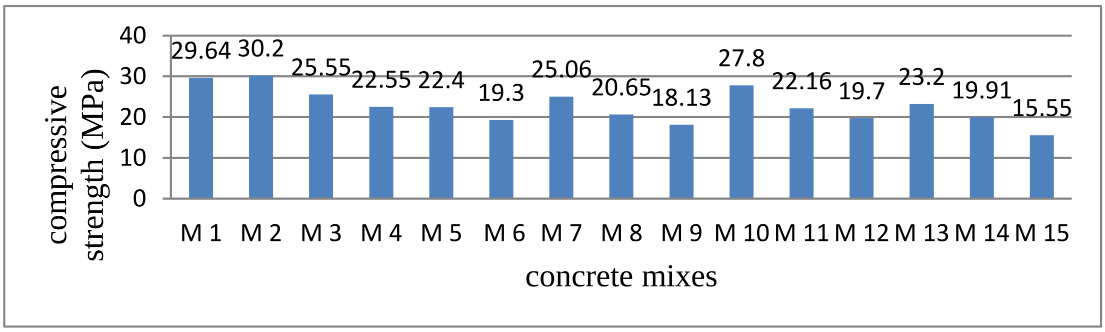

Fig.4.1 compressive strength of concrete mixes at 7 days

Fig. 4.1 show the compressive strength of concrete mixes at 7 days water curing, M 1 was control mix. M 2, M 3, and M 4 were mixes of 10, 20 and 30% replacement of cement by saw dust ash, the compressive strength of concrete mix was increased 1.89% at 10% replacement and decreased 13.80% and 23.92% respectively at 20 and 30% of replacement. M 5 and M 6 were mixes of 10 and 20% replacement of cement by rice husk ash, the compressive strength of concrete mix were decreased

24.42% and 34.88% at 10 and 20% replacement. M 7, M 8, and M 9 were mixes of 5, 10 and 15% replacement of coarse aggregate by scrape tyre rubber fibre of size 5 x 5 x 5 mm, the compressive strength of concrete mix were decreased by 15.45%, 30.33% and 38.83% respectively replacement.

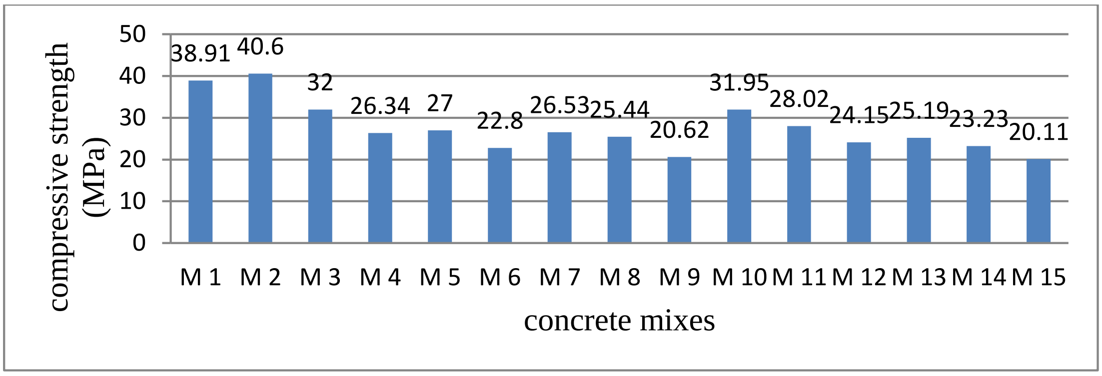

Fig.4.2 compressive strength of concrete mixes at 28 days

Fig.4.2 show the compressive strength of concrete mixes at 28 days water curing, M 1 was control mix. M 2, M 3, and M 4 were mixes of 10, 20 and 30% replacement of cement by saw dust ash, the compressive strength of concrete mix was increased 4.35% at 10% replacement and decreased 17.75% and 32.30% respectively at 20 and 30% of replacement. M 5 and M 6 were mixes of 10 and 20% replacement of cement by rice husk ash, the compressive strength of concrete mix were decreased 30.60% and 41.40% at 10 and 20% replacement.

