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"ENHANCEMENT OF STRUCTURE STRENGTH BYADDITIONOF POLYMER CONCRETE WITH STEEL BARSLAMINATED WITH FIBER STEELREINFORCEMENTRUBBERAND CRUSHED BRICKWALL WASTE"

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ABSTRACT

Global warming and environmental destruction are currently the most significant concern. Many people's perspectives have shifted because of the realisation that the industrial production of greenhouse gases have serious negative consequences for the climate. Currently, there is a movement towards a zero-emissions society, away from the wasteful, over- consumption, mass-production norms of the last several decades. They can achieve this while also lowering our environmental effect by recycling and repurposing industrial waste. Researchers argued that depletion of natural resources is a majorproblem in the world. Many previous studies argued that use of recycled waste in industrial activities can save natural resourcesfromdepletion. Further, concreteis usecommonly in constructionindustry, coarse (CA) andfineaggregate(FA)is a major and natural sources which are depleted. To save this various industrial waste can be used and mixed in concrete to improve its strength.Therefore, present paper aims to experimental study on strength properties of concrete by partial replacing coarse aggregate, with broken bricks, glass fibre, rubber tyre waste and fine aggregate by slag and lime kiln dust.

KEYWORDS: Coarse aggregate, with broken bricks, glass fibre, rubber tyre waste and fine aggregate by slag and limekiln dust.

I. INTRODUCTION

Concrete is one of the most important material which is commonly used in construction. Cement bind various ingredients in concrete. Further, these ingredients in concrete can be serious threat to sustainability. Nevertheless, the construction process is not suitable. This is due to the fact to make concrete various ingredients are used which are not sustainable. Cement does not contribute positively to the environment. In the manufacturing of cement, a lots of energy isconsumedandincreasedCO2emissions.About8percentof the carbon dioxide gas is emitted into the air as cement is being made. Depending on their physical and chemical properties, various solid wastes and by products can be utilized as aggregates or cement substitutes in concrete mixtures after proper treatment.

Use of crushed brick in construction industry is a major challenge. It can be used as an alternative of CA and can be used in concrete, it is crucial to conduct tests to categories the physical and mechanical characteristics of the material. The use of stone pits is severely limited due to environmental constraints, which include noise, dust, vibrations, and a significant impacton rural areas. Additionally, thepits consume non-renewable resources. Maximum of theaggregate recycled are naturally aggregates that are binned with cement in concrete.

The fundamental material of solid model concrete, sand and scraptire elastic areutilized conventional Portland cement can gave either by incorporating the foreordained amounts of Portland concrete this cement produce less heat of hydration and offer more prominent impervious to the sulfate assaultand chlorine Nation penetration because of debasements in water than the ordinary Portland Cement in the present investigation the old elastic from overwhelming vehicle, for example, truck tire was utilized. The cheeped elastic example was obtained by cutting tire physically. The piece tire elastic chips goingthrough the 20mmsieve measure were utilized in the examination.

Tire elastic Chips in a solid are uniquely proposed for solid structure situated in the zone of extreme seismic tremor chance. A typical tyre is composed of a variety of materials such as carbon black (24% to 28%), natural rubber (42% to 48%) and synthetic rubber (24% to 36%). The materials such as styrene butadiene rubber (SBR) and Butyl rubber (BR) are the two main component in the manufacturing of tyres.

However, in concrete old tyre rubber can be use data replacement of CA. Past studies have concluded that by replacing waste tyre rubber as a replacement of CA improve the properties of concrete. This cause concrete to be more flexible and durable. In other words, we can have

both astrong and flexible concrete surface thanks to the innovative incorporation of tire chips and crumb rubber.

Steel slag was discovered to be a highly effective material for road paving throughout the 20th century. The chemical composition of common waste material that shows potential for use in steel slag mostly consists of SiO2, Fe203, Al2O3, MnO, CaO, TiO2, MgO, and P205. Steel slag is highly regarded as a construction material for numerous projects due to its exceptional durability. Concrete is a commonly employed building material in the construction industry. For an extended period, it was regarded as a resilient substance that demanded minimal or no upkeep. Recent studies indicate that concrete is degraded when subjected to acid attack. Onthe other side, aggregates used in concrete are in great demand. There was some pushback from the construction industry about the use of secondary materials and industrial soil waste in cement and concrete production. Incorporating steel slag into cement concrete, however, has not been extensively studied.

