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STUDY ON BEHAVIOUR OF CEMENT CONCRETE WITH PARTIAL REPLACEMENT OF COAL DUST AND IRON RUST

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ABSTRACT
The Cement concrete is widely used now-a-days for general as well as massive structures. There may be a situation, which leads to the stoppage in the production of cement due to the lack of lime which is going on reducing in the quarries for many other beneficial uses. So replacement of cement is necessary either completely or partially for further making of new products. Experiments are being conducted using different materials which are naturally available and by products obtained from industries trying for the efficient and safe result. Our project is one of those trials which deal with the partial replacement of cement with coal dust and iron rust. Coal dust and iron rust are naturally available materials formed by the disintegration of coal and iron respectively. The compressive strength of M20 grade concrete is tested with 5%, 10%, 15% and 20% replacements for 7 days and 14 days and compared accordingly.

INTRODUCTION
Cement have an awesome quality which makes us to utilize it in past, present and future eras. Cement is a water-based binder used to tie other building materials together. It is utilized as a part of the creation of mortar and cement amid the development process. Concrete then again, is a material utilized as a part of development, made by blending total (i.e. distinctive sorts of sand and rock), bond, little stones and water. The reason concrete is a standout amongst the most widely recognized development fixings among other is its capacity to hold the structure together. To get solid, one blends water, sand and rock. At the point when concrete is blended with water and sand, the result is bond mortar, yet when concrete is blended with water, lime and sand, the outcome is mortar. Most structures like individual and business use concrete in light of the fact that it is a solid component. Cement sets and solidifies in the wake of blending with water and position because of a synthetic procedure known as hydration. The water responds with the concrete, which bonds alternate parts together, in the long run making a stone-like material. Cement concrete is utilized to make asphalts, funnel, building structures, establishments, and motorways/streets, spans/bridges, stopping structures, block/piece dividers and footings for entryways, fences and posts.

Fig 1: Cement Concrete

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MATERIALS AND THEIR SIGNIFICANCE

COAL DUST

Coal dust is a fine powdered type of coal, which is made by the devastating, pounding, or beating of coal. On account of the fragile way of coal, coal dust can be made amid mining, transportation, or by mechanically taking care of coal. Coal dust suspended in air is hazardous; coal dust has significantly more surface region per unit weight than pieces of coal, and is more helpless to sudden ignition. Subsequently, an about unfilled coal store is a more noteworthy blast hazard than an entire one.

For use in warm power plants, coal is ground into dust utilizing a gadget called a powdered coal plant. The subsequent item, called powdered coal or pounded coal, is then for the most part utilized as a part of a fossil fuel force plant for power era. Pummeled coal is a huge dust blast danger, as huge amounts are suspended in air for exchange from the factory to the force plant. Blasts have happened when the stream drops and flares in the blazing chamber go back along the ventilation work conveying fuel.

Fig 2: Coal powder

IRON RUST

Rust is an iron oxide, generally red oxide framed by the redox response of iron and oxygen in the vicinity of water or air dampness. A few types of rust are recognizable both outwardly and by spectroscopy, and structure under distinctive circumstances. Given adequate time, oxygen, and water, any iron mass will in the long run change over altogether to rust and break down. Surface rust is flaky and friable, and it gives no assurance to the fundamental iron, dissimilar to the arrangement of patina on copper surfaces. Rusting is the normal term for erosion of iron and its amalgams, for example, steel. Numerous different metals experience proportional consumption; however the subsequent oxides are not generally called rust.

Fig 3: Iron Rust

The finest nature of coal and iron inspired to make them use as a partial replacement of cement to find the characteristic strength of concrete

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CEMENT

Cement is the powder that responds with water to shape concrete glue, a hard, strong material that structures the framework for the solid composite. The expansion of sand that is up to a couple of millimeters in breadth makes mortar, and the expansion of rocks of up to a couple of centimeters in width makes concrete. It has dependably been realized that solid is a permeable material, whose properties rely on upon its pore space. There are a wide range of sorts of pores in concrete, running from the air voids that are captured in the blending procedure, which can be entirely expansive, up to a couple of millimeters in distance across, to the fine pores, which are basically the space involved by the remaining water from blending, down to the nanometer-scale pores that exist in a percentage of the hydration items delivered by the bond water synthetic response.

WATER

water utilized as a part of the mix design procedure should to be clean and free from polluting influences like dust particles, oils, inorganic solutes, so that the qualities acquired for compressive strength should to be exact.

