IOSR Journal of Engineering (IOSR JEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 84-91

A Critical Review on Green and Sustainable Concrete Reusing Various Dismentled Building Waste Materials

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Abstract: *Real estate is growing very rapidly worldwide and this field requires various construction materials most out of which the concrete as the core material. In manufacturing of concrete number of natural resources are employed creating an issue to environment. The consumption of Ordinary Portland Cement causes severe pollutions to the environment mainly due to emission of CO_2. Ponderable efforts have been made all over the world for utilizing the locally available natural wastes and by product materials as supplementary cementing materials in cement concrete to improve its properties. The utilization of these waste materials leads to the proper disposal and lesser environmental effect. Flyash, Ground Granulated Blast Furnace Slag, Silica fume, Rice husk ash, waste glass and marble powder is such by products. This paper reviews the effects of using different waste materials in the production on concrete. Using such materials it is known that these waste materials have cementitious properties. Recycling and reuse of various waste materials as byproducts from various industries and also the dismantled building waste materials is now a days becoming very essential so as to protect our environment from different issues. So it is an urgent to develop a green and sustainable concrete. Researchers are getting attracted towards this area of research. This paper scrutinizes some research articles and inventors logics with some innovatory techniques with advantages and disadvantages. Utilization of waste materials will not only help in making the pollution free environment, not only beneficial to the civil engineering industry making low cost construction, not only revalue to the waste, not only solving the disposal problem of dismantled building materials requiring lot of area and consuming lot of agricultural land but also it will help the society in solid management to a great extent.*

Keywords: *Fly ash, GGBS, Silica Fume, waste materials, pozzolona etc.*
Themes Covered: *Green Concrete, Environmental Pollution Control, Solid Waste Management*

I. Introduction

Concrete is an important building material in construction industry. It is a homogenous mixture of cement, fine aggregates and coarse an aggregate along with water, the strength of concrete is depends upon the cement content. The huge amount of production of Portland cement and the acquisition of aggregates from dredging and quarrying have a dramatic impact on the environment. Consequently extensive research is ongoing into the use of Portland cement replacements replacement using many waste materials and industrial by products. The use of industrial and agricultural by product such as Fly ash, Ceramic waste powder, Rice Husk Ash, Marble powder and Waste glass powder containing cementitious and pozzolanic properties may be used in addition or as a partial replacement of Portland cement or blended cement in concrete, depending on the properties of the materials and the desired effect on concrete. Supplementary cementitious materials are added to concrete as part of the total cementitious system is attaining enormous importance today, mainly on account of the improvements in the long-term durability of concrete combined with ecological benefits. Another waste material ceramic tile aggregate are also partially replaced with coarse aggregate because the tile aggregate are easy to obtain and their cost is cheaper than the natural aggregate. The use of these tile aggregates as partial replacement in coarse aggregate in concrete has also positive effect on the environment

II. Different Waste Materials

(2.1) Fly Ash

Fly ash, the most widely used supplementary cementitious material in concrete, is a byproduct of the combustion if pulverized coal in electric power generating plants. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the fuel gases reach the chimneys of coal-fired power plants, and together with bottom ash removed from the bottom of the furnace is in this case jointly known as coal ash. Depending upon the source and makeup of the coal being burned, the components of fly ash vary considerably, but all fly ash includes substantial amounts of silicon dioxide (SiO_2) (both amorphous and crystalline) and calcium oxide (CaO), both being endemic ingredients in many coal-bearing rock strata.In the past, fly ash was generally released into the atmosphere, but pollution control equipment mandated in recent decades now require that it be captured prior to release. In the US, fly ash is generally stored at coal power plants or placed in landfills. About 43% is recycled, often used as a pozzolana to produce hydraulic cement or hydraulic plaster or a partial replacement for Portland cement in concrete production.

