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Research paper



Behaviour of concrete by using artificial aggregates a review

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Abstract

Natural aggregate is not an environmental friendly material due to its destructive resource consuming nature. GGBS is a byproduct of steel industries, whereas GGBFS mixed with cement of 1:2 ratio making an artificial aggregate, whereas hardening powder used to spray made upon artificial aggregate to develop the strength of concrete. The basic properties of natural and artificial aggregates were determined. The mix design to be determined obtained for conventional concrete of control mix of grade M 25. The different mix proportions were prepared by replacement of 20, 40, 60, 80, 100 of natural aggregate instead of artificial aggregate. To check the compressive strength, split tensile strength determine. Based on the result we choose optimum percentage of aggregate and make it and concrete to determine the durability properties of concrete compared with natural aggregate.

Keywords: *GGBFS (Ground Granulated Blast Furnace Slag), hardening powder, light weight recycled aggregates.*

1. Introduction

Recycling of waste materials and by products of material is to be used. Now days waste materials to be recycled in our civil industries. We are using waste material in construction work, so is very economic and easy to work. Due to reusing materials to avoid the exhausting are natural materials. We using recycled aggregates in construction work due to light weight concrete and also decrease the cost of building is very low. Artificial aggregates many of them manufacturing process are very easy and also that aggregates reach full strength.

Natural aggregates are occurring in natural place after that the rocks are cut and sieving of various sizes based on required. The artificial aggregates is compare to natural aggregates the strength should be more then approximately 80 percentage, so only the concrete of artificial aggregates of durability is high otherwise the strength of concrete will be less.

The properties of artificial aggregate strength is compared to normal aggregate should be match. So testing of artificial aggregates is impact test, crushing test, soundness test, abrasion test should be conducted.

So many of waste materials, properties based on sources of materials should be consider the making of artificial aggregates. This aggregates is angular shapes is better workability and bonding strength will be increase.

1.1. GGBFS

Ground granulated blast furnace slag in this material by product of steel manufacturing industries to be used and also partially fineness material. This physical and chemical property is compare with cement is almost same. So we are using of this material making of artificial aggregates.

1.2. Hardening powder

This powder surface is Hardening properties and carbon content is low. This powder is using of made on fresh flooring concrete will spray the powder after that the flooring so hard and also strength of concrete is increase

1.3. Making of artificial aggregate

Artificial aggregate is made by the ratio of 1:1:2 that contain GGBFS, cement and sand. it is formed by pellitization method and the aggregate will be formed in a shape of pellets and then using the hardening powder will be sprayed in pellets for its hardness after completing the hardening process the pellets are collected and kept in room temperature for 1 day and then the pellets are collected to curing for 21 days for its hardness

2. Literature survey

Ks.Hemanthnaveen et al (2017)[3] the possibility ggbfs in cement concrete as the sand substitute for decreasing the environmental issues is related to sand and waste material of slag the extend work is done by 100 % replacement for natural sand with GGBFS also w/c proportion of 0.4 and 0.6 demand for sand in concrete is quantity of ggbfs in concrete contain the quarry dust as sand or replacement for sand by ggbfs the range of 5,10 and 15 percentage of concrete mixtures were mixed completely to be test conducted. To determine the test of compressive and spilt tensile both strength which is compare to normal fine aggregates.

AnchuAjayakumar and Jaseela K.H (2017) [1]) they have been considered as alternative materials like ggbfs for the ordinary Portland cement (OPC) in conventional concrete for at training concrete cube metals like zen, cd, ni, pb, cu were studied according to the central pollution control board (CPCB) limit . Concrete cube in different percentage 10%,20%,30%,40% and

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50%. For fine aggregate with in ggbfs. Determine the compressive strength of concrete cube was improved up to 30% of replacement of EAFS .It is concluded that aggregate there by resulting of sustainable way to utilize industrial by-products.

