

A Review Paper on Effect of Marble Dust Powder and Quartzite Dust Powder on Strength Characteristics of Concrete

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Abstract – The use of waste materials and industrial by products in construction are in demand and becoming important. Sustainable construction, government and public awareness leads to use of waste materials in construction. Increase in demand of construction population and demolition of buildings and other form of waste materials being generated in high amount. In concrete Marble Dust Powder and Quartzite Dust Powder have been used widely and there are various research has been done on use and their effects on concrete. Marble Dust Powder and Quartzite Dust Powder can be used as partial replacement for fine aggregates or cement in concrete mix. The objective of this study is to find the effect of Marble Dust Powder and Quartzite Dust Powder on concrete. This study includes published papers from journals and conferences

Key Words: Marble Dust Powder(MDP), Quartzite Dust Powder(QDP), Compressive Strength, Split Tensile Strength, Flexural Strength

1. INTRODUCTION

Concrete is one of important and widely used construction material. It is made of a mix of course, fine aggregates and bonded by cement paste. Due to this concrete consume high amount of natural resources like river sand and stones. As human population is growing, need of new infrastructure has increased. Now days environmental problem are important concern in construction industry. Use of natural resources in concrete leads to consumption of natural resources. Cost of natural resources also plays a major role in construction related problems. In order to find alternates to natural resources researchers has found other ways which may reduce the use of natural resources. Use of waste materials is one of them, which are now days widely used in construction industry.

Marble Dust Powder and Quartzite Dust Powder are waste materials generated from cutting of marble and quartzite rocks respectively. These two materials are found to be effective to be used in concrete mix and positive effects on strength characteristics also observed. In this research Marble Dust Powder and Quartzite Dust Powder will be used as partial replacement for cement and sand respectively. Various tests will be conducted to check effective of these two materials together in single mix in concrete to find effects on strength characteristics.

1.1 Materials

1.1.1 Cement: Cement is binding material used in construction to bind materials together in the presence of water. It happens due to series of hydration reactions.

1.1.2 Coarse Aggregates: Coarse aggregates are basic ingredients in concrete and these are granular material made from crushing of rocks or stones. These can be obtain from rivers, mining or cutting of rocks and stones. Coarse aggregates in concrete provide resistance to compaction. These are widely used in construction industry as filler material for concrete.

1.1.3 Fine Aggregates: Fine aggregates are natural sand particle or obtain from crushing of stones. It is widely used in the construction industry to increase the volume of concrete. Quality of fine aggregates are very important for concrete and it can effects the factors like abrasion, durability or porosity in hardened concrete.

1.1.4 Marble Dust Powder: Marble Dust Powder is made up of cutting of Marble rocks which now days widely used in construction work. MDP can be used in concrete as partial replacement for cement or fine aggregates. MDP helps in increasing strength of hardened concrete.

1.1.5 Quartzite Dust Powder: Quartzite Dust Powder is obtain from cutting of quartzite rocks which are made from quartz sandstone. It can be used in concrete as addition to sand to provide it more strength. QDP has binding properties when comes in contact with water.

2. Scope of Paper

Use of waste material are completely encouraging or beneficial in concrete because concrete contains large amount of natural resources in form of fine aggregates or course aggregates. To reduce the amount of using natural resources in concrete waste materials can be effective alternates. This study if focused on use of Marble Dust Powder and Quartzite Dust Powder in concrete and to check various effects.

3. Literature Review

Huseyin Yilmaz Arunta et al. (2010) [1] In this research waste marble dust is used in cement production as an additive material. It was observed that 10% of waste marble dust can be used as additive in cement production. Waste marble dust increases value of specific gravity in

concrete. Waste marble dust does not affect the setting time. Compressive strength is also high in waste marble dust concrete as compared to standard concrete.

Ali A Aliabdo et al. (2013) [2] In this research waste marble dust was utilized in cement and concrete production. Marble dust up to 15% as cement replacement has positive effects on steel concrete bond strength and maximum was at 10%. It was also observed that porosity also decreases with addition of marble dust in concrete. There was insignificant change in ultrasonic pulse velocity with use of marble dust in concrete.

Ankita Khatri, Abhishek Kanoungo et al. (2014) [3] In this paper the focus is feasibility of the substitution of marble waste for cement to attain economy and environmental saving. In presence of superplasticizer mixture. Marble waste had negligible effect on mechanical properties. It was also observed that marble dust decreases the porosity of the hardened concrete.