(2.2) Rice Husk Ash

Rice milling generates a by product know as husk . This surrounds the paddy grain. During milling of paddy about 78 % of weight is received as rice , broken rice and bran .Rest 22 % of the weight of paddy is received as husk . This husk is used as fuel in the rice mills to generate steam for the parboiling process . This husk contains about 75 % organic volatile matter and the balance 25 % of the weight of this husk is converted into ash during the firing process is known as rice husk ash (RHA).

(2.3) Glass Powder

This glass powder was prepared from transparent glass waste. It was grounded and then passed through the sieve of 0.6 mm (N°30) where more than 95% passed through the sieve of 0.25 mm (N°60). The physical and mechanical tests gave a value of 2,500 kg/m^3 of specific density and 2,850 cm^2/g for the specific surface area; the value of the dry internal angle was varied between 24° and 26° and 18° to 20° for the saturated friction angle. The chemical composition analysis gave a value of 65% by weight of SiO_2 and 15% for the sum of CaO and Na_2O.

(2.4) Marble powder

Marble is one of the most important materials used in buildings since ancient times, especially for decorative purposes. However its powder has bad effects on the environment, soil, water and health problems. Marble powder is produced from processing plants sawing and polishing of marble blocks. Some factories have water recycling plants containing flocculation tank and filter press unit. About 25% of the processed marble is turn into dust or powder form. About 7,000,000 tons of marble have been produced in the world. Disposal of the marble powder material of the marble industry is one of the environmental problems worldwide today.

(2.5) Ceramic Waste Powder

Ceramic wall tiles are used as building material in the field of construction. Manufacturing of ceramic tiles require different raw material like clay, potash, dolomite, feldspar, talc and different chemicals like sodium silicate, sodium tripoly, phosphate (STPP) in ceramic production. The temperature in the kiln varies from 200.c to 1200.c.this variation of manufacturing; therefore there is a pozzolanic reactivity in such material.In ceramic industry about 5-10% production goes as waste in various processes while manufacturing (this waste percentage goes down if the technology is installed in new units.) this waste of ceramic industries dumped at nearby places resulting in environmental pollution causing effect to habitant and agricultural lands. Therefore using of ceramic waste powder in concrete would benefit in many ways in saving energy & protecting the environment

(2.6) Ceramic Tile Aggregate:

Ceramic Tile Aggregate are crushed uniformly to about 20mm size manually using hammer and sieved through 20mm IS: Sieve.

III. Review of Literature

The following suggestions can be drawn from the various consolidated literature review:

Ravande et al in their research studied the replacement of cement by RHA in concrete increases, the workability of concrete decreases by 27% slump and 9% compaction factor. Replacement of cement with Rice Husk Ash leads to decrease in the compressive strength improved the workability and achieved the target strength at 10% replacement for both the grades of concrete. The rate of increase with age of concrete was good for the replacement levels and was on par with the conventional cases at early ages. The optimum replacement level of Rice Husk Ash is found to be to10% for both M40 and M50 grades of concrete [3].

Krishna et al investigated suitability of rice husk ash as a cementitious material was assessed by conducting the physiochemical analysis of the ingredients and the influence of RHA on concrete properties (fresh state and hardened state). From the chemical analysis conducted on RHA it was found that it contains nearly 80% silica. To assess the fresh stage properties, the workability values in terms of Slump (mm), Vee – Bee Degrees (sec.) and compaction factor for varying RHA percentage of concrete mix at a temperature of 32 C were carried out and the results were analyzed. Hardened properties like compressive strength, split tensile strength and flexural strength properties were evaluated. To check the efficiency of sample in terms of water absorption, a water absorption study was conducted. From the experimental investigation it was found that optimum replacement of Rice Husk ash in cement was near to 10% in terms of workability and strength. The usage of Rice husk ash in concrete as a replacement for cement can decrease the emission of green-house gases to a larger extent which automatically increases the possibility for gaining more number of carbon credits [31] .