Even though it produces good results, concrete is best mixed with a fine lime powder. Hence, hydraulic lime becomes the best type of lime to use in concrete. Limestone, a type of calcareous sedimentary rock that exists naturally because of shell build up at sea and lake bottoms, calcite and aragoniteare the common minerals which are found in limestone dust.

II. LITERATUREREVIEW

T.N.Durai and S. Kandasamy (2023)The study report utilised concrete with partial replacement of coarse aggregate by Polystyrene, namely M20 grade. Polystyrene with CA at various percentage of 5%, 10%, 15%, 20%, and 25% were tested in the trials. Traditional concrete was compared to the produced results. Coarse aggregates made from HDPE are utilised.Based on the findings, results indicate that polystyrene with CA enhance the performance of concrete.

Akshay Takle et.al (2022) replaced CA with crushed bricks. There are 38 different concrete samples, some of which includecrushedjhamabricksandotherswhichdonot.Various tests have beenperformed and concrete wastested at 7 and28 days after curing, respectively. Results revealed that 25% replacement of CA with crushed bricks give economic conditions. The results demonstrate that compared to conventional concrete, the aggregate used in jhama brick concrete achieved a lower strength.

Anjali P and Sajitha Beegom A (2022) replaced cement with steel slag and various tests haven been performed to determine its applicability. Also chemical activators was mixed to accelerate the chemical reactions between the various ingredients in concrete. Further, results revealed that 4% of chemical was found suitable and optimum percentage dosage. Additionally, at 4% dosage of chemical, the properties and strength increases.

Dr. S. R. Shahapur and Md Aadil (2022) The purpose of this study article was to examine the effects of adding steel fibres to both newly-mixed and previously-cured concrete. Because of their rough surface and huge pores, bats made ofoverburned brick are not ideal. In lieu of coarse aggregate, a varietyof percentages of over burned brick bats with a set 2% crimped steel fibre content are used, including15, 20, 25, and 30% replacement.
At 7,14, and 28 days after curing, M60 grade concrete was undergonevarioustestsandupto20%replacement,according to the results. After that, the strength decreased withincreasing OBB %. Making use of garbage and non- biodegradable trash, such as ash from burned-out buildings Aside from the obvious benefit of lowering building costs, using bricks in concrete mixes helps create environmentally friendly products that require less natural resources.

Jawad Ahmad et.al (2022) To determine the pros and cons of rubber tyres in relation to concrete performance, acompressive study is required. Consideration was given to the crucial aspects ofconcrete's freshness, durability, and strength qualities during the evaluation. Moreover, a microstructure examination and many treatments was incorporated.Due to variouspropertiesofrubber,concretepropertiesareimproved.
Ebenezer,J.Sheeba,etal.(2022)used10%to30%quicklime and a mixture of concrete was prepared. Results indicate that with increase in percentage of quick lime, compressive strength increases up to 120%. After that it is decreases. This is due to fact that with the addition of lime stone in concrete,it loses strength.

Sameeulah Bhat et.al (2022) investigated the effects on the mechanical and durability properties of concrete by adding cupola slag. Investigating fine aggregate that was supplemented with cupola slag in percentages of 10%, 20%, 30%, 50%, and 80% yielded results.

The coarse aggregates were mixed in a 2:1 ratio, with 20 mm and 12.5 mm being the precise sizes used, to obtain the requisite workability of 75 mm slump.

Maximum values of compressive strength was observed at 30% FA along with slag. Slag produce hydrated calcium alumina silcates which enhance the strength. In summary, whenslagisusedasareplacementwithFAitlosesitsstrength and slump value.

II. MATERIALANDPROPERTIES

1. Cement

Cement acts as a binder in a concrete. When crafting cement, the key ingredient is limestone, a compound primarily made up of calcium carbonate.Along with trace elements like silica and iron, this mixture is heated to perfection. At 450 °C of heating of limestone, quicklime is produced also known as calcium oxide, this process is called calcination which is a major source of releasing CO2. After that, it's tossed in the mixer alongside the remaining ingredients. The cement being utilised has the following qualities. Grade 53 Ordinary Portland Cement, which is commercially accessible, was utilised in this study.