S. Murali Krishnan and T. Felix kala (2017) [19] The recently this generation mostly used Msand for fine aggregate and partially replacement of cement with admixtures in the concrete at 28 days strength attain 60 Mpa . the percentage of M-Sand added by weight of (0,2.5,50 and 75%) as that replacement of fine aggregates used in concrete and cement was replaced by ggbfs with 0,5,10 and 15% and the dosage of super plasticizers added 0,1, 1.3% by the weight of cement in strength characteristics of flexural strength of property of concrete is enhanced by partial replacement of sand with 50% of the Msand compared to normal strength of high performance concrete.

Pramodininaikgaonkar (2016) [15] The production of raw materials of concrete has contain determined on environment mostly the production on cement and coarse aggregate obtained mining of river bed for getting the natural sand (GGBFS) naturally oxides river pebble crushed rock fines (CRF) the replacement of fine aggregates, coarse aggregates and cement is used of ground granulated blast slag (GGBFS). naturally oxides river pebbles crushed rock fines (CRF) as partial replacement of cement sand and coarse aggregate for making green materials as the replacement of cement sand and characteristics by high compressive strength and good workability .

Srinivasan.k Et Al (2016) [23] Now a day's increasing demand for construction materials is the result of environmental affect, so only artificial aggregate are made of various waste materials in the current genrations. The waste materials of industrial is by product like fly ash paper pulp, municipal solid waste power plant solid waste saw this are all to be used in concrete to develop the strength of concrete on the other hand the world is much interested innovative production of alternative materials in large in the presence project on was upto 56 days durability test was conducted on normal cured specimens for 28 days continues immersion in NACL solution for the results. It shows that the present manufactured aggregates.

JayalakshmiSasidharan Nair And BasilJohny (2016) [6] Concrete is playing of significant of growth infrastructural and industrial segment and many decades. the base of this research is to findout the effects of use of artificial aggregate in concrete is various different between fresh and hardened properties of concrete. The study of ground granulated blast furnace slag (ggbs) and recycled concrete aggregate . The concrete mix grade M40. Mixes were prepared by replacing 40, 50 & 60 % of natural aggregates with ggbs together with 50 % replacement of recycled aggregate adequate strength compared to control mix.

S. Viveka&R.Renuka(2016) [20] Granite aggregate and river sand are the vital elements in concrete and its extensive use results in destruction of hilly reason of geological and environmental factors. Manufacturing process of coal in thermal power plant which making the byproduct of fly ash. it can be used for making artificial aggregates it approach to be made with 100% replacement of aggregate by fly ash aggregates in the various proportion of cement and fly ash ratio of 10; 90, 15:85, 20:80 and 25:75 were tried to get fly ash aggregate it found to be 25:75 the concrete cubes, cylinder and prisms are casted with the replacement fly ash aggregate the test compare to natural aggregate.

Prasannakumar et al (2016) [16] the materials of GGBFS from the steel plant of iron ore while production of artificial aggregate. In this project use in of concrete either GGBS as a aggregates by mean of its artificial aggregates production. The artificial aggregates GGBS aggregate gives improve the crushing value is 24% and artificial aggregate impact value of 31%. The mechanical and physical properties for concrete of M20 grade made with different percentage of replacement of natural aggregate by GGBS aggregate up to 40%.

Sayied R zedan, et al (2015) [21] Microscopy (SEM) and the results were compared with The key point of this investigation is to study the effect of demolition, building waste mateirls for physica,- chemistry and mechanical properties of alkali activated slag (AAS) hydroxide liquid sodium silicate(NaoH:Nasio) ratio by weight of GGBFS was replacement by 10%wt. red clay brick and concrete wastes (CW,RCBW and CoW) the results showed that significant shorter setting times were observed when AAS was replaced by CW RCBW or CoW the AAS –CoW showed the shortest setting times compared to other all mixes the Fe o present in waste played an important role on the development of compressive strength the hydration products were we are using x-rays of diffraction and Fourier transform infrared investigated using x-rays diffraction (XRD) Fourier transform infrared (FTIR) to determine the compressive strength.