Syed Mehdi abbas et al. in their research all the cement replacement levels of Rice husk ash, the rate of development of compressive strength up to 28 days is slower as compared with that of concrete in which RHA content is zero, while the rate of development of strength gradually increases after 28 days up to 56 days in case of RHA mixed concrete. The compressive strength of concrete having 10% replacement was found to be more than the other levels of replacements. (i.e. 0%, 5%, & 15%). The study shows that the compressive strength of concrete is optimal by replacing OPC by 10% of PFA with RHA keeping total binder content same. For the desired workability and strength, the water content required in case of RHA mixed concrete was more than in normal concrete. This is because RHA is finer than cement & the fact is that RHA particles being finer it has more surface area and hence water required is comparatively more [22].

Seyed Alireza Zareei et al in their investigation shows the mixtures with 25% RHA showed the lowest ratios of water absorption by about 4.8% at 7 days and 3% at 28 days of cuing respectively.The performance of rice husk ash in concrete is of factors influencing the amount of silica added. This is because rice husk ash contains 85% to 95% weight percent of amorphous silica. Rice husk ash as a pozzolanic reactive material can be used to improve surface area of transition zone between the microscopic structure of cement paste and aggregate in the high-performance concrete. Increase of 6.9% compressive strength at 7 days, and 6.8% at 28 days were obtained with increase in containment of RHA up to 25%, but the results are likely to be contrasted by more ratios of replacements. The same trend was observed for the tensile strength most increased up to 6.8% RHA, and then it tends to be decreased. In the case of compressive strength and chloride permeation properties, standard practice of curing for 28 days is found to be adequate. Replacement with 25% rice hush ash result in drastic enhancement of the permeability properties of blended concrete compared to that of in ordinary concrete, such that cause Leads to 26% reduction in water permeability.Leads to 78% reduction in chloride permeation [27] .

Godwin investigated the effects of introducing Rice Husk Ash(RHA) as a Partial Replacement of Ordinary Portland Cement (OPC) on the structural properties of concrete. Rice Husk Ash which is an Agro-Waste and known to be a Super Pozzolana have been used for mass concrete and found to have compressive strength ranging from 33-38.4N/mm^{2}atreplacement percentages of 10-25% in a mix of 1:1.5:3. A further study was carried out on its flexural properties to determine their moduli of rupture as well as its tensile strength characteristics for the determination of cracking, the values obtained at 28days are 3, 2.5 and 2.4N/mm^2 while the tensile strength values are 1.94, 1.17 and 0.91N/mm2 at replacement percentages of 10%, 20% and25%. This research has proved that RHA Concrete can be used as a Structural Concrete at suitable replacement percentages [4].

Gautam Singh et al. in their study conventional M20 shown the compresive strength 28.88 N/mm2. Replacement of glass powder with 5%, 10%, 15%, and 20% of sand- Decrease the value of construction cost by 20% to 31% in the compare of conventional mix of M25, M30 and M35. Increase the value of compressive strength a by 20.22%, 30.12%, 43.39%, 49.22% respectively. Decrease the value of unit weight of concrete by 0.16%, 0.36%, 0.48%, 0.76% respectively. Increase the alkalinity property of concrete by 0.79%, 2.20%, 3.65%, 4.47% respectively. Decrease in the value of slump[14] .

Edson jansen et al. in their study, the compressive strength of Portland cement concrete was found to increase in response to the use of waste flat glass powder, which has so far not been used as fine aggregate. The concrete containing flat glass powder was found to be suitable for structural applications when prepared with a w/c ratio of 0.55 and waste glass content of 20%, and with a w/c ratio of 0.50, regardless of the percentage of glass used. The w/c ratio of 0.50 showed the best potential when substituting sand for waste glass. The results of the ANOVA analysis confirmed the significant influence of the w/c ratio and percentage of waste glass on the compressive strength of concrete cured for 7, 14 and 28 days. In addition, it was found that the compressive strength of the concrete was more influenced by the w/c ratio than by the percentage of waste glass in substitution of sand [15].