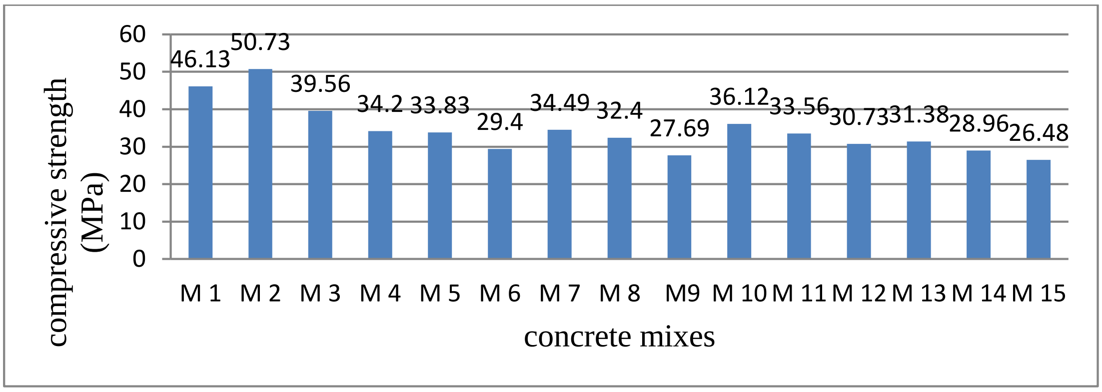

Fig.4.3 compressive strength of concrete mixes at 56 days

Fig.4.3 show the compressive strength of concrete mixes at 56 days water curing, M 1 was control mix. M 2, M 3, and M 4 were mixes of 10, 20 and 30% replacement of cement by saw dust ash, the compressive strength of concrete mix was increased 9.97% at 10% replacement and decreased 14.24% and 25.86% respectively at 20 and 30% of replacement. M 5 and M 6 were mixes of 10 and 20% replacement of cement by rice husk ash, the compressive strength of concrete mix were decreased 26.66% and 36.26% at 10 and 20% replacement.

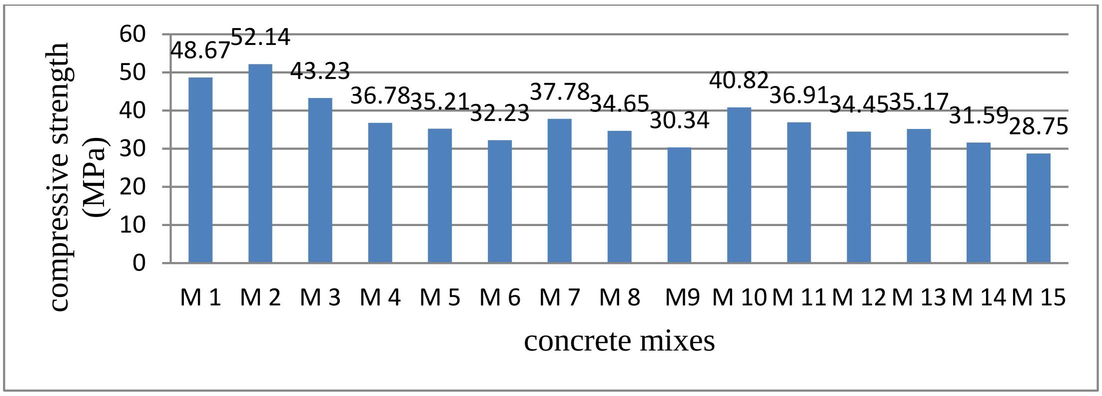

Fig.4.4 compressive strength of concrete mixes at 90 days

Fig.4.4 show the compressive strength of concrete mixes at 90 days water curing, M 1 was control mix. M 2, M 3, and M 4 were mixes of 10, 20 and 30% replacement of cement by saw dust ash, the compressive strength of concrete mix was increased 7.12% at 10% replacement and decreased 11.17% and 24.42% respectively at 20 and 30% of replacement. M 5 and M 6 were mixes of 10 and 20% replacement of cement by rice husk ash, the compressive strength of concrete mix were decreased 27.65% and 33.77% at 10 and 20% replacement.

