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STATE OF ART OF USAGE OF ALTERNATIVE MATERIALS IN CONCRETE

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ABSTRACT
This paper present review on usage of alternate materials in concrete which includes upcoming changes in concrete technology that paves the way to utilise some of the alternative materials that can be utilised as a composition to the ingredients of concrete that can be partially or completely be replaced with one or more materials that can be used other than the traditional concrete that we are using since time immoral. This paper covers various aspects about the using of waste materials in concrete as alternate aggregate and changes in strength parameters with different composition mixture of concrete and usage of alternate materials in concrete at presence scenario

INTRODUCTION
Cement is used as binder material in construction industries. Use of Concrete is increased day by day after rate of construction is increased. Concrete is used in construction of different engineering and non-engineering structures (temporary structures).Concrete is nothing but a mixture of different raw materials like fine aggregate, coarse aggregate, cement and water. Use of this all raw material is increased day by day due to increase in rate of construction and at same period availability of raw material is reduced and some material among natural raw material omits CO2 in to the atmosphere. Anyhow Use of concrete spoils Atmosphere. However, these construction and engineering materials must meet new and higher demands. When facing issues of Productivity, Economy, Quality and Environmental. They have to compete with alternate construction materials such as sawdust, glass piece, quarry dust etc…..
We can solve this problems by two methods (a) concrete is replaced by other alternative materials which is very difficult to manage or impossible right now in terms of the properties of concrete i.e. durability, workability and strength (b) Partial or full replace different raw materials. Second option is possible. Now a day's lots of invention in field of concrete technology are carried out by different researchers. We are trying to solve this problem with the help of partial replacement of different waste materials for this we have go through different published paper which gives the suggestion of different material which can be used as partial replacement of raw materials i.e. Cement, Coarse aggregate and Fine aggregate

LITERATURE REVIEW
Literature Review is bifurcated into different materials and Author's Research work is intimate as follows:

Sawdust
Tomas.U.Ganiron Jr [2014] has studied on Effect of replacement of fine aggregate with sawdust in concrete mixture for building construction. Concrete a composite material made from fine aggregate, coarse aggregate, water and some admixtures. The present paper deals with the replacement of fine aggregate with sawdust and comparison replaced material concrete and traditional concrete. He casted the three specimens for curing period of 7 days, 14 days, 28 days .in that highest compressive strength is gained by 7 day sample which was not cured in that period and Strength of sawdust concrete decrease as the water cement ratio less than 0.45 curves is dropping down, which shows that the sawdust concrete mix is not workable. The sawdust-gravel-cement concrete showed 10% reduction in weight than traditional concrete which got about 40% weight. Due to mixing the concrete with waste material, the workability and consistency parameters are varied from traditional concrete and the sawdust waste material is cheaper than the fine aggregate
Dilip Kumar et al. [2014] researched on low cost construction material for concrete as saw dust and investigated on the effects of introducing the cost between sawdust used concrete block and sand used concrete block .There made concrete specimens by replacing the sand with 10% 15% and 20% saw dust and there conclude that at the initial ages, with the increase in the percentage replacement of sawdust, the strength as well

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as compressive strength increases .While using sawdust in concrete ,the weight of concrete will decrease and it can be used as Light weight Concrete in civil engineering applications

Prof.R.Sathish Kumar [2012] researched on properties of concrete varied with alternate construction materials .He used cement, sand, rice husk ash, coarse aggregate, saw dust, brick bats, recycled aggregates as materials in concrete. The compressive strength of saw dust concrete was found to be nearly 10-15% of conventional concrete. The maximum Average Compressive Strength of sawdust contained Concrete of 7 days and 28 days is 20.26 Kg/cm^2 and 43.22 Kg/cm^2 at proportional of 1 :(1+0.5):3 and water-cement ratio of 0.75

Fly Ash

Michael Berry et al [2009] researched on production of green concrete without using Portland cement and with some changing the environment. In this research there have used the fly ash as replacement of Portland cement in 100% content and casted the specimens with traditional and glass concrete and the fly ash concretes made throughout in this research program have had slumps from 102 to 216mm (4 to 8.5 in), set times of approximately 120 minutes, and 28 day unconfined strengths on the order of magnitude of at least 28 MPa (4,000 psi) an they have concluded that new concretes offer good durability relative to ASR and freeze thaw resistance. Reinforced structural elements made with fly ash concrete behaved as would be expected based on design equations for conventional Portland cement based concrete and they stated that their research program has moved beyond the laboratory and has been used in multiple pilot projects.