Vijaya S Reddy et al in their research 20% replacement of fine aggregates by waste glass showed 35% increase in compressive strength at 7 days and 30% increase in compressive strength at 28 days. Fine aggregates can be replaced by waste glass up to 30% by weight showing 8.5% increase in compressive strength at 28 days. With increase in waste glass content, percentage water absorption decreases. With increase in waste glass content, average weight decreases by 5% for mixture with 30% waste glass content thus making waste glass concrete light weight. Workability of concrete mix increases with increase in waste glass content [16].

Sayisetti Rajaiah et al. in their research on addition of GLP initial the rate of gain of strength is low but at 28th day it meets required design strength. Addition of GLP increases the strength of concrete. At the level of 20% replacement of cement by glass powder meets maximum strength as compare to that of normal concrete and other percentage of replacement of cement. As the size of GLP particle decreases in concrete the strength of concrete increases. From results it is conclude that particle size less than 90 micron get higher strength than that of particle size ranges from 90 to 150 micron [23].

Patil examined the effect of Fly ash on concrete, It can be seen that 0% fly ash i.e. concrete with no replacement of cement with fly ash, has maximum rate of compressive strength development at 60 days and after it becomes nearly constant. 5% fly ash has maximum rate of compressive strength development up to the age of 21 days and then after its rate decreases. Strength development at later stage is negligible. The rate of strength development is large upto 21 days for 10% fly ash and then after its rate becomes negligible for few days and after 28 days it increases uniformly. It also tells us about the properties of concrete like consistency of cement has increased with the addition of fly ash from 32% for 0% fly for 50% fly ash. It may be attributed to the increased specific surface area of cement – fly ash blend due to finer particles of the later. The initial setting time (IST) has increased from 155 minutes for 0% fly ash to 250 minutes for 50% fly ash [5].

Tomas U. Ganiron Jr. in their investigation reported in this paper the physical, chemical and mechanical properties of fly ash cement concrete for road construction. Research has shown that 30% of fly ash and 70% of cement has a superior performance. Characteristics compared to the standard requirements conformable code. Moreover, the use of fly ash would result in reduction of the cost of materials in construction and the reduction of greenhouse gas emission. High strength of concrete can be made and the incorporation of admixture or substitute to improve the properties of concrete. Test result of specimens indicates the workability, and bonding strength of properties, and different reaction when the water ratio a change its content. Slump test having an appropriate workable mixing the slump of a concrete, gave sufficient compressive strength. Test results of 14 days specimens having different results but it only treated when it downs to minimum level of required conformable code [6]. Serkan Subası in his study, the effect of using fly ash in high strength lightweight aggregate concrete produced with expanded clay aggregate on physical and mechanical properties of the concrete was investigated. Forthis purpose, lightweight concrete mixtures with 350, 400 and 450 kg/m3 cement content were prepared using expanded clay aggregate. Besides, concretes with 0, 10, 20 and 30% fly ash replacement wereproduced out of the mixtures with different cement contents. Concrete density, porosity, ultrasonicpulse velocity, compressive and split tensile strength experiments were performed on the preparedsamples. As a result, it was seen that it is possible to produce high strength lightweight concrete usingexpanded clay aggregate; the cement content with 450 kg/m3 among concrete mixtures had the highest strength values; mechanical properties of concrete could be enhanced by using 10% fly ash; thus a saving in cement amount could be achieved [1] .

Vinod Goud et al. in their research work the study of the effect of fly ash on the properties of concrete‖ for nominal mix of M25 grade of concrete are as follows Slump loss of concrete increases with increase in w/c ratio of concrete, For w/c ratio 0.35 without any admixtures, initial slump cannot be measured by slump cone test as it is very less. Ultimate compressive strength of concrete decreasing with increase in w/c ratio of concrete.Slump loss of concrete goes on increasing with increase of quantity of fly ash. The 10% and 20% replacement of cement with fly ash shows good compressive strength for 28 days. and the 30% replacement of cement with fly ash ultimate compressive strength of concrete decreases [26] .