4.2 SPLITTING TENSILE STRENGTH

Splitting tensile strength of concrete mixes was checking out at 28 and 56 days of water curing. Specimens were taken out from water tank at specified days and put in open environment in laboratory for drying. After this cylinder was tested on compressive strength testing machine, cylinder was put horizontally on machine than tested. The test result was shown of average three values of specimens for each batch of concrete mix at specified days of water curing.

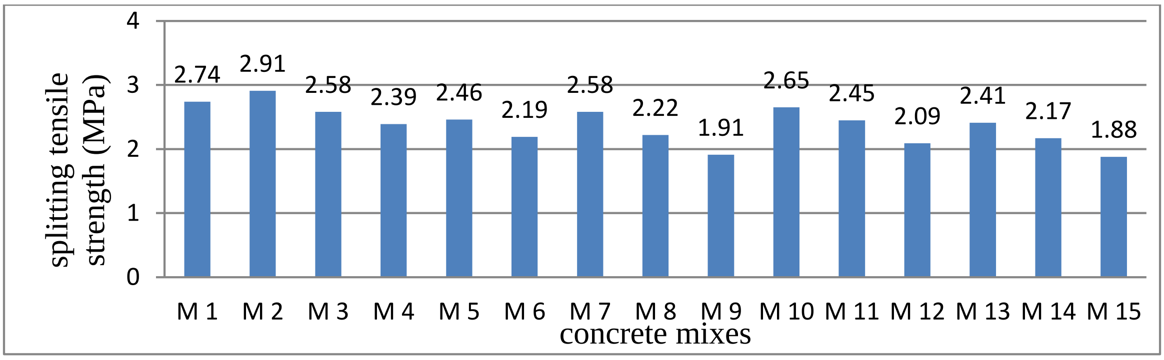

Fig.4.5 splitting tensile strength of concrete mixes at 28 days

Fig.4.5 show the splitting tensile strength of concrete mixes at 28 days water curing, M 1 was control mix. M 2, M 3, and M 4 were mixes of 10, 20 and 30% replacement of cement by saw dust ash, the splitting tensile strength of concrete mix was increased 6.20% at 10% replacement and decreased 5.85% and 12.77% respectively at 20 and 30% of replacement. M 5 and M 6 were mixes of 10 and 20% replacement of cement by rice husk ash, the splitting tensile strength of concrete mix were decreased 10.21% and 20.07% at 10 and 20% replacement.

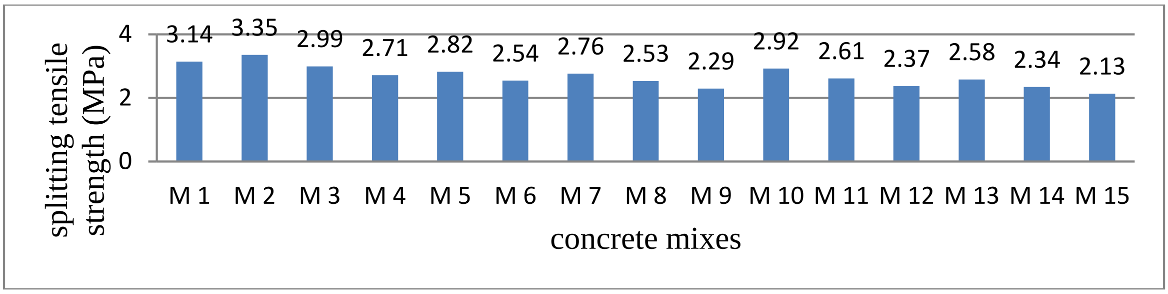

Fig.4.6 splitting tensile strength of concrete mixes at 56 days

Fig.4.6 show the splitting tensile strength of concrete mixes at 56 days water curing, M 1 was control mix. M 2, M 3, and M 4 were mixes of 10, 20 and 30% replacement of cement by saw dust ash, the splitting tensile strength of concrete mix was increased 6.68% at 10% replacement and decreased 4.77% and 13.69% respectively at 20 and 30% of replacement. M 5 and M 6 were mixes of 10 and 20% replacement of cement by rice husk ash, the splitting tensile strength of concrete mix were decreased 10.19% and 19.10% at 10 and 20% replacement. M 7, M 8, and M 9 were mixes of 5, 10 and 15% replacement of coarse aggregate by scrape tyre rubber fibre of size 5 x 5 x 5 mm, the splitting tensile strength of concrete mix were decreased by 12.10%, 19.42% and 27.07% respectively replacement.

