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Review Article

Review on the feasibility of Marble Dust as Replacement of Cement in Concrete

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Abstract

Marble dust (MD) is associate degree inert powdered material that is incurred as associate degree industrial by-product throughout sawing, sprucing, and shaping of marble which makes a reason of a heavy downside to the surroundings. Earlier analysis conjointly indicate that the consequences of blending marble dust on the different properties of cement like setting times, consistency as well as soundness stay at intervals the appropriate ranges of various standards. It's been used as a replacement of fine aggregates as well as course aggregate in several literature works however this paper presents the practicability of the cheaper production of concrete with dust of marble in place of cement. The workability as well as compressive strength of concrete is often accrued by the addition of waste marble in place of cement as well as marble granules in place of fine aggregate. The workability, strength as well as durability of concrete modified with marble dust and marble granules are investigated by many researchers. These types of production of concrete with MD also lead to innovation of cheaper production of concrete. It also leads to decrease in hazard caused by MD in surrounding atmospheres as well on agriculture land. This paper also provides a scope for more research which is a requisite to design more reliable and more long-lasting concrete with marble dust.

Keywords: *Cement, Marble dust, Marble Granules, Workability, Setting times.*

Introduction

Marble may be a stone ensuing from the transformation of a pure sedimentary rock. On the idea of color and look the purity of the marble is decided: it's white if the sedimentary rock consists entirely of spar (100% CaCO3). An oversized amount of powder is generated throughout the cutting method. The result's that the mass of marble waste that is two hundredth of total marble quarried has reached as high as countless tons. These waste materials exploiting the atmosphere directly and reason for environment drawback. The advancement of concrete technology will cut back the consumption of natural resources and energy sources that successively more reduce the burden of pollutants on the atmosphere. Presently, great deal of marble dust square measure generated in natural stone process plants with a vital impact on the atmosphere. The expansion in industrial production resulted in more resulting waste materials cause environmental hazards. A lot of waste has made by development of industry cause health conditions. These wastes are created throughout grounding and sharpening processes. All these procedures turn out an outsized quantity of waste materials. Marble particles are resolved by alleviation then drop away which ends associate environmental air pollution, additionally to creating dust and intimidating each agricultural as well as open public health. Usage of the marble dust particles in commercial sectors like development, agriculture, goblet and paper sectors would facilitate to guard the environment. Hence the use of materials has been pressured. Waste materials may be wont to make new product or can be utilized as admixtures to ensure that natural resources are being used additional expeditiously as well as the environment is shielded from misuse deposits. There are many utilize and usage solutions for this industrial by-product, each at associate experimental section and in sensible applications. On the opposite hand, usage waste while not properly primarily based research project and development may end up in environmental issues bigger than the waste itself.

Literature Review

Bekir Topcu *et. al* (2009) looked into the result of waste material marble dust consumption as filler materials in self-compacting concrete on different properties like capillarity and figured the easiness in handling of fresh SCC is not damaged up to two

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hundred kg/m^3 marble dust content. The mechanised properties of solidified SCC have lowered by using MD, Above 200 kg/m^3 content the mechanical properties of self-compacting concrete have decreased.

Yilmaz Aruntas *et.al* (2010) experimentally studied the usability of marble dust created by waste (W.M.D.) as associate additive as well as filler material in alloyed cement. For this purpose, waste marble dust added cements (W.M.D.Cs) are obtained by bury grinding W.M.D. with cement clinker. 40×40×160 millimetre mortar prisms are made with the blended cements.

Test on strength are carried out for 7, 28, and 90 days on mortar specimens. CEM I and CEM II are compared with W.M.D.Cs with relevancy their chemical, physical as well as mechanical properties. The acquired outcomes proved that W.M.D.Cs do the accepted thing to EN 197-1. Therefore 10% WMD can be used in cement producing.

Bahar Demirel (2010) investigated four different series of concrete-mixtures by replacing the fine sand with dust from marble waste (WMD) at different proportions of 0, 25, 50 and 100% by weight. It was discovered that the mixing of WMD in different proportions has shown an improving influence on compressive strength.