Pofale & Deo with their study indicated about 20% increase in compressive strength and about 15% increase in flexural strength of concrete over control concrete by replacing 27% of sand with low lime fly ash. In study fly ash based Portland pozzolana cement was used. They had also reported about 25% increase in workability of the fly ash based concrete over control concrete [2] .

Aalok D. Sakalkale et al in their research the compressive strength of concrete is increased with addition of waste marble powder up to 50% by weight in place of sand and further any addition of waste marble powder the compressive strength decreases. The split tensile strength of cylinders is decreased with addition of waste marble powder, from control mix to 100% replacement of sand. However, the tensile strength at 25% replacement of sand is coming nearly equal to the tensile strength at control mix. Thus, 25% sand replacement with WMD can also give better tensile strength. The flexural strength of beams is also increased with addition of waste marble powder up to 50% sand replacement and then gradually decreases. Thus, we found out the optimum percentage for replacement of sand with marble powder in concrete is almost 50% [13].

Gulden Cagin Ulubeylia et al. in their study, using of waste marble in the conventional concrete as binder or fine/coarse aggregate was positively affected on properties of hardened concrete. Whereas in self-compacting concrete, increasing of waste marble replacement ratios in the concrete were decreased the mechanical properties of concrete. Same declining trend of hardened properties of concrete was also determined in the polymer concrete Consequently, it was concluded that replacement of waste marble with cement or aggregate in conventional concrete was improved properties of hardened concrete. But, using of waste marble in self-compacting or polymer concrete was not affected positively on the properties of hardened concrete [21] .

Sonu Pal Amit Singh et al in their study the Compressive strength of Concrete increases up to 10% replacement of cement by marble dust powder and further− increasing of percentage of marble dust powder leads to decrease in compressive strength of concrete. The addition of marble dust powder (10% by weight of cement) into the concrete improved its compressive strength by 8.54 % and 12.84 % respectively at 7 & 28 days. The split tensile strength of concrete increases up to 10% replacement of cement by marble waste powder. The split tensile– strength of concrete improved by 15.55 % and 17.95 % for M20 grade concrete (10% by weight of cement) respectively after 7 & 28 days. Thus we found out the optimum percentage for replacement of marble dust powder with cement and it is almost 10% cement– for both cubes and cylinders [25].

Jay N. Bhanushali in their study the maximum compressive strength obtained was at 14% marble powder replacement for cement. Workability of concrete was reduced due to large surface area of waste marble powder. Durability parameters of marble powder showed improvement which makes it suitable as an additive in concrete. Extreme value against acid attacks was obtained when cement Is replacement with marble dust powder at 3.5%. Standard consistency is found to reduce where as initial and final setting times increase but not very significantly. This is good for proper setting of concrete as initial setting time should be sufficiently long for the transportation and placing of concrete. 5% replacement of cement with marble waste powder led to an increase of about 4% in the compressive strength. The compressive strength reduction of specimens subjected to the sulphuric acid test decreased with the increase of marble waste powder and silica fume contents. The permeability of the concrete increases with the increase in percentage of replacement of natural coarse aggregate by marble aggregate. This is mainly due to presence of pores in the concrete. it can be said that the strength and durability of concrete with marble waste powder tended to decline for replacement ratios of more than 10%. Satisfactory results were obtained for replacement ratios of marble waste powder up to 10% [30].

A.M. Mustafa Al Bakri1 et al They have investigated the strength of concrete with ceramic waste as replacement of coarse aggregate in concrete. The sources of ceramic waste are obtained from the industrial in Malaysia. Presently, in ceramics industries the production goes as waste, which is not undergoing the recycle process yet. The potential of recycled ceramic waste as a substitute for coarse aggregates in concrete has been investigated. The recycle ceramic waste as aggregate was used. Concrete mixes with a 28 days characteristic strength of 20 MPa had prepared using water/cement ratio of 0.4, 0.5 and 0.7. The strength development of the concrete mixes containing recycled ceramic waste aggregates was compared to that of conventional concrete. They have resulted that the concrete mixes containing recycled ceramic waste aggregates achieve strength levels between 80 to 95 % compared to the conventional concrete. They have concluded that ceramic waste can be effectively replaced partially by cement in concrete [8].