K. Kavita, V.R. Sankar Cheela et al. (2015) [4] In this research quartzite powder was replaced with fine aggregate in concrete up 100%. It was observed that more we replace quartzite with sand the workability start to decrease due to high water absorption in quartzite powder. Increase in compressive strength of up to 18.6% when 100% of sand is replaced. Due to low bulk density the weight of concrete was also low. Quartzite powder also gives smooth surface finish when compared to normal sand in concrete.

K Surendra Babu, G. Nagesh Kumar (2015) [5] In this research crushed quartzite is used as partial replacement to fine aggregates along with fly ash as mineral admixture. Upto 50% replacement of quartzite powder provide positive effect on fresh properties of concrete. It was also observed that 10% to 50% crushed quartzite as fine aggregate does not affect more on strength properties.

Ummar Shareef et al. (2015) [6] In this research silica manganese and quartzite used as alternative material for coarse aggregate. It was observed that quartzite has good resistance in crushing and impact test. Quartzite has higher 28 days compressive strength as compare to conventional aggregates. Quartzite also has higher water absorption as compared to natural course aggregates.

Mrs. Shakaka, S Utkar (2016) [7] This research focus on strengthening concrete by replacing cement by marble powder in most economic way for m20 grade. Research shows marble powder has very good cohesiveness of mortar and concrete. 20% of replacement gives excellent result in strength and quality. Concrete having 20% replacement of marble powder with cement has high compressive strength and improvement of properties related to durability.

Gopi R et al. (2017) [8] In this paper marble powder was used as partial replacement for cement and checked for strength characteristics. It was observed that 15% replacement of cement by marble powder increases compactor factor. Even 15% replacement increases

compressive, tensile strength by 14.53% and 14.25% respectively. Modulus of concrete also increases up to 7.1 % when they replaced by 15% of amount.

Bassam A. Tayeh (2018) [9] In this research waste materials like glass, timber and marble powder used as partial replacement of cement in concrete and mechanical and physical properties were investigated. Researcher finds that workability decrease when we increase partial replacement of cement with these materials and optimum percentage is nearly strength of concrete is high when partially replaced by 10%. Use of these materials can diminish the utilization of concrete and the related vitality interest effect on air contamination and CO₂ emission.

OM Ofuyanta et al. (2019) [10] In this research marble dust powder was used in concrete by partially replacement with cement along with fly ash, slash silica fume and superplasticizer. 25% of Replacement leads to high degree of slump and 15% and 35% record lowest slump value. When replaced by 25%, compressive and tensile strength increase by 11% and 17% respectively. Waste Marble dust concrete have a resistance to stress and also have greater load bearing capacity.

S.Suresh, J. Revathi (2019) [11] In this research the objective of research was to examine the possibility of utilizing marble powder in concrete production. It was observed that compressive strength flexural strength increased up to 23% 24% and 17.82% respectively when they replaced by 10% of marble powder. It was also observed there is a decrease in chloride penetrations but new significant change in water absorption as compared to standard concrete.

Mes Belouadah saouda et al. (2019) [12] In this research marble and glass powder used as alternates for cement and their effect on physical and mechanical properties were tested. It was observed that compressive strength increase when marble powder use up to 10%. For glass powder up to 5% to 10% compressive strength increases and for 10% it was maximum. So the optimum percentage for waste class and marble is up to 10%.

Rajni, Vipasha Rishi, Himanshu Guleria (2019) [13] In this research waste foundry sand and marble dust powder used as partial replacement for sand and cement respectively and tested for strength characteristics. It was observed that better results are at 10% of marble dust powder and waste foundry sand at 25% replacement and after that strength decreasing. Research also shows that waste marble powder represents good performance due to proficient micro filling ability.

Tamires Galvao Tovaes Pereira et al (2020) [14] In this research coconut fibres and quartzite waste was used in fibre cement production. It was observed that modulus of fineness of quartzite is 0.88 and it has filler characteristics after adding these two materials in concrete it can be an option for more resistant and more sustainable fibre cement concrete. This addition also leads to reduce mining waste and environmental impacts.

4. CONCLUSIONS

From the study it can be observed that MDP and QDP have positive effects on various properties on concrete when replaced at a specific quantity. From study it was observed that there is very less findings on use of quartzite in concrete. Conclusion of the following study can be explained for MDP and QDP as

4.1 Effect of Marble Dust Powder in Concrete

- Upto 15% replacement of cement with Marble Dust Powder in concrete shows positive effects on strength of concrete.
- 10% replacement of cement with MDP in concrete shows highest increase in compressive strength i.e. by 14.2% increase.
- Addition of MDP increases specific gravity of concrete.
- Steel concrete bond strength increases with addition of MDP in cement.
- Porosity decreases with use of MDP in concrete as compare to standard concrete.
- 25% replacement of MDP with cement leads to low slump value.