JayrajVinodsinh Solanki and Jayeshkumar Pitroda [2013] An experimental investigation with the use of industrial end products Fly Ash and Hypo Sludge is carried out to know the strength of concrete and optimum percentage of the partial replacement of waste required. 150 mm × 150 mm × 150 mm concrete cubes are casted by using M20 grade concrete. Specimens with ordinary Portland cement (OPC) and OPC replaced with hypo sludge and fly ash at 10%, 20%, 30% and 40% levels. After curing,they have tested and concluded that compressive strength of the concrete after 7 days decreases when the percentage of replacement of fly ash increases and with replacement of 10 % hypo sludge compressive strength increases after 7 days. Compressive strength of the concrete after 28 days increases when the percentage of replacement of fly ash increases up to 30% and with replacements of 20 % hypo sludge compressive strength increases after 28 days.

Rice Husk Ash

Prof.R.Sathish Kumar [2012] in his research he got the compressive strength values of rice husk ash concrete was found to be in the range of 70-80% of conventional concrete for a replacement of cement up to 20% and his research study shows that the early strength of rice husk ash concrete was found to be less and strength increases with age.

Tomas.U.Ganiron Jr [2013] has studied on Effect of replacement of fine aggregate with rice husk ash in concrete mixture for building construction. The present paper deals with the replacement of fine aggregate with Rice husk ash. He casted the three specimens with different mixtures D, E, F for curing period of 7 days, 14 days, 28 days .in that maximum Average compressive strength is gained by 28 day's Mixture E sample was 70.1 Mpa and Similarly coming to Tensile Strength Mixture E sample got Maximum Average Tensile Strength was 6.98 MPa and he has included the elasticity modulus and got a maximum average elasticity modulus of concrete at Mixture D for 28 days curing of 51.19Gpa and he concluded that rice husk ash can be used for reducing environmental polluter factors. While Adding RHA to concrete, a decreasing in water absorption was verified. A reducing of 32.4% was observed when compared to control sample. An increment of 15% was obtained when added 7% of RHA. According to the results of splitting tensile test, all the replacement degrees of RHA researched, achieve similar results and it can be used for interior concrete walls. The rice husk is applicable to concrete for interior concrete wall. Moreover, the application was intended to non- entrained placement. The wet weather conditions cause deterioration of husks that affect the stability of concrete.

Recycled Aggregate

Prof.R.Sathish Kumar [2012] in his research he got the compressive strength values of recycled aggregate concrete was found to be in the range of 70-80% of conventional concrete for a replacement of cement up to 20% and at last he concluded alternate materials contained concrete like sawdust and brick bats can be used for partition and filling purposes & nailing purposes where the strength is not criteria.

Nitish Puri et al [2013] investigated the utilization of recycled wastes as ingredients in concrete mix by replacing following aggregates with incorporating various percentages i.e. Recycled aggregates and natural

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aggregates with 100%,75% and 25% of recycled debris (20mm average particle size), . They got maximum average compressive strength in mix design consists of 25%debris + 75% coarse aggregate is 33.14 KN/m2 for 28 days and they got Average maximum flexural strength in same mix design i.e. 25%debris + 75% coarse aggregate is 5.04 KN/m2 thus by replacing fully or partially the strength parameters are increased in long time period (28 days). The aim of this investigation was to form a light weight concrete. By using different waste materials as replacement of fine aggregates and coarse aggregate they got average compressive strength as follows. There concluded that except leather waste other materials like construction debris and PVC scrap Performed well as full or partial replacer of concrete aggregates and can find suitable application in construction industry as alternative to conventional materials.

Glass Concrete

Dr.T.Sekar et al [2011] researched on strength characteristics on utilization of waste materials as coarse aggregate in concrete. There considered the 4 samples with conventional, Ceramic Insulator scrap (100%), crushed glass (100%), Tile Waste (100%) materials concrete. He Casted the specimen with same workability of 0.49 and mix proportions of (1:1.22:2.66) there have concluded that The compressive strength of concrete specimens made with glass concrete was found to be 16% and 26.34% lesser respectively than that of conventional concrete.