H. Hebhoub *et.al* (2011) display the likelihood of using wastes from marble as an alternative of natural aggregates in cement production. Experimental research was allotted on three groups of concrete mixtures, fine sand substitution, gravel substitution and a combo of every aggregate. The outcomes show that the mechanical properties of concrete samples were good and victimization the marble wastes were found to adapt to the concrete production standards.

Baboo Rai *et.al* (2011) studied the effect of exploitation marble powder and granules as constituents of fines in mortar or concrete by partly reducing quantities of cement additionally as different typical fines has been studied in terms of the relative workability, compressive strength as additionally as flexural strengths. Partial replacement of cement and usual fine aggregates by varied proportion of marble powder and marble grains reveals that lifted waste marble powder (WMP) or waste marble granule (WMG) ratio has positive effect on workability as well as compressive strength of the mortar and cement concrete.

Ali Ergun (2011) studied about Diatomite and test outcomes mentioned that the cement samples containing ten % diatomite & 5% WMP and 5% WMP +10% diatomite had the better compressive & bending strength. The replacement of concrete with diatomite & WMP independently as well as along having a very plasticizing admixture may be used to enhance the mechanical properties of the typical concrete combination of mixtures.

P.A. Shirule *et. al* (2012) investigated physical, chemical and mechanical properties of the waste and concluded that with 10% inclusion of marble dust the initial strength gain in concrete is high. Hassan A. Mohamadien (2012) investigated the replacement and addition quantitative relation of each marble powder and silicon oxide fume with cement content independently 0%, 5%, 10%, 15%, 20%, 30% and 50% by weight and ascertained that the strength developments at seven, and twenty eight days and therefore the highest development rate of compressive strength was ascertained at 15% replacement proportion of each the marble powder and silica fume independently.

Omar M. Omar *et. al* (2012) has done study by experiment undertaken to research the influence of partial replacement of fine aggregate with waste from limestone (LSW), with marble powder (M.P) as an additive on all the concrete properties. The replacement proportion of sand with rock waste, 25%, 50%, and 75% were practiced within the concrete combines except within the concrete mix. It had been found that rock waste as fine combination increased the slump take a look at of the contemporary concretes. However the unit weight concretes weren't affected.

Satish Chandra and Rajan Choudhary (2013) explored the attainable use of those three industrial wastes, in conjunction with lime hydrate & standard stone from quartzite used as filler in construction with bitumen. Completely different take a look at procedures area unit accustomed examine the void and clay content material in the 5 fillers. Mixes of Bituminous concrete (BC) have been designed constant with the Marshall technique at 4 absolutely specific possibilities of the five styles of fillers. Many of the three commercial wastes and marble dirt is the good filler and could prove to be very cost-effective.

Animesh Mishra *et. al* (2013) investigated the compressive strength and microstructure of blended cement. The hydration products of cements were recognized by way of scanning electron microscopy. Compressive strength discussed as a function of several parameters: curing time, binder composition and (Binder/aggregate) ratio. This was concluded that the blended cements developed higher energy, at 28 days as compared to 7 days. The energy increase was higher, the better the marble dust content.

AbdElmoaty Mohamed AbdElmoaty (2013) studied that granite dirt cement substitute or addition of 5.0%, 7.5%, 10.0% and 15.0 %. Check outcomes confirmed an increase in compressive strength of concrete at 5.0% dust from granite as cement alternative and development in compressive strength at the most stages of granite dust as cement addition. Usage of 5.0% granite dust raised the corrosion cracking time & no essential decline in cracking time was decided at granite dust contents larger than 5.0. V.M.

Sounthararajan & A. Sivakumar (2013) investigated the hardened concrete properties up to 10% replacement of cement with powder of marble waste. The end result of numerous percentage substitute of marble dust at the compressive strength & splitting tensile strength as well as bending strength has

evaluated. It may be cited that have an impact of fine to coarse aggregate combination (F/C) and cement-to-total aggregate combination (C/TA) had a higher affect at the increase in strength parameter. A brilliant increase inside the compressive strength at seven days for 10 percent substitution with marble dust was observed.