A.V.S. Sai. Kumar and Krishna Rao B They have investigated the effect of strength of concrete with partial replacement of cement with quarry dust and Metakaolin. They have stated that concrete is a composite material made from cement, water, fine aggregate and coarse aggregate. But present researchers are in interest of finding new cement materials by waste materials or waste products produced from industries which are harmful to environment. The paper is deals with partial replacement of cement with quarry dust and metakaolin which are having silica used as admixture for making concrete. They have investigated first quarry dust is made partial replacement of cement and found that 25% of partial replacement is beneficial to concrete without loss of standard strength of cement. They have made 25% partial replacement of cement with quarry dust as constant, 2.5%, 5.0%, 7.5%, 10.0%, 12.5% metakaolin was made in partial replacement of cement and they had founded that quarry dust and metakaolin can be used as a partial replacement of cement [12].

Vajje and Murthy studied the effect on concrete due to addition of the natural fibres. With the addition of natural fibres, slump decreases. More the fibre –cement ratio, more is the decrease in slump due to absorbency of water by fibres and about the strength part the addition of fibres increased compressive strength with 0.5% fibre-cement ratio and little increase for 1% of fibre-cement ratio compared to plain concrete, but at 1.5% of fibre cement ratio, through plasticizer is added, the compressive strength is decreasing compared to plain concrete [9].

Domke et al focused on the effect on concrete by using the combination of RHA and COIR fibres. It is observed that the RHA and COIR fibres have some properties by which after adding it in the concrete, will reduces the weight of concrete. It is also observed that 12.5%RHA+ 2%COIR gives maximum compressive strength, flexural strength shows maximum improvement at 20%RHA+COIR, As far as Rate Analysis, it shows that as the percentage of RHA and COIR increases ,the cost goes on decreases [10].

Ankur et al studied compressive strength and split tensile strength of concrete involving rice husk ash (RHA) and plastic fiber in different proportions. M-20 grade of concrete was taken for experimental study. RHA content was used from 5% to 15% at the interval of 5% by replacing Ordinary Portland Cement (O.P.C.) and plastic fibers were used from 1% to 3% at the interval of 1% by replacing the coarse aggregate. The compressive strength and split tensile strength of concrete was checked at 7 days and 28 days of curing period. The results show that concrete samples having 10% RHA and 2% plastic fibers showed 22% increase in compressive strength as compared to controlled concrete samples [20].

Wahyuni et al investigated the tensile strength of concrete with 0.50% addition of bamboo fibre based on cement weight. In this mixture of rice husk ash (RHA) and sea shell ash (SSA) was used as partial replacement of fine aggregate. The replacement is divided into four different percentages namely 10%, 20%,30% and 40% based on the weight of fine aggregate. The experimental work consisted of casting 13 different types of concrete tobe compared in term of splitting tensile strength at the age of 28 and 90 days. In general the tensile strength of bamboo fibre reinforced concrete is comparable to that of Normal Concrete. A few sample which decrease at the later age, the bigger picture shows the addition of rice husk ash, sea shell ash and bamboo fibre, increase the tensile strength of concrete. Tensile strength is higher than that of normal concrete by 26% at the age of 90 days [11].

D. Tavakoli et al investigated on the possibility of using ceramic tile in concrete. Coarse aggregate is replaced in the range of 0-40%. There is an increase in compressive strength by 5.13% whereas there is a decrease in slump, water absorption and unit weight by 10%, 0.1% and 2.29% respectively with 10% substitution [7].

M.Roobini et al determined the development strength of concrete with ceramic tiles as coarse aggregate. 20MPa characteristic strength concrete is used with water cement ratio of 0.5. The compressive strength and split tensile strength improved by 4.84% and 13.30% respectively at 20% replacement. Where as, flexure strength is best at 10% replacement which is 4.84% more than that of conventional concrete [17].