4.3 COMPRESSIVE STRENGTH

Compression has been done between compressive strength of different types of waste materials were used in the concrete mixes was analyses at particular replacement percentages. Compression was done between waste materials which replace cement or coarse aggregate in concrete mixture. Saw dust ash and rice husk ash were replacing cement in concrete mixture so at constant percentage of both materials.

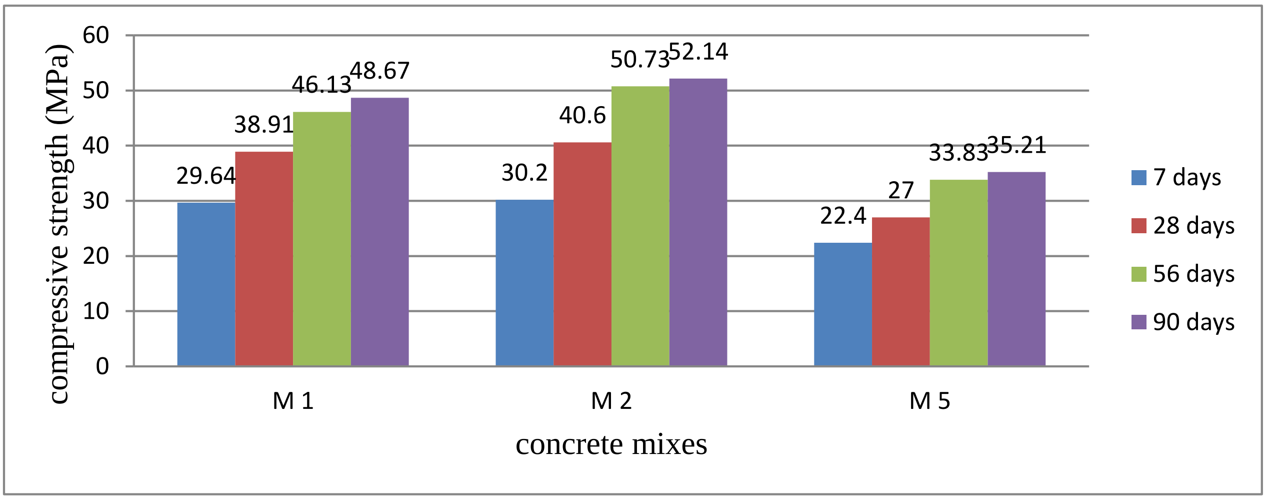

Fig.4.7 compressive strength of concrete mixes at 10% replacement of cement

Fig.4.7 show the compressive strength of concrete mixes at 10% replacement of cement by saw dust ash and rice husk ash. M 1 was control mix. At 10% replacement of cement by saw dust ash increased the maximum strength of concrete mix 9.97% at 56 days water curing with respect to control mix. At 10% replacement of cement by rice husk ash decreased the compressive strength approximately 27% at 56 days water curing with respect to control mix. At 10% replacement compressive strength of saw dust ash mix was approximately 37% more than rice husk ash concrete mix at 56 days water curing.

Saw dust ash concrete mix show at early age (7 days) increase in compressive strength was very low 1.89% but at higher age (56 days) increase 10% approximately so the pozzolanic reaction at early age was very slow but latter age it increased rapidly. It show that at 10% replacement saw dust ash has better pozzolanic reaction than control mix and rice husk ash mix.