2. FineAggregate

The 4.75 mm Tyler sieve is passing the aggregates, butthe.075 mm sieve is being kept. One of the most crucial materials in civil engineering is fine aggregate, also known as sand. In construction projects it is used as a FA. Based on its composition, FA might be siliceous, argillaceous, or calcareous, meaning it is a kind of quartz. Sands that occur naturally are the result of rocks being weathered. Sand grains can be spherical, pointed, or angular.

3. CoarseAggregate

Within the production of concrete, it plays a crucial role. The strengthofconcreteissignificantlyaffectedbytheaggregates, which make up around 72–75% of its volume. Compared to cement and admixtures, they are less expensive. Due to CA concrete achieve density. The particles that cannot pass through a 4.75 mm screen are considered CA. In comparison to FA (Sand), CA have a smaller surface area. It is used as a non-reactive filler in concrete. “The gradation restrictions as per IS:383-2016 were satisfied by using 20mm and 10mm single sized crushed stone aggregates from the nearby quarry as CA in a ratio of 65% to 35%.

4. Water

Water is freely available and extensively used in concrete for preparing mixes. Concrete and steel are both susceptible to corrosion if the water used in their manufacture and curing contains any harmful substances, such as oil, acid, alkali, salt, sugar, silt, organic matter, etc.

They can assume that water is suitable for building concrete if it is safe to drink. This study makesuseofthecollege'sstandardborewell waterfor mixing and curing purposes since it is fit for drinking.

5. SteelSlag

Steel slag is sourced from Ramadar Services, Mandideep, for this investigation. All throughout the world, people are using steel items these days. Steel is long-lasting and robust. Steel slag is an industrial waste and cannot be dumped into atmosphere.

6. Crushed Bricks

The over burnt brick are available in brick manufacturing unit in a large quantity. Brick are crushed into the size of 20mm. By sieve analysis, dust particles have been removed. In comparison to the coarse material, these charred bricks are quite light. The crushed material is next cleaned of any loose or dirty particles. Different machines are available forcrushing the bricks.

7. Rubber Crumb

The use of waste truck tire rubber is collected fromremoulding shops. The aggregate will have of a uniform size thanks to the cutting of these truck tyre rubbers into 20 mm pieces using a shoemaking knife. The characteristics of the shredded rubber aggregates with a 20 mm form.

8. LimestonePowder

The Limestone used in this project is obtained from Chemical Industry in Govindpura which is from one of the leading companies and is well known for the chips of the limestone.

9. METHODOLOGY

The process of casting concrete represents a crucial technique that enhances itsdensity, workability, and strength.Astep-by- step procedure is adopted to make different mixes. Prior to mixing, first all materials are weighted and drum was used for mixing. For this project, we utilised a cube mould measuring “150 x 150 x 150 mm, a cylinder mould measuring 150 x 300 mm, & a beam mould measuring 150 x 150 x 700 mm for casting”. At 50 mm intervals, with 35 strokes per layer of concrete, the cube and cylinder moulds are compacted using a conventional tamping bar.

The beam moulds are vibrated by a machine vibrator. Specimens have been deformed and sent to a curing tank to cure for seven or twenty-eight days after casting, respectively.

III. RESULTS AND DISCUSSION

1. Compressive StrengthTestResults

From the results, it observed that with addition of rubber crumbs, broken bricks, glass fiber, lime stone kiln, utilising 10% rubber crumbs, broken bricks, lime stone kiln, and steel slag, the material achieves its maximum compressive strength of 33.42 MPa. Compressive strengths decline with increasing amounts of rubber crumbs, shattered bricks, lime stone kiln, and steel slag.

2. Flexural StrengthTestResults

From the results, the impact of various materials on flexural strength was studied. At 10% rubber crumbs, broken bricks, limestonekiln,andsteelslag,thehighestflexuralstrengthof4.87 MPa was reached. With further addition of rubber crumbs, broken bricks, lime stone kiln, glass fiber and steel slag, flexural strength decreases.