K.L Ravisankar et al (2015) [7] Aggregate is most widely used in reinforcement concrete construction. Then the cement and fly proportion of 25:75, 27.5:72.5, 30:70, 32.5:67.5, 35:65 and 37.5:62.5 were adapted to artificial fly ash aggregate. the normal and fly ash aggregate concrete cube specimens were tested for 1,3,7,14,28days the results were tabulated based on the results obtained conclusions and suggestion were made.

V.Anandabaskaran et al (2015) [23] The increase demand for producing durable construction materials is the outcome of the fast pollution environment. Due to its high pozzolanic activity both strength and durability of concrete are enriched. Hence there is a need for the production of artificial aggregate which meets present requirement of the construction industry. Weight loss and reduction in strength was monitored up to 56 days and durability test was conducted on normal cured specimen for 28days continuous immersion in NACL solution from the results it show that the present manufactured aggregate

NitendraPalankar et al (2015) [13] in this project binder materials to ordinary Portland cement due to some amount of green house gases combined with production opc. GGBFS-FA geopolymer of concrete with steel slag coarse aggregate are prepared by recycling the natural granite aggregate at different percentage replacement of 0%, 25%,50%,75% and 100% of physical and mechanic properties. The water absorption and quantity of geopolymer concrete is mixes containing steel slag as compared to granite aggregate the test value should be estimated.. the test for steel slag is structural and pavement application is developing new construction material.

Ahmed S.Ouda (2015) [2] in this project nuclear power plant they having two major components like primary and secondary structure. The concrete of structures are mainly focused on radiological protection, structural integrity and durability etc. The aggregate properties of physical, chemical and mechanical should be evaluated in concrete is consider the affect of properties the coarse aggregates of barite magnetite goethite and serpentine along with 10% silica fume 20% fly ash and ground granulated blast furnace the high performance concrete incorporating magnetite as a fine aggregate the shielding efficiency against gamma rays

ParthaSarathi Deb (2015) [14] The slag of ggbfs with low calcium ash is early strength will be increase of geo polymer concrete mixture in which class of fly ash is replaced with 10 % and 20% ggbfs and sodium silicate to sodium hydroxide ratio either 1:5 or 2:5 shrinkage of 4 geopolymer and opc concrete dried in room temperature of the shrinkage of geo polymer concrete up to 180 days was found to be comparable to that opc concrete of compressive strength to values within the limit recommended in the Australian standards for normal opc concrete

Francesco colangelo and raffaelecioffi (2013) [4] ggbfs and marble powder they collected and making of cold bonding pelletize process for production of artificial aggregate. Which is influence of for slag reactivity should be evaluated in two CAO and sulfates. 18 types of granular they employed in concrete production process were normal aggregates substituted in artificial aggregates to obtained the suitable for cold bonding pelletization process in artificial aggregates production.

MC Nataraj et al (2013) [9] The granulated blast furnace slag as a sand mixed with in cement mortar to reduce weather problems

related to aggregate properties and waste by product materials should be used in cement mortar mix 1:3 ratio and ggbfs at 0,25,50,75&100% replacement to natural sand with ggbfs for w/c ratio of 0.4and0.6 the flow properties of different mixes of their compressive strength are studied the ggbfs could be used in partially as another construction material for natural sand in mortar application of adding to the suitable % of super plasticizer..

KG Hiraskar and Chetanpatil (2013) [8] The waste material of small percentage of used to ggbfs used in industries for manufacture cement in the present investigation blast furnace slag from local industries has utilized to find its suitability as a coarse aggregates with slag to avoid environmental effect and cause neglible degradation in compressive strength of ggbfs is compare to conventional normal aggregates is high of 90 days of strength. it has also reduced water absorption and porosity beyond 28 days in comparison to concrete with stone chips used as coarse aggregate.