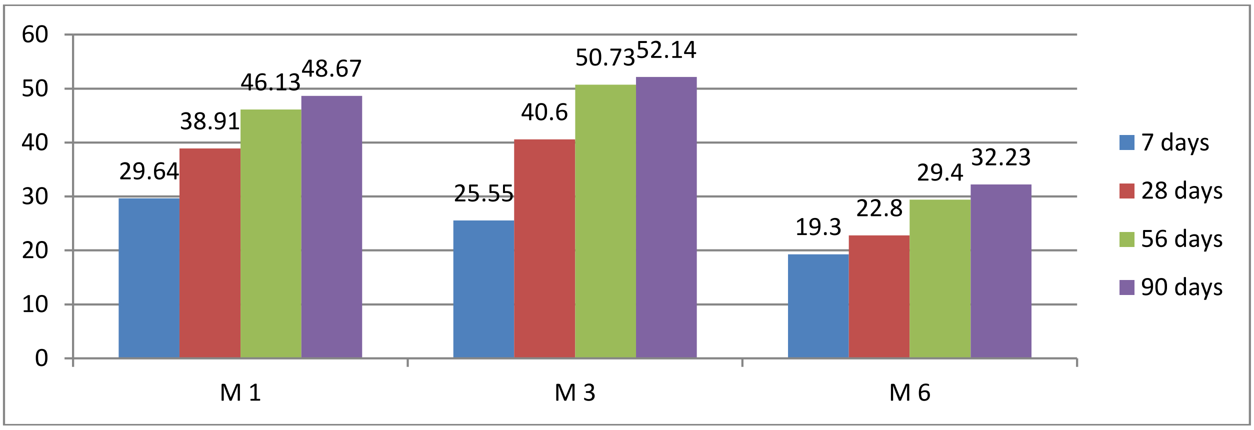

Fig.4.8 compressive strength of concrete mixes at 20% replacement of cement

Fig.4.8 show the compressive strength of concrete mixes at 20% replacement of cement by saw dust ash and rice husk ash. M 1 was control mix. At 20% replacement of cement by saw dust ash and rice husk ash, the compressive strength of concrete mix were maximum decrease 17% and 41% approximately at 28 days water curing with respect to control mix. At 20% replacement, the compressive strength of saw dust ash concrete mix was approximately 24% more than rice husk ash concrete mix at 56 days water curing. Saw dust ash and rice husk ash concrete mix show at early age compressive strength were decrease rapidly 17.75% and 41.40% respectively but at latter age strength was decreased slowly 11.17% and 33% respectively. So the compressive strength of concrete mix was decreased more at early age but at latter age specimen were gaining strength. It shows that at 20% replacement of saw dust ash mix has better pozzolanic reaction than rice husk ash mix.

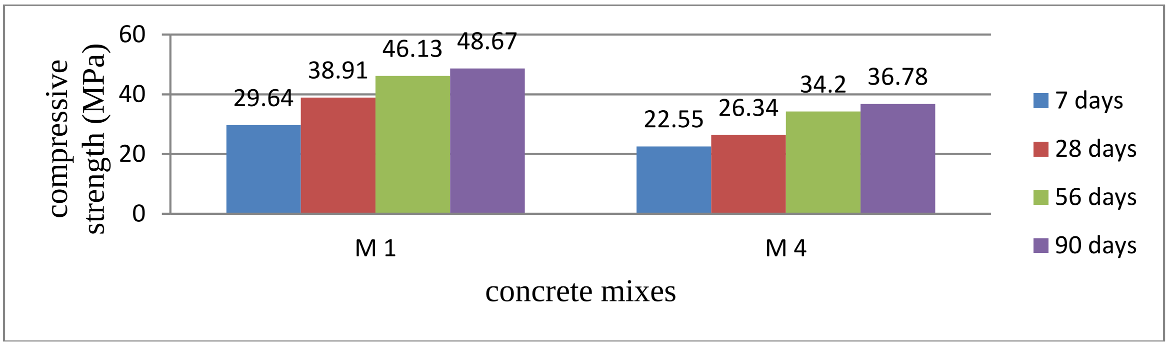

Fig.4.9 compressive strength of concrete mixes at 30% replacement of cement

Fig.4.9 show the compressive strength of concrete mixes at 30% replacement of cement by saw dust ash. M 1 was control mix. At 30% replacement of cement by saw dust ash, the compressive strength of concrete mix was maximum decrease 32% approximately at 28 days water curing with respect to control mix. Saw dust ash concrete mix show at early age compressive strength were decrease rapidly 32% and but at latter age strength was decreased slowly 26%. So the compressive strength of concrete mix was decreased higher at early age but at latter age specimen was slightly higher strength than early age. It shows that at 30% replacement of saw dust ash mix has better pozzolanic reaction than rice husk ash mix of 20% replacement because it losses lower strength than rice husk ash mix. Rice husk ash concrete mix was not prepared at 30% replacement because at 30% replacement rice husk ash has a very high volume than cement content so it was not mix properly in concrete mix at constant water cement ratio and superplasticizer content.