Dr. Haider K. Ammash, et.al.[2009] studied on the possibilities Waste Glass of size up to 5mm as a fine aggregate in concrete. The waste glass was used as a partial weight replacement of fine aggregate (sand) with percentages of 10, 20, 30 and 40 %. They found that, waste glass aggregate can be satisfactorily substituted for natural fine aggregate at replacement levels up to 20%.

Copper Slag

B.Jaivignesh and R.S.Gandhimathi [2015] investigated experimentally on partial replacement of fine aggregate by copper slag .There performed lab experiments on M30 grade specimen with following materials i.e. water, cement, fine aggregate, coarse aggregate , copper slag ,Super plasticizer .There used the copper slag of 20%,40%,60%,80% and 100% in replacement of fine aggregate and the highest compressive strength was achieved by 40% replacement of copper slag ,which was found about 44.52 N/mm^2 compared with 31.36 N/mm^2 for the control mixture .there have concluded that all percentage replacement of fine aggregate by copper slag the compressive strength and split tensile strength of concrete is more than control mix ,Compressive strength and split tensile strength is increased due to high toughness of copper slag hence for normal practical applications upto 40% replacement of fine aggregate by copper slag should be recommended.

Anzar Hamid Mir [2015] Studied about Replacement of sand with efficient alternatives **and** he concluded the results of compression & split tensile test indicated that the strength of concrete increases with respect to the percentage of copper slag added by weight of fine aggregate. Addition of slag in concrete increases the density thereby the self-weight of the concrete.

Quarry Dust

Chandana Sukesh et al. [2013] studied about Partial Replacement of Sand with Quarry Dust in Concrete. Quarry dust, a by-product from the crushing process during quarrying activities is one of such materials. Granite fines or rock dust is a by-product obtained during crushing of granite rocks and is also called quarry dust. In recent days there were also been many attempts to use Fly Ash, an industrial by product as partial replacement for cement to have higher workability. This paper was an attempt to use Quarry Dust as partial replacement for Sand in concrete.

H. S. Suresh Chandra et al. [2014] have studied on the Effect of Replacement of Sand by Quarry Dust in Hollow Concrete Block for Different Mix Proportions. In this paper an attempt has been made to determine the property.es of hollow concrete blocks produced by replacement of quarry dust instead of sand. Both partial (i.e.50%) and complete replacement has been tried with and without admixtures.

Nano particles

K.Brahmani [2014] studied about characteristics study of concrete using Nano particles. She considered the Titanium Dioxide (Tio_2) and Nano silicate (Sio_2) has a Nano Particles in her research work with percentage of 0.1, 0.125, 0.25, 0.5, 0.75 and 1 of Sio_2 and Tio_2 respectively for testing compressive and flexure test and she casted the 12 cubes for every percentage of above two Nano particles with inclusion of constant M20 Concrete

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Grade mix (1:1.5:2.7) & water cement ratio of 0.48 and without any usage of Nano Particles, she concluded that while usage of Sio_2 in Concrete ,7-days compressive strength is gradually increasing up to 0.75% later decrease in strength is occurred .while adding 1% of Sio_2 there is not much change in strength of concrete and 28-days compressive strength is also increasing up to 0.75% later decreases for 1% addition of Sio_2 .the maximum percentage of 0.75% ,the 28-day compressive strength is observed as 50.7N/mm^2 and optimum content of Sio_2 is restricted as 0.75% ,For Tio_2 7-Days compressive strength is alternate increase and decrease were observed and addition of Nano particles up to 0.25% of Tio_2 there is not much change in 28-day strength of concrete and 28-Days compressive strength is increasing after 0.25% of Tio_2 and is observed as 59N/mm^2 . Flexural strength is also observed as increase in strength with usage of both Nano materials in Concrete.

Saurav [2012] has studied on the "Application of Nanotechnology in Building Materials". And here Application of nanotechnology in building materials for various civil engineering works is discussed. Since the use of nanotechnology controls the matter at the atomic level, the properties of matter are seriously affected. Strength and other properties of materials are dramatically affected under a scale of Nano meter(10-9m).This paper also reveals how the use of Nano technology makes concrete more stronger, durable and more easily placed. Different types of Nano materials used are discussed with its wide applications.