FINE AGGREGATE AND COARSE AGGREGATE

Naturally available finer sand with no organic and inorganic impurities is used as fine aggregate. Size of 10mm and 20mm stones with proportions according to IS: 383-1970 is used as coarse aggregates. Aggregates strongly impact concrete's crisply blended and solidified properties, blend extents, and economy. Consequently, determination of aggregates is an essential procedure. Albeit some variety in aggregates properties is normal, attributes that are considered include Reviewing, Sturdiness, molecule shape and surface composition, scraped area and slide resistance, unit weights and voids, ingestion and surface dampness.

Reviewing alludes to the determination of the molecule size appropriation for aggregates. Evaluating breaking points and most extreme total size are determined on the grounds that these properties influence the measure of total utilized and in addition bond and water necessities, workability, pump ability, and toughness of cement. As a rule, if the water-bond proportion is picked accurately, a wide range in evaluating can be utilized without a noteworthy impact on quality. At the point when Gap graded aggregate are determined, sure molecule sizes of total are overlooked from the size continuum. Gap graded aggregate are utilized to acquire uniform surfaces in uncovered total cement. Close control of blend extents is important to maintain a strategic distance from isolation.

RESULTS AND DISCUSSION

The results obtained are on characteristic strength of concrete or can be said as compressive strength tested on standard 150mm x 150mm x 150mm size cube. The result such obtained is known as grade of concrete. Portland cement of grade 53 N/mm2 is taken and design mix of M20 is used. No design procedure is required for M20 grade according to Is 10262-2009 as normal proportion is adopted i.e. 1:1.5:3 based upon the weight, where 1 is quantity of cement, 1.5 is quantity of fine aggregate and 3 is quantity of coarse aggregate. The water cement ratio is taken as 0.45.

The characteristic strength of cement concrete with partial replacement using iron rust and coal powder are as given below

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% content	Iron Rust powder		Coal powder	
	7days	14days	7days	14days
5%	20.88	23.11	16	18.67
10%	24	25.78	17.33	20.44
15%	27.11	29.33	19.56	22.67
20%	30.22	32	20.88	24.89

Table 1: Compressive Strength for 7days and 14 days of curing in N/mm²

GRAPHICAL REPRESENTATION

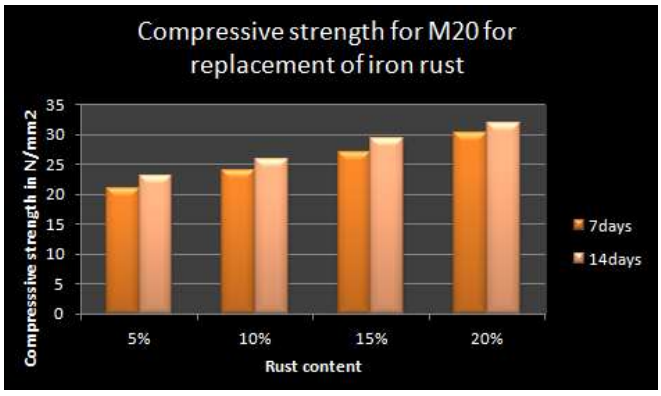

Fig 4: Compressive strength for replacement of iron rust for 7days and 14 days of curing

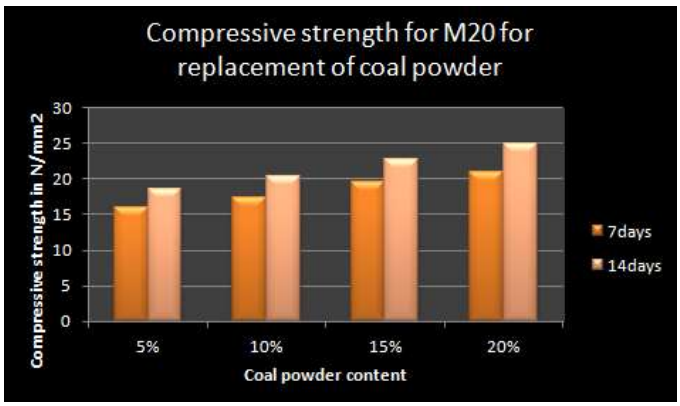

Fig 5: Compressive strength for replacement of coal powder for 7days and 14 days of curing

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CONCLUSION

The compressive strength increases as the content of iron rust and coal powder increases.
The compressive strength found by partial replacement of iron rust is more than the compressive strength by partial replacement of coal powder.
The maximum value obtained is 32 N/mm2 for iron rust at 14 days of curing.
Iron rust can be suggested to be use as a partial replacement in cement than coal powder.

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