Harilal.b and Job Thomas (2013) [5] The aggregate are manufactured through polarization method in different proportion of fly ash and quarry dust with ordinary Portland cement as binder three types of artificial aggregate shows that have different strength characteristics the tests carried out in concrete are porosity compaction factor and compressive strength of 28 days for w/c ratio of the quantity is 0,35,0.45,0.55 and 0.65 the result indicate that the usage of above aggregate in concrete is an alternative for natural aggregate in concrete industry and future practice in concrete also reduce the environmental impact.

Mohdshariq et al (2013) [12] The result of experimental investigation into the time dependent ultra sonic pulse velocity of concrete contain ggbfs was determined at the age of 180 days twelve concrete mixes using the prism specimens of plains and ggbfs was varied from20%to60% relationship between cube and cylinder compressive strength and for ggbfs based concrete has been presented.

Priyadharshini.P et al (2011) [17] Is mainly focused by partially replacement of cement and fly ash. production of artificial aggregate to be used fly ash react with concrete to reduce the environmental pollutions. The natural resources of artificial aggregates is production of pelltization method taken away of the fresh aggregates dry in room temperature. The curing has been done in cold bonded technique that to be used as an aggregate replacement materials in concrete. The strength of 28 days reduces the compressive strength.

Table 1: Materials, Types of Testing and Experimental Results

S.No	Title	Author	Specimen	Types Of Testing	Result
1	Green Concrete Using Ggbfs River Pebble And Crf As Partial Replacement To Cement And Aggregates	Pramodini Naik Gaonkar (2016)	Cube Size (150x150x150) Grade M25	Compressive Test	Workability Of Concrete Mixes Increase With The Increase In Percentage Of River Pebbles This Is Mainly Because Of Smooth Surface And Round Shape Of River Pebbles
2	Behavior Of Artificial Aggregate Incorporating with waste product.	Srinivasan.K (2016)	Beam Size (1000x150x150) Grade M20	Crushing And Impact Testing	The Study of Artificial Aggregate to be Prepared without machines. The techniques of making aggregates are Cold Bonding Technique. The light weight aggregates of properties which is compared to normal aggregates
3	Study Of Strength Characteristics Of Fly Ash Aggregate In Light Weight Concrete	S. Viveka (2016)	Cubes 15cmx15cmx15cm Grade M25	Compression Test Split Tension Test	From The Experiments Study The Best Cement Fly Ash Ratio For Fly Ash Aggregate Production Obtained From The Testing Of Physical Properties 25:75 It Can Found That The 30% Replacement In Coarse And 100% Fine Aggregate Gives Better Strength Results
4	Study Of Properties Of Concrete Using Ggbs And Recycled Concrete Aggregates	Jayalakshmi (2016)	Cubes (150x150x150mm) Grade M40	Slump Test, Compaction Factor Test	From The Study Conducted It Shows That Replacement Of Coarse And Fine Aggregate And Cement Gives A Satisfactory Strength
5	Some Physical And Mechanical Properties Of Concrete Made From Partial Replacement Of Natural Aggregate With Artificially Manufactured Aggregates Using Ground Granulated blast Furnace	Prasanna Kumar(2016)	Cube (100x100x100mm) Grade M25	Compressive Strength, Pull Out test	Concrete With Partial Replacement of Natural Aggregate then get Same Strength
6	Experiment study On Eco Friendly Concrete Incorporating Industrial Waste Aggregate	Nitendra Palankar (2015)	Cube(100x100x100mm) Cylinder (Diax300mm) Prism(100x100x500mm) Grade M25	Compressive Strength	The In Corporating Of Steel Slag used in Coarse Aggregate In Ggbfs and Geo Polymer Mixes Slightly Lower strength.
7	Studies On Manufacture Of Artificial Aggregates In Cooperating Fly Ash, Rice Husk And Iron Ore Dust	V.Logeshwaran (2015)	Cube (150x150x150mm) Grade M 25	Compressive Strength	30% of compressive strength of Artificial Aggregate Concrete which is compared to normal aggregate of concrete is less.
8	Experimental Study Of Artificial Fly Ash Aggregate Concrete	K.L Ravishankar (2015)	Prism Size(10x10x50cm) Cube(15x15x15cm) Grade M43	Compressive Strength	Which compare to The Compressive Strength Fly Ash Aggregate Concrete. Fly Ash mix Proportion 30:70 Showed High Compressive Strength Than Control Concrete At All Ages Of Concrete
9	Concrete Made Using Cold Bonded Artificial Aggregate	Harilal.B (2013)	Cube Size(100x100x100cm) Grade M25	Compressive Strength	The Fly Ash Aggregate Concrete Shows Less Amount Of Water Absorption Than Other Two Types Aggregate This Indicate That The Dense Packing Of Fly Ash Particles In The Aggregate
10	Study of ggbfs as replacement of Fine Aggregate In Cement Mortar	Mc Nataraja (2013)	Mortar Cubes Size(70.7x70.7x70.7cm) Grade M43	Compressive Strength Of Cubes Mortar	The low percentage of flow for 25%. And also for Higher Percentages. The Flow will be Decrease Substantially
11	Materials of used Of Blast Furnace Slag Aggregate In Concrete	Kg Hiraskar (2013)	Cube Size(150mmx150mmx150mm) Beam Size (100x100x500mm3) Grade M30	Flexural Strength	The Results of this paper Properties of materials Similar To Natural Aggregate And no cause of Incorporated In To Concrete
12	Marble Powder And Ggbfs Used In The Manufacture Of Sustainable Artificial Aggregate By Mean Of Cold Bonding	Francesco Colangelo (2013)	Cube Size(10x10mm)	Compressive Strength	Experimental Results in the paper And Previous journal Of results also will be same.