Metakolin

Beulah et al. [2012] researched an experimental investigation on the effect of partial replacement of cement by metakolin by various percentages i.e. 0%, 10%, 20%, and 30% on the properties of high performance concrete, when it is subjected to hydrochloric acid attack. An aggregate binder ratio of 2 and different water binder ratios i.e. 0.3, 0.35, 0.40 and 0.45 was used in this investigation. Concrete specimens of size 150 x 150 x 150 mm were casted to find residual compressive strength and specimens of size 100 x 100 x 100mm were casted to find percentage weight loss; both the sizes of specimens were casted and cured as per IS specification. After 28 days water curing, the concrete specimens were kept immersed in 5% concentrated hydrochloric acid solution for 30, 60 and 90 days for observation. Before immersion, they were weighed accurately and after required days of immersion and observation, the specimens were removed from hydrochloric acid media, weighed accurately and tested for their compressive strength; weight loss and hardness of concrete were studied. The various results which indicate the effect of replacement of cement by metakolin on High Performance Concrete are presented in this paper to draw useful conclusions.

Bo wu et al [2002] studied the effect of high temperature on residual mechanical properties of confined and unconfined high strength concrete. They varied the temperature from 100ºC to 900ºC. Also elastic modulus decreases sharply at the higher temperatures.

Waste Foundry sand

Cyr et al. [2007] studied sewage sludge ash (SSA) in cement based materials. They observed that compressive strength of mortars containing 25% and 50% of SSA was always lower than those of reference mortars but it shown that SSA has a long term positive effect which might be related to a slight pozzolanic activity.

Mishra et al. [1994] investigate the effect of blast furnace slag, fly ash and silica fume on permeability of concrete. Rapid chloride permeability test was performed to check the quality of concrete. They concluded that use of these waste in concrete decreased the permeability of concrete and increases the quality of concrete.

LITERATURE SURVEY

Chirag Garg and Aakash Jain [2014] stated that concrete is an environmental friendly material and the overall impact on the environment per ton of concrete is limited and usage of waste materials in concrete like fly ash as cementitious material, fly ash aggregates, stone crusher waste as fine aggregates, Recycled concrete and masonry as aggregates, marble waste as filler material, waste plastic as concrete composite .He concluded that an increasing trend and incentives for the greater use of manufactured and recycled aggregates in construction and use of concrete products like green concrete in future will not only reduce the emission of CO2 in environment and environmental impact but it is also economical to produce.

Ruoyu Jin and Qian Chen [2013] stated in his research paper, by utilizing of Alternate materials we can reduce energy consumption, environmental impact and natural resource use and investigated on current status of Green Concrete in the U.S Construction industry through Questionnaires process (Surveying), He concluded that despite a large number of academic studies on various types of Supplementary Cementitious Materials (SCMs) and Alternative Aggregates(AAs) ,their current usage in the industry was limited to top three SCMs i.e.

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Fly Ash Class F and Class c ,GGBFS (Ground Granulated Blast Furnace Slag) as well as light weight aggregate and RCA for AAs. Also, Companies were at different levels in recognizing and utilizing SCMs and AAs and he gave information about advantages and disadvantages of SCMs and AAs in his research paper.

RESULTS AND DISCUSSION

After reviewing all literatures, following materials can be used as alternate materials in concrete with some range, considered materials have a capability to increase in strength parameters by adding less percentage of alternate materials usage beside economy and there are included the materials in following table which gives effective increase in all strength parameters.

Table 1: Results

ALTERNATE MATERIALS USED IN CONCRETE	PERMISSIBLE USAGE PERCENTAGE IN CONCRETE
Saw Dust	5% to 10% partial replacement as fine aggregate
Quarry Dust	20% to 30% partial replacement as fine aggregate
Broken glass pieces	10% to 20% partial replacement as coarse aggregate

CONCLUSION

From above Literature Reviews, We have Studied that following materials can be used as Alternate materials in concrete are as follows: (1) Saw Dust (2) Rice Husk Ash (3) Recycled Aggregate (4) Fly Ash (5) Quarry Dust (6) Glass powder (7) Nano Particles (Sio_2 and Tio_2) (8) Metakolin (9) Waste foundry sand. Every alternate aggregate has percentage limit to add as substitute of conventional concrete aggregates for good strength in compressive and flexural if the percentage limit is high then it impacts on compressive and flexural strength of concrete

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