A Review on Utilization of Dolomite Powder in Mortar and Concrete as a Pozzolanic Material

Shrinivas K. Sontakke[1] Amardip B. Dehane[2]
[1]M. Tech Research Scholar [2]Assistant Professor
[1,2]Department of Civil Engineering
[1,2]Bapurao Deshmukh College of Engineering, Sevagram, Wardha, MH, India

Abstract— Concrete is a one of most versatile construction materials used since hundreds of years. Concrete production needs natural resources, which is diminishing the production of natural resources and energy day by day. This cement manufacturing companies are one of the primary producers of carbon dioxide, a potent greenhouse gas and responsible for global warming. The cost of concrete materials in building and civil engineering project has been a concern to the society. This requirement is drawn the attention of investigators to explore new replacements of ingredients of concrete. Several experimental studies have been carried out to find effective replacement for these raw materials of concrete to reduce cost, effect to the atmosphere. By considering all these aspects and need of present Dolomite powder can be beneficially used as a partial replacement of cement in concrete. The primary objective of this paper is to quantify the 7th, 14th & 28th Days desirable properties of concrete at various replacement levels with the help of literature review found and studied. This study includes previous investigation done on the mechanical and chemical properties of concrete produced using partial replacement of cement by dolomite powder So as to produce Eco-friendly concrete having similar or higher strength.

Keywords: ordinary Portland cement (53 Grade), dolomite powder

I. INTRODUCTION

Concrete is the most popular building material in the world. Concrete plays a vital role in the development of infrastructure Viz., buildings, industrial structures, bridges, highways and Dams etc. leading to utilization of large quantity of concrete. Concrete is known to be the most wide spread structural material due to its quality to shape up in various geometrical configurations. It is a mixture of cement, fine and coarse aggregates and water. These materials possess problems of disposal, health hazards and aesthetic problems. The global consumption of cement is getting higher due to its extensive use in concrete. Over 5 billion tone's of cement is produced in the world per year. However, the production of cement is diminishing the limestone reserves in the world and also requires a great consumption of energy. River sand has been the best choice as a fine aggregate component of concrete in the past, but overuse of the material has led to environmental concerns, the depleting of river sand deposits and a high increase in the price of material. Thus there is the need to search for local materials as alternatives for the construction of functional but low-cost buildings in both rural and urban areas. Therefore Engineers and technologists looked forward for finding out the best alternative for the upcoming need of future and to develop sustainably same as a conventional material. Considerable strides over the last two or three decades with regard to trials in the use of one or another Cementitious materials generally identified as Pozzolanas, for the compounding of various cement based products. These have not only resulted an improving the compressive strength but also in qualities like ability to set and harden under water. Among these coal fly-ash, blast furnace slag, rice hulk ash, silica fume, or meta- kaolin, Copper slag, marble dust are the most common ones. As per composition it is thought that Dolomite powder will benefit the chemical& mechanical properties of ordinary Portland cement (both in fresh & hardened state). Dolomite powder obtained by powderising the sedimentary rock forming mineral dolostone can be used as a replacement material for cement in concrete up to certain percentage. This chemical change is known as "dolomitization." Dolomite is a carbonate material composed of calcium magnesium carbonate $CaMg(CO_3)_2$. Dolomite is a rock forming mineral which is noted for its remarkable wettability and dispersibility. Dolomite has a good weathering resistance. Dolomite is usually preferred for construction material due to its higher surface hardness, strength and density. Concrete applications prefer dolomite as a filler material due to its higher strength and hardness. By the effective utilization of dolomite powder, the objective of reduction of cost of construction as well as better durability to structure and strength can be achieved.

A. Objectives

- To enhance the property of concrete.
- To minimize the use of conventional material.
- To Achieve Good strength by using dolomite powder as partial replacement of cement in concrete.

II. LITERATURE REVIEW

1) Preethi Getal (2015), researcher carried out an investigation on effects of using dolomite powder as a partial replacement material to cement. The dolomite powder was replaced at 0%, 5%, 10%, 15%, 20% and 25% with cement of M20 grade. The compressive, split tensile and flexural strengths of concrete with dolomite powder were compared with those of the reference specimens. The results indicated that as the percentage replacement of cement with dolomite powder increases, the compressive, the split tensile and the flexural strengths, reach a maximum value and then decrease. The maximum compressive and flexural strength was obtained at a replacement of 10% and was found to be 31.24 N/mm2 and 8.48 N/mm2 respectively. The maximum tensile strength was obtained at 15% replacement and it was found to be 4.25 N/mm2. The maximum increase in 28th day compressive and flexural strength was found to be 10.4% and 17.8%

respectively. The percentage increase in split tensile strength was 39.8%. Use of dolomite powder decreases the cost of concrete. Since the cost of dolomite is less than that of cement.