3. Conclusion

Based on the study, following conclusion are arrived at the artificial aggregate provides an alternate source for natural aggregate. Artificial aggregate are made by using petllization method, for different proportion of cement and waste material. The properties of light weight aggregates are mainly based on its source of materials. But each and every material having different properties and usage are in construction industry. Waste materials is utilize in construction work must be taken up covering various aspects at different percentage to minimize the environmental pollution, depletion natural resources constructions and growing cost of the construction and are more economical sources compare to light weight aggregate used in concrete.

References

[1] Aanchuajaya K & Jaseelak H, "Feasibility study of electric arc furnace slag as fine aggregate in ggbs incorporated concrete", *International Journal of Advance Research and Innovative Ideas in Education (IJARIIE)*, Vol.2, (2017), pp.24 – 31.

[2] Ouda AS, "Development of high-performance heavy density concrete using different aggregates for gamma-ray shielding", *Progress in Nuclear Energy*, Vol.79, (2015), 48-55.

[3] Baskaran P, Karthickkumar M, Krishnamoorthy N, Saravanan P, Hemathnaveenk S & Vinothan KG, "Partially replacement of fine aggregate with GGBS", *International journal of civil engineering (SSRG-IJCE)*, Vol.4, (2017), pp.49 – 56.

[4] Francesco C & Raffaele C, "Use of Cement Kiln Dust, Blast Furnace Slag and Marble Sludge in the Manufacture of Sustainable Artificial Aggregates by Means of Cold Bonding Pelletization", *Materials Issn Journel*, (2013), pp.34139 – 3159.

[5] Harilal B & Job T, "Concrete made using cold bonded artificial aggregate", *American journal of engineering research (AJER)*, Vol.1, (2012), pp.20-25.

[6] Jayalakshmi SN & Basil J, "Study of Properties of Concrete using GGBS and Recycled Concrete Aggregates", *International Journal of Engineering Research & Technology (IJERT)*, Vol.5, (2016), pp.160 – 166.

[7] Ravisankar K, Gowtham SK & Raghavan TR, "Experimental study on artificial fly ash aggregate concrete", *International Journal of Innovative Research in Science, Engineering*, Vol.4, (2015), pp.11124 – 11132.