Noha M. Soliman (2013) studied the effect of exploitation marble powder as part replace of cement on the properties of concrete. The influence of exploitation marble powder on the behavior of ferroconcrete slabs is additionally investigated. The most variable taken into thought is that the proportion of marble powder as partial replacement of cement content in concrete mixes. The experimental results showed that, exploitation definite quantity of marble powder replacement of cement content will increase the workability, compressive strength and durability. Exploitation marble powder increased additionally the structural performance of the tested slabs because it inflated the stiffness and also the final strength compared to the control slabs.

Aalok D. Sakalkale *et. al* (2014) investigated that waste marble powder construction industry itself as fine aggregate replacing natural sand in concrete. The replacement is done partially and fully in the proportion 0%, 25%, 50% and 100% and its effect on concrete properties were analyzed and outcomes that replacement of 50% of sand with marble powder is optimum percentage in concrete.

Ronak Malpani *et.al* (2014) experimentally studied the concrete properties for eight series of concrete mixtures by substitution the portion of fine aggregates by marble sludge & quarry rock dust and mixtures of each. The result of both these mixture on the compressive strength and split enduringness were recorded at the set age of seven and twenty eight days. It absolutely was determined that exact proportions of powder of marble sludge & quarry rock dust displayed enhancing result on the compressive strength.

Ali A. Aliabdo *et. al* (2014) worked on the homes of concrete which has formed by replacement of cement with marble dust as well as marble as a sand substitute. Check outcomes of cement paste & cement mortar indicate that the marble dust mixed cement remains in the perfect degrees of the Egyptian standards.

Oguzhan Kelestemur *et. al* (2014) investigated experimentally the usability of marble dust and optical fibre in opposition to the damaging consequences of freeze & thaw (feet) cycles on cement mortars. To the present day end the specimens of cement mortar containing different amount of marble dust and glass fibre were geared up. Quantities of glass fibre, possibilities of marble dust & cycles of freeze & thaw, has been changed to explore their outcomes at the compressive as well as bending strengths of the mortar specimen. Consequences of the factors were conjointly determined by means of victimisation analysis of variance (ANOVA) method. Ultimately, experimental results were as compared with carried out math outcomes and a first rate agreement among them became executed. F. Gameiro *et. al* (2014) worked on the long-lasting properties of concrete consists of numerous percentages of fine aggregates created with the marble production. It had been ended that the sturdiness properties of concrete consists of fine aggregates of granite, volcanic rock and watercourse sand tend to enhance, stay constant and reduce, severally, with the amalgamation of fine aggregates from marble production waste.

Kirti Vardhan *et al* (2015) investigated the prospect of utilizing marble powder with cement substitution. The results of the study indicated that up to ten % of marble powder is also used as substitution of cement with no cooperation on the technical individuality of the mixture

R. Rodrigues *et al*. (2015) assessed the mechanical execution of cement concrete with various consolidation proportions of muck from the marble extraction exchange as bond substitution (0, 5, 10 and 20 in percent), what's more similar to plasticizers. Workability and mass thickness tests were disseminated on contemporary cement, though compressive quality, uproarious enduringness, modulus of elasticity, UPV and scraped area protection tests were performed to guage the applicable properties of cement inside the solidified state. it had been discovered that the mechanical properties of cement concrete containing sludge from the marble extraction exchange tend to state no. Attractive outcomes were gotten for substitution proportions of up to 10 percent.

Manuel Sardinha *et al*. (2016) utilised four substitution proportions talking to, by bond volume, 0, 5, 10 and twenty p.c of marble sludge. Their examination incontestable that the solidness qualities of cement weaken as bond substance can increment and marble slop substance can increment. For the 5 and 10 p.c change of integrity proportions, these misfortunes were immaterial.

Hamdy A. El-Sayed *et al.* (2016) incontestable that five wt.% could be securely, additional to the cement without unfavorable impacts on the bond properties by deciding the physic – chemical and mechanical properties of the marble squander on the bond properties. growth of such retiring to the bond (or replacement some portion of the used mineral within the concrete produce) may be a real vitality and cash connected stinting plan, moreover, stinting piece of the common assets and easing the ecological result forced by the marble getting ready waste.

Manpreet Singh *et al*.(2017) represented the waste marble suspension from Makrana locus of Rajasthan in India for various physiochemical properties and accustomed replace bond partly by weight in concrete. Drying shrinkage was found to decrease and quality of mortar increased for a selected rate substitution. They watched that the mechanical

properties of cement concrete upgraded with change of integrity of became dried marble slurry for scarce to fifteen percent substitution.