2) Deepa Bala krishnan S and Paulose K.C (2013), carried out an investigation on the workability and strength characteristics of self compacting concrete containing fly ash and dolomite powder. They made high volume fly ash self compacting concrete with 12.5percent, 18.75percent, 25percent and 37.5percent of the cement (by mass) replaced by fly ash and 6.25percent, 12.5percent and 25percent of the cement replaced by dolomite powder. For all levels of cement replacement, concrete achieved superior performance in the fresh and hardened states when compared with the reference mixture.
3) J. Satheesh Kumar, G. Palaniselvan, D. Jayganesh, & J. Vijayaraghavan (2016), the work is focused on M20 grades of concrete. The percentage of Dolomite powder that replaced cement in this investigation are 0%, 5%, 10%, 15% and 20%. The fresh property is workability and hardened properties are compressive strength, flexural strength, split tensile strength have been carried out with the evidence of FTIR, SEM, EDAX. After performing the test they concluded At low percentage, from 5 to 15%, dolomite additive plays the role of active component or even acts as cement replacement. At higher amount the "dilution" effect occurs.
4) K. Sathish kumar, K.Anitha (2017), carried out investigation by the replacement percentages of cement by dolomite powder is 20%, 25% & 30% and fine aggregate by copper slag is 20% by the weight of M20 grade concrete. The dolomite powder and copper slag is mixed with natural cement and fine aggregate in the grade of M20 with the mix proportion of 1:1.5:3. The concrete cubes and cylinders were casted with varying content of dolomite powder and copper slag. The test specimens were cured and tested for compressive strength and split tensile strength in 7 days, 14 days & 28 days for concrete. The use of dolomite powder and copper slag increased the compressive and tensile strength of concrete The compressive strength for M20 grade concrete is 27 and it is increased by replacement of 20% copper slag with 20%, 25% & 30% of dolomite powder. Thus, the use of these eco-friendly materials has changed waste into wealth.
5) A. Muthukumaran (2017), carried out investigation by the replacement percentages of cement by dolomite powder is 10%, 20% & 30% and fine aggregate by M-sand is 10%, 20% & 30% by the weight of M25 grade concrete. By the experimental investigation it can be concluded that Replacement of dolomite powder and m-sand is found to improve the strength of concrete. The target mean of M25 grade concrete is 31.6 N/mm2. The optimal replacement percentage of cement with dolomite powder 10% and sand with m-sand 10%, when the compressive strength is 36.55 N/mm2. The optimal replacement percentage of cement with dolomite powder 10% and sand with M-sand 10%, when the Split tensile strength is 2.96 N/mm2. The optimal replacement percentage of cement with dolomite powder 10% and sand with M-sand 10%, when the Flexural strength is 3.84N/mm^2.
6) Kamal M.M, et al (2012) evaluated the bond strength of self compacting concrete mixes containing dolomite powder. Either silica flume or fly ash was used along with dolomite powder to increase the bond stength considerably. The result showed that the bond strength increased as the replacement of Portland cement with dolomite powder increased. All SCC mixes containing dolomite powder up to 30 % yielded bond strength that is adequate for design purpose. They reported that the shear strength of RC beams were better than that of the conventional SCC without dolomite powder. Shanmugapriya et al. (2012), concluded from experimental researchers that compressive and flexural strength of concrete can be improved by partial replacement of cement by silica fume and manufactured sand for natural fine aggregates. They suggested that optimum replacement of natural sand by manufactured sand is 50%.Saeed Ahmad et al.(2008), have found that compressive strength of various mix ratios increased from 7% to 33% whereas workability decreased from 11% to 67% with increasing proportion of manufactured sand. Shyam Prakash et al. (2007), says that manufactured sand satisfies the requirements fine aggregates such as strength, gradation, shape angularity. It is also possible to produce manufactured sand falling into the desired grade. They say that the mechanical properties of manufactured sand depend upon the source of its raw material, i.e., parent rock. Hence the selection of the quarry is very important to quality fine aggregate.
7) Marija Jelcic Rukavina, Issn-1330-3651 fresh and hardened properties of self-compacting concretes made with dolomite filer and mineral additives as cement replacement were investigated. For that purpose, seven self-compacting concrete mixtures were prepared. The binder for the control of self-compacting mixture included ordinary Portland cement (PC) and dolomite filler (D), while in six other mixtures, beside cement and dolomite, part of the cement was replaced with 5 ÷ 15 % of metakaolin (MK) and 20 ÷ 40 % fly ash (FA)(by weight). Fresh properties included filling, passing ability and segregation resistance of SCC, while the hardened properties included compressive strength and modulus of elasticity development up to 365 days.
8) Salim Barbhuiya (2011) carried out an investigation to explore the possibilities of using dolomite powder for the production of SCC. Test results indicated that it is possible to manufacture SCC using fly ash and dolomite powder. The mix containing fly ash and dolomite powder in the ratio 3:1 was found to satisfy the requirements suggested by the European Federation of Producers and Contractors of Specialist Products for Structures (EFNARC) guidelines for making SCC. Compressive strengths of SCC with 75% flyash and 25% dolomite powder was found to be satisfactory for structural applications.
9) L.Ranjith Kumar, J.Kiran, P.Rangarajan (2017), The work was carried out to describe the effect of fine ground dolomite on important physical and mechanical