4.2 Effect of Quartzite Dust Powder in Concrete

- More we increase quartzite replacement with fine aggregates workability starts to decrease due to high water absorption in quartzite powder.
- Bulk density of concrete decreases with addition of QDP in concrete as partial replacement for fine aggregates.
- QDP leads to smooth surface of concrete when replaced with sand as compare to standard concrete samples.
- 100% of replacement of QDP with sand can be done in concrete and positive can be seen.
- There is increase in compressive strength of concrete by 18.6% when replaced by 100% MDP with sand.
- Quartzite has higher water absorption ratio as compare to natural sand and this leads to more consumption of water in concrete.

REFERENCES

- [1] Aruntaş, H.Y., Gürü, M., Dayı, M. and Tekin, I., 2010. Utilization of waste marble dust as an additive in cement production. *Materials & Design*, 31(8), pp.4039-4042
- [2] Aliabdo, A.A., Abd Elmoaty, M. and Auda, E.M., 2014. Re-use of waste marble dust in the production of cement and concrete. *Construction and building materials*, 50, pp.28-41.
- [3] Sharma, U., Khatri, A. and Kanoungo, A., 2014. Use of waste marble dust in Concrete. In National Conference on Sustainable Infrastructure Development, Chandigarh
- [4] Babu, K.S. and Kumar, G.N., 2014. Effect of Crushed Quartzite on Self-Compacting Concrete. *International Journal of Science and Research*, 4, pp.782-785.
- [5] Shareef, U., Cheela, V.S. and Raju, S.G., 2015. Study on Physical and Mechanical Properties of Quartzite and Silico-Manganese Slag as Alternative Material for Coarse Aggregate. *International Journal for Scientific Research and Development*, 3, pp.72-74.
- [6] Kavitha, K., Cheela, V.S. and Raju, G., 2015. Utilization of Quartzite as Fine Aggregate in Concrete. *E-Journal of Science and Technology*, 10, pp.45-53.
- [7] Mrs. Shalaka S. Utkar., 2016. USE OF MARBLE POWDER AS A PARTIAL REPLACEMENT OF CEMENT. *International Journal of Advance Research in Science and Engineering*, vol. no. 5, issue no. 12.
- [8] Gopi, R., 2017. Study on Marble Powder as Partial Replacement of Cement in Concrete. *Global Resey and Development Journal for Engineering*.
- [9] Tayeh, B.A., 2018. Effects of marble, timber, and glass powder as partial replacements for cement. *Journal of Civil Engineering and Construction*, 7(2), pp.63-71.
- [10] Ofuyatan, O.M., Olowofoyeku, A.M., Obatoki, J. and Oluwafemi, J., 2019, November. Utilization of marble dust powder in concrete. In *IOP Conference Series: Materials Science and Engineering* (Vol. 640, No. 1, p. 012053). IOP Publishing.
- [11] Suresh, S. and Revathi, J., 2019. An Experimental Examination on Mechanical and Durability Properties of Cement Replacing with Marble Powder. *International Journal of Innovative Technology and Exploring Engineering*
- [12] Belouadah, M., Rahmouni, Z.E.A. and Tebbal, N., 2019. Influence of the addition of glass powder and marble powder on the physical and mechanical behavior of composite cement. *Procedia Computer Science*, 158, pp.366-375.
- [13] Rajni, V.R. and Guleria, H., 2019. Experimental Approach on Strength Characteristics of Concrete on Partially Replacing Sand with Waste Foundry Sand and Cement with Marble Dust Powder. *International Journal of Innovative Technology and Exploring Engineering*
- [14] Pereira, T.G.T., Silva, D.W., Eugênio, T.M.C., Scatolino, M.V., de Carvalho Terra, I.C., Fonseca, C.S., Bufalino, L., Mendes, R.F. and Mendes, L.M., 2020. Coconut fibers and quartzite wastes for fiber-cement production by extrusion. *Materials Today: Proceedings*.
- [15] IS 456 – 2000 “Plain and reinforced concrete code of practice”
- [16] IS 10262-2009 and SP: 23:1982 “Recommended Guidelines for Concrete mix. Bureau of Indian standards, New Delhi.”