[8] Hiraskar KG & Chetan P, "Use of Blast Furnace Slag Aggregate in Concrete", *International Journal of Scientific & Engineering Research*, Vol.4, (2013), pp.95 – 98.

[9] Nataraja MC, Dileep Kumar PG, Manu AS & Sanjay MC, "Use of granulated blast furnace slag as fine aggregate in cement mortar", *International journal and structural and structural research*, Vol.2, (2013), pp.59 – 68.

[10] Pavan Kumar M & Mahesh Y, "The Behaviour of Concrete by Partial Replacement of Fine Aggregate with Copper Slag and Cement with GGBS", *IOSR Journal of Mechanical and Civil Engineering*, Vol.12, (2012), pp.51 – 56.

[11] Narendra MD & Gangha G, "An experimental study on high performance concrete partially replacing cement and fine aggregate with GGBS & ROBO sand", *International Journal of Engineering Sciences & Emerging Technologies*, Vol.7, (2015), pp.737-742.

[12] Shariq M, Prasad J & Masood A, "Studies in ultrasonic pulse velocity of concrete containing GGBFS", *Construction and Building Materials*, Vol.40, (2013), pp.944-950.

[13] Palankar N, Shankar AR & Mithun BM, "Studies on eco-friendly concrete incorporating industrial waste as aggregates", *International Journal of Sustainable Built Environment*, Vol.4, No.2, (2015), pp.378-390.

[14] Deb PS, Nath P & Sarker PK, "Drying shrinkage of slag blended fly ash geopolymer concrete cured at room temperature", *Procedia Engineering*, Vol.125, (2015), pp.594-600.

[15] Pramodininaikgaonkar. "Green concrete using GGBFS, river pebbles and CRF as partial replacement to cement and aggregates", *International journal of engineering research*, Vol.5, (2016), pp.129 – 133.

[16] Prasannakumar P, Suhas S, Ravikumar D, Roopa S, Keshavmurthy MS & Shivamagarwa, "Some physical and mechanical properties of concrete made from partial replacement of natural aggregates with artificially manufactured aggregates using ground granulated blast furnace slag", *International journal of research in engineering and technology*, Vol.5, (2016), pp.47 – 52.

[17] Priyadharshini P, Mohan G & Santhi AS, "Experimental study on cold bonded fly ash aggregates", *International journal of civil and structural engineering*, Vol.2, (2011), pp.493 – 501.

[18] Siddique R & Kaur D, "Properties of concrete containing ground granulated blast furnace slag (GGBFS) at elevated temperatures", *Journal of Advanced Research*, Vol.3, No.1, (2012), pp.45-51.

[19] Muralikrishnan S & Felixkala T, "Flexural behaviour of concrete using m30 & m60 grade", *International journal of control theory and applications*, Vol.10, (2017), pp.343 – 348.

[20] Viveka S & Renuka R, "Study of strength characteristics of fly ash aggregates in light weight Concrete", *International journal of innovations in engineering and technology*, Vol.6, (2016), pp.331-334.

[21] Sayieda RZ, Maha RM, Doaa AA & Aya HM, "Effect of demolition/construction wastes on the properties of alkali activated slag cement", *Housing and Building National Research Center HBRC Journal*, Vol.1, (2015), pp.1 – 6.

[22] Srinivasan K, Mutharasi M, Vaishnavi R, Sajinmohan and Logeswaran V, "An experimental study on manufacture of artificial aggregates incorporating fly ash, rice husk ash and iron ore dust", *International journal of science, engineering and technology research (IJSETR)*, Vol.5, (2016), pp.163 – 168.

[23] Logeswaran V, Dr.Ramakrishna G & Anandabaskaran V, "Studies on manufacture of artificial aggregates incorporating fly ash, rice husk ash and iron ore dust", *Singaporean journal of scientific research (SJSR) issue of international journal of applied sciences*. Vol.7, (2015), pp.392 – 405.