properties of concrete. Dolomite powder has some similar characteristics of cement. The replacement percentages tried were 0%, 5%, 10%, 15% and 20% by weight of cement. The compressive, split tensile and flexural strengths of concrete with dolomite powder were compared with those of the reference specimens. The results indicate that replacement of cement with dolomite powder increases the compressive, split tensile and flexural strengths of concrete. Replacement of cement with dolomite powder is found to improve the strength of concrete. The optimal replacement percentage of cement with dolomite powder is found to be 5% and at this replacement level, the maximum increase in the 28th day compression and flexural strength were found to be 5.84% and 2.73% respectively. In case of split tensile strength, the optimal replacement is 5% and at this replacement level, the percentage increase in split tensile strength was found to be 2.74%.

10) Athulya Sugathan (2017), This paper examines the possibility of using dolomite powder as a partial replacement material to cement. The replacement percentages tried were 0%, 5%, 7.5%, 10% and 15% by weight of cement. The compressive and split tensile strength of concrete with dolomite powder was compared with those of the reference specimens. The results indicate that replacement of cement with dolomite powder increases the compressive and split tensile strength of concrete. The Compressive strength of Cubes are increased with addition of dolomite powder up to 15% replaced by weight of cement and further any addition of dolomite powder the compressive strength decreases. The Split Tensile strength of Cylinders are increased with addition of dolomite powder up to 15% replaced by weight of cement and further any addition of dolomite powder the Split Tensile strength decreases. We found out the optimum percentage for replacement of dolomite powder with cement and it is 7.5% cement for both cubes and cylinders.
11) Shaikh Mohtasim M.A, Sanap S.T. (2018), the project work examines the possibility of using dolomite powder as a partial replacement material to cement. The replacement percentages tried were 0%, 10%, 20%, 30% and 40% by weight of cement. The compressive, split tensile, flexure strength & modulus of elasticity of specimen with dolomite powder compared with those of the reference specimens. The result 7, 28 & 56 days curing indicates that partial replacement of cement with dolomite powder has increased that the respective strength of concrete. As a result of study Dolomite is an economical substitute for cement in construction industry. Use of Dolomite increases mechanical as well Elastic Properties of Concrete when replaced in optimum percentage. Environmental burden can be reduced efficiently using dolomite.
12) Bhavin k, et al (2013) presented the details of the investigation carried out on paver blocks made with cement, dolomite block and different percentages of polypropylene fibers. They reported that addition of 0.3% and 0.4% of polypropylene fibers improved the abrasion resistance and flexural strength of paver block.

III. Research Methodology

The proposed work is planned to be carried out in the following manner.

- Collection of materials.
- Testing of materials.
- Mix design.
- Batching of material.
- Mixing.
- Casting of concrete.
- Testing.
- Compilation of results.
- Conclusion.

References

[1] V Bharathi,., R. J. V., Subramania, R. Regupathy, and C. Seenivasa, (2009).Workability and strength study of high volume fly ash self- concrete, The Indian Concrete Journal, 83, 17-22. [2] EFNARC (2002), “Specification and Guidelines for Self Compact Concrete” EFNARC (Eurepean Federation of producers and Applications of Specialist Products for Structures).
[2] C. Sangeetha (2017), Performance of concrete using dolomite & vermiculite as partial replacement of cement and fine aggregate, international journal of Engineering Research & Technology, ISSN: 2278-0181.
[3] Deepa Balakrishnan S., Paulose K.C. (2013), American Journal of Engineering Research (AJER), e-ISSN: 2320-0847 p-ISSN: 2320-0936 Volume-2 pp-43- 47.
[4] Marija Jelcic Rukavina, Ivan Gabrijel, Dubravka Bjegovic, (2015), “Modifications of dolomite-based self-compacting concrete properties using mineral additives”, Technical Gazette 22, 1, pp 233-240.
[5] G.Latha, (2015), “Experimental Investigation on Strength Characteristics of Concrete Using Waste Marble Powder as Cementitious Material”, IJIRSET, Vol.4, Issue 12, pp 12691-12698.
[6] Ranjith Kumar L, Kiran J, Rangarajan P, (2017), “Properties of Concrete Incorporating Dolomite Powder”, IOSR-JMCE, Vol.14, Issue 2 Ver II, pp 78-80.
[7] Salim Barbhuiya, "Effects of fly ash and dolomite powder on the properties of self-compacting concrete”, Construction and Building Materials, Volume. 25, 2011, pp.3301-3305
[8] K. Bhavin, Kashiyani, Jayeshkumar pitroda, and K. Bhavnaben Shah, “Effect Of Polypropylene Fibers on Abrasion Resistance and Flexural Strength for Interlocking Paver Block”, International Journal of Engineering Trends and Technology(IJETT), Volume. 4, 2013, pp. 1837-1843.