4.4 COMPRESSION OF TENSILE STRENGTH

Compression has been done between splitting tensile strength of different types of waste materials were used in the concrete mixes was analyses at particular replacement percentages. Compression was done between waste materials which replace cement or coarse aggregate in concrete mixture. Saw dust ash and rice husk ash were replacing cement in concrete mixture so at constant percentage of both materials, which material give better strength were analysis.

The splitting tensile strength of concrete mixes at 10% replacement of cement by saw dust ash and rice husk ash. M 1 was control mix. At 10% replacement of cement by saw dust ash increased the maximum strength of concrete mix 6.68% at 56 days water curing with respect to control mix. At 10% replacement of cement by rice husk ash decreased the splitting tensile strength approximately 10.20% at 56 days water curing with respect to control mix. At 10% replacement splitting tensile strength of saw dust ash mix was approximately 17% more than rice husk ash concrete mix at 56 days water curing. At 10% replacement of cement by waste materials tensile strength of all mix increase or decrease approximately same rate at all water curing age. It show that at 10% replacement saw dust ash has better pozzolanic reaction than control mix and rice husk ash mix.

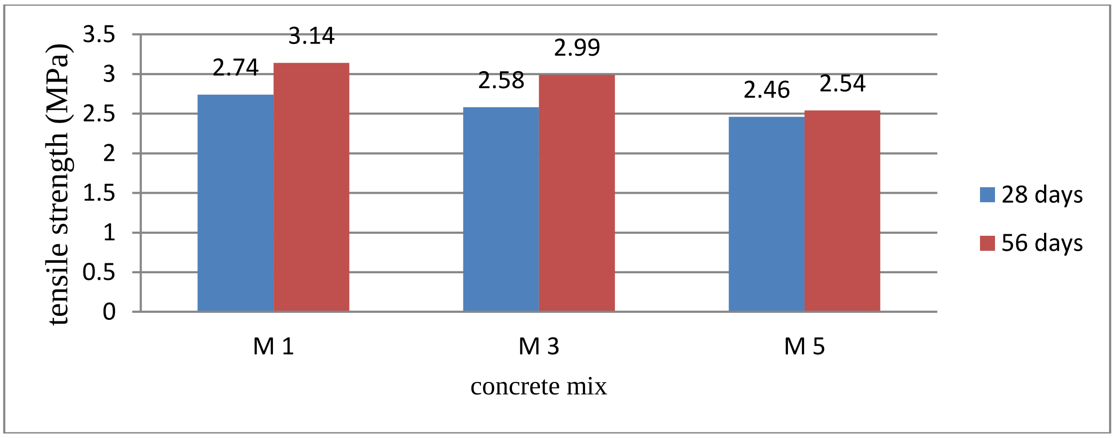

Fig.4.10 tensile strength of concrete mixes at 20% replacement of cement

Fig.4.10 show the splitting tensile strength of concrete mixes at 20% replacement of cement by saw dust ash and rice husk ash. M 1 was control mix. At 20% replacement of cement by saw dust ash and rice husk ash, the splitting tensile strength of concrete mix were maximum decrease 5.85% and 20.07% approximately at 28 days water curing with respect to control mix. At 20% replacement, the splitting tensile strength of saw dust ash concrete mix was approximately 14% more than rice husk ash concrete mix at 56 days water curing. So the splitting tensile splitting tensile strength of concrete mix was decreased as approximately same percentages at all age of water curing. It shows that at 20% replacement of saw dust ash mix has better pozzolanic reaction than rice husk ash mix.

V. CONCLUSION

1. Workability of concrete mixes was decreasing as increasing the percentage of saw dust ash content in concrete mix with respect to control mix. Mix was obtained homogenous at all percentage of replacement.