I. S. Buyuksagis *et al*.(2017) examined the accessibility of marble powder (MP) additional substance at numerous proportions instead of dolomite, that is that the crude material in glue mortars of insulation board. The employment of marble powder with dolomite was additionally investigated economically and it had been observed that it had been additional advantageous to form price calculations and in accordance with the relevant EN standards

Discussion

Lot of work has been done on the fractional replacement of cement by powder of marble, sand with marble particles and coarse aggregate with marble aggregates. When Marble Dust has mixed with Portland cement clinker at different ratios & they found the positive results which can reduce the environmental problem directly related to human beings (Aruntas H.Y *et al*, 2010). Investigation has also done on MD as space filler material in self-compacting concrete properties like capillarity and concluded that up to 200 kg/m^3 MD content, the workability of fresh Self compacting concrete has not been affected (Topçu I. B. *et al*, 2009). It has also concluded that dense concrete can be made by reducing void content in concrete by marble sludge powder. Some more researchers also found positive effect of marble dust as filler in design of bitumen mixes by Marshall Method as compared to different filler (Chandra S *et al*, 2013). Substitution of cement and fine aggregate by varying the percentage of marble dust and marble granules increased the workability as well as compressive strength of concrete and mortar (Rai B *et al*, 2011). Physical, chemical and mechanical properties of the waste with 10% inclusion of marble dust has increased & the initial strength gain in concrete is high (Shirule P.A *et al*, 2012). Results showed that the compressive strength increased at 15% substitution ratio of silica fume with cement content. The better performance was observed when waste of limestone was used as fine aggregate in company of marble powder (Omar M.O. *et al*, 2012). It has been found that sturdiness of concrete made with marble and floor furnace slag changed into found to be superior to manipulate concrete (Binci H. *et al*, 2008). Experimentally investigated the suitability of granite powder (GP) waste up to 15% has high-quality impact as an alternative cloth for fine/natural combination of aggregate in concrete manufacturing (Vijayalakshmi M *et al*, 2013). Research has accomplished via scanning electron microscopy on the compressive energy and microstructure of combined cement and it was located that the blended cements advanced better energy/ strength, at 28 days in comparison to 7 days (Mishra A. *et al*, 2013). Other researchers have investigated the waste marble powder up to 10% (detain via forty five microns) by way of weight of cement for hardened concrete homes (Sounthararajan V. M. *et al*, 2013). The experimental consequences showed that the employment of precise total of marble dirt substitute of cement content material will increase within the workability, compressive strength furthermore as tensile power/strength. worked on the homes of concrete that has fashioned by replacement of cement with marble dirt furthermore as marble as a sand substitute (Aliabdo A.A. *et. al*, 2014). 10 percent of marble powder is also utilized in mortar as substitution of cement with no participation on the specialized independence of the blend (Vardhan K. *et al*, 2015). Mechanical properties of cement concrete upgraded with change of integrity of became dried marble suspension for scarce to fifteen percent substitution (Manpreet Singh *et al*, 2017).

Conclusion

Marble dust can be used as cement replacement & fine aggregate replacement as well as course aggregate replacement. Marble dust merging had a wonderful effect on compactness, shrinkage and plasticity during all levels of the manufacture process, awaiting some adjustments within the business manufacturing line. Marble dust with cement concluded increase in workability & compressive strength of concrete. The usage of marble dust in cement concrete production as cement alternative or sand alternative grade by grade enhances each of the mechanical as well as physical houses of concrete in particular with decrease water cement quantitative relation. Best results are obtained by replacement at 10% of cement with marble dust in case of mortar. More dense structure can be achieved with addition of marble dust in concrete. The usage of marble dust in construction is more economical for the reason that this waste is existing free of cost. Environmental connected issues will be reduced to massive extent by exploitation waste obtained from marble trade in concrete production. Therefore, the outcome of this revision offer a robust suggestion for the utilization of dust from marble in concrete producing as partial replacement of cement. During this paper, just some basic study of exploitation marble waste in cement and concrete construction is investigated. It can be used in construction for economical as well as environment protection purpose.

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