V. Giridhar et al experimented on concrete with ceramic waste as natural coarse aggreagate at 0%, 20%, 40%, 60%, 80% and 100%. M20 concrete is adopted. Maximum compression attained at 20% replacement reached 93.45% and 98.84% to that of conventional concrete. Similarly split tensile strength reaches 97.38% and 93.78% to that of conventional concrete at 7 and 28 days respectively [18].

H.G Shruthi et al determined the maximum compression strength is obtained when 30% of ceramic tile aggregate was replaced with coarse aggregate. The maximum split tensile strength is obtained when 30% of Ceramic tile aggregate was replaced with coarse aggregate. The compressive strength and split tensile strength for 10% and 20% replacement of CTA is not increased. There is little variation in the strength when compared with normal concrete. The optimum result is obtained for 30% replacement of CTA with coarse aggregate. By addition of ceramic tile aggregates into coarse aggregate, proper utilization of ceramic tile waste can be achieved. In case of combinations, the compressive strength is increasing for all the cases [24].

Agil . r and A. Kumar determined the most optimal dosage for the partial alternative of cement by ceramic tile powder is 15 %. The compressive strength of concrete decreases, when the addition of dosage is more than 15%.The results show if 20% replacement of cement by ceramic tile powder will affect the strength of concrete [28].

Hardik patel et al determined When only Ceramic Waste Powder is used in different varying percentage of cement (0% to 60%), compressive strength decrease from 0% to 39.7% respectively, When Ceramic Waste Powder & 1% sodium silicate of water is used in different varying percentage of cement (0% to 60%) compressive strength decreases from -1.3% to 38.3% respectively with compare to the conventional concrete and When Ceramic Waste Powder & 2% sodium silicate is used in different varying percentage of cement (0% to 60%) compressive strength -1.3% to 42% with respect to conventional concrete. Concrete on 30% replacement of cement with Ceramic Waste Powder compressive strength obtained is 33.44 N/mm2 (i.e., 30% CWP & 2% Na2SO4) can be recommended [19].

Kuldeepak diwedi determined The effect on the properties (28 Days compressive and split tensile strengths) of normal strength concrete with partial replacement of coarse aggregate by over burnt brick chips and demolished concrete waste, with water cement ratio of 0.40 is studied. The percentage replacement of coarse aggregate by over brick is varied from 10% to 50% while that for by demolished concrete waste is varied from 10% to 60 % at an interval of 5%. The compressive and split tensile strength of concrete up to 25% replacement of coarse aggregate by over burnt brick chips and that of up 35% replacement of demolished concrete waste reveals approximately same strength as compared to concrete made by conventional coarse aggregate. Although it is found that the compressive and tensile strength of conventional concrete is always higher for both the case (i.e. in case of over burnt brick chips and demolished concrete waste.) but up to 255 and 35% replacement of conventional coarse aggregate by over burnt brick chips and demolished concrete waste respectively the variation in these properties are very less. All the mixes of over burnt brick chips shows better performance in splitting tensile strength test as compared to demolished concrete waste mixes [29].

IV. Conclusion

On the basis of literature survey carried out, the suitability of using waste different types of industrial and agricultural by products such as Flyash, RHA, Waste marble powder and Glass powder in concrete has been explored. Due to the presence of pozzolanic and cementitious properties in such by products, these can be used in addition or as a partial replacement of Portland cement or blended cement in concrete. Also Portland cement production represents the majority of total CO_2 emissions of concrete so the use of pozzolans as cement replacement can allow major carbon dioxide reductions and also increase the service life of concrete structures. Further more in the case of waste pozzolans it also reduces the disposal areas. Wastes generated by industrial and agricultural processes have created disposal and management problems which pose serious challenges to efforts towards environmental conservation. From the study we also conclude that various types and percentages of industry by product materials can be used as complement in concrete to improve the strength and workability of concrete which can serve to reduce environmental waste, there preventing environmental pollution.

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