2. Workability of concrete mixes was increasing when rice husk ash used in concrete mixes at all percentages with respect to control mix but workability of rice husk ash concrete mixes were decreasing as increasing rice husk ash content.
3. Compressive strength of concrete mix at 10% replacement of saw dust ash was approximately 10% more than control mix but at 20 and 30% replacement the strength was approximately 15 and 25% less than control mix.
4. Compressive strength of rice husk ash concrete mixes was decreasing as increasing rice husk ash content by approximately 25 and 35% at 10 and 20% replacement.
5. Compressive strength of saw dust ash concrete mixes was greater than rice husk ash concrete mixes at all percentages of replacement.
6. At 10% replacement of cement by saw dust ash in concrete mix gives more strength than control mix.
7. Splitting tensile strength of concrete mix at 10% replacement of saw dust ash was approximately 6% more than control mix but at 20 and 30% replacement the strength was approximately 5 and 13% less than control mix.
8. Splitting tensile strength of rice husk ash concrete mixes was decreasing as increasing rice husk ash content by approximately 10 and 20%.
9. Splitting tensile strength of concrete mixes was decreasing less as compared to compressive strength of concrete mixes.

REFERANCE

I. ACI Committee 211, 1993, ‘Guide for Selecting Proportions for High Strength Concrete with Portland Cement and Fly ash’, ACI 211, 4R-93, ACI Materials Journal, Vol.90, No. 3, pp. 272-283.
II. ACI 211.4R-93,1996 “Guide for Selecting Properties for High-Strength Concrete with Portland Cement and Fly Ash”, ACI Manual of Concrete Practice, Part 1, American Concrete Institute, Detroit, Michigan.
III. Aitcin, P.C, Mehta, P.K., 1990, “Principles Underlying the Production of High- Performance Concrete.” Cement, Concrete and Aggregates Journal 12(2), pp. 70-78.
IV. Ahmad Shayan and Aimin Xu, “Value-added utilisation of waste glass in concrete”, Cement and Concrete Research 34, 2004, pp.81–89.
V. Ahmad Shayan and Aimin Xu, “Performance of glass powder as a pozzolanic material in concrete: A field trial on concrete slabs”, Cement and Concrete Research 36, 2006, pp.457–468.
VI. Andres Salas et al, “Comparison of two processes for treating rice husk ash for use in high performance concrete”, Cement and Concrete Research 39, 2009, pp.773–778.
VII. Antiohos S. At el (2004), “Evaluation of blends of high and low calcium fly ashes for use as supplementary cementing materials”, Cement & Concrete Composites 27, 2005, pp.349–356.
VIII. Atis C. D, “Accelerated carbonation and testing of concrete made with fly ash”, Construction and Building Materials, Vol. 17, 2003, pp.147-152.
IX. ASTM C595-92, 1994, “Standard Specification For Blended Hydraulic Cement”, American Society for Testing and Materials, Annual book of ASTM Standars, Volume 04.02, West Conshohocken, Pennsylvania.
X. ASTM C311-92, 1994, "Standard Methods of Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture inPortland Cement Concrete", American Society for Testing and Materials, Annual Book of ASTM Standards, Volume 04.02, West Conshohocken, Pennsylvania.
XI. Baoshan Huang et al, “Laboratory evaluation of incorporating waste ceramic materials into Portland cement and asphaltic concrete”, Construction and Building Materials 23, 2009, pp.3451–3456.
XII. Bashar Taha, Ghassan Nounu, “Properties of concrete contains mixed colour waste recycled glass as sand and cement replacement”, Construction and Building Materials 22, 2008, pp.713–720.
XIII. Benazzouk A, “Effect of rubber aggregates on the physico-mechanical behaviour of cement–rubber composites-influence of the alveolar texture of rubber aggregates”, Cement & Concrete Composites 25, 2003, pp.711–720.
XIV. Benazzouk A, “Transport of fluids in cement–rubber composites”, Cement & Concrete Composites 26, 2004, pp.21–29.
XV. Benazzouk et al, “Physico-mechanical properties of aerated cement composites containing shredded rubber waste”, Cement & Concrete Composites 28, 2006, pp.650–657.
XVI. Benazzouk et al, “Physico-mechanical properties and water absorption of cement composite containing shredded rubber wastes”, Cement & Concrete Composites 29, 2007, pp.732–740.