3. Split Tensile Strength Test Results

From the results, it observed that with addition of rubber crumbs, broken bricks, lime stone kiln, glass fiber and steel slag on split tensile strength, the maximum split tensile strength is achieved at 10% of rubber crumbs, broken bricks, lime stone kiln, glass fiber and steel slag i.e. 4.42 MPa. With further addition of rubber crumbs, broken bricks, lime stone kiln, and steel slag, split tensile strength decreases.

IV. CONCLUSION

1. The results demonstrated that the compressive strength was enhanced by adding rubber crumbs; the optimum dosage of rubber crumbs is 10%, at this the value of compressive strength is recorded as 32.45 MPa. According to the results, the compressive strength is increased withtheadditionofbrokenbricks,theoptimumdosage of broken bricks is 10%, at this the value of compressive strength is recorded as 31.42 MPa
2. Scholars discovered that using lime stone kiln enhanced the compressive strength. The greatest compressive strength of32.56 MPa wasachieved with 10% lime stone kiln. The amount of lime stone kiln applied causes a decrease in pressure.
3. According to the previous studies, steel slag enhance the compressive strength. The optimum dosage of steel slagis 10%, at this the value of compressive strength is recorded

as 31.78 MPa, after further addition of steelslag, compressive strength decreases.

4. The combined effect of rubber crumbs, broken bricks, lime stone kiln, glass fiber and steel slag enhance the compressive strength and at 10%, the value of compressive strength is 33.42 MPa.
5. The research showed that 10% rubber crumbs, or 4.11 MPa, had the most significant influence on flexural strength. 6. As the quantity of rubber crumbs rises, the flexural strength decreases.
6. That may boost the flexural strength by including broken bricks. 7. The result indicates that 10% of broken bricks achieve the maximum flexural strength of 4.28 MPa. As the number of fractured bricks increases, the flexural strength decreases.
7. Addinglimestonekilnboostsflexuralstrength,according tothestudy.Theflexuralstrengthreacheditspeakat4.52 MPa when the lime stone kiln was 10%. A higher percentageoflimestonekilncausesadecreaseinflexural strength.
8. The inclusion of steel slag boosted the flexural strength, with the greatest value of 4.87 MPa achieved with 10% slag, according to the results. Adding more steel slag reduces the flexural strength.
9. The results demonstrate that including rubber crumbs, crushed bricks, lime stone kiln, glass fiber and steel slag enhances the flexural strength. The maximum flexural strength of 4.87 MPa was achieved when 10% of the materials were used. To a combination, adding extra components such as shattered bricks, steel slag, limestone kiln, glass fiber and rubber crumbs reduces its flexural strength.
10. Results showed that 10% rubber crumbs produced the maximum split tensile strength of 4.45 MPa, the highest value observed in the study. An increasing number of rubber crumbs causes a decrease in the split tensile strength.
11. In terms of split tensile strength, the results showed that 10%brokenbricks,or4.42MPa,had themostsignificant influence. Adding more broken bricks reduces the split tensile strength.
12. The results demonstrate that the influence of lime stone kiln on split tensile strength grows as the percentage increases, peaking at 4.56 MPa when the lime stone kilncontent is 10%. The split tensile strength is decreasedwith the addition of more lime stone kiln.
13. The findings indicate that the inclusion of steel slag influences split tensile strength, and at 10% steel slag, maximum split tensile strength of 4.78 MPa is observed.
14. It is found that the inclusion of glass fiber increases the splittensile strength.At 10% ofglass fiber, the maximum split tensile strength is 5.9 MPa. Split tensile strength

declines as glass fiber is added to the mixture.

15. It observed that with addition of glass fiber on flexural strength, the maximum flexural strength is achieved at 10% of glass fiber i.e. 5.9 MPa. With further addition of glass fiber, flexural strength decreases.
16. It is observed that with addition of glass fiber on compressive strength," the maximum compressive strength is achieved at 10% of glass fiber i.e. 32.9 MPa. With further addition of glass fiber, compressive decreases.
17. According to the results, adding 10% of rubber crumbs, broken bricks, lime stone kiln, glass fiber and steel slag increases the split tensile strength to 4.42 MPa. Rubber crumbs, broken bricks, lime stone kiln, and steel slag in combined effect decrease the split tensile strength.

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