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A REVIEW OF ECO FRIENDLY BLOCKS PRODUCTION BY USING KOTA STONE CHIPS

[1]RAMANI H.D., [2]DR.PITRODA J.R., [3]DR.VYAS C.M.

[1] Student of final year, M.E. (Construction Engineering& Management), B.V.M. Engineering College, Vallabh Vidyanagar, Gujarat, India
[2] Assistant professor, Civil Engineering Dept., B.V.M. Engineering College, Vallabh Vidyanagar, Gujarat, India
[3]Assistant professor, Civil Engineering Dept., A. D. Patel Institute of Technology, New Vallabh Vidyanagar, Gujarat, India

ramanihiren93@gmail.com

ABSTRACT*: India is a pioneer in the exploration, mining of commercial rock deposits and in establishing a firm base for stone industry. Of the 300 varieties of stone; being traded in the world market, nearly half of them are from India. The study concerns mainly on the possible use of stone waste in construction industry, which would reduce both environmental impacts and the production cost. Concrete works in the construction industry are particularly important as it is not only responsible for consuming natural resources and energy but also its capacity to absorb other industrial waste. The main objective of this investigation is to increase the strength and permeability of concrete blocks and decrease the cost of concrete blocks by replacing aggregates and cement with the kota stone chips and kota stone sludge also include the granite chips for the replacement of the aggregates. This paper describes the literature which is based on concrete blocks and concrete in which industrial waste like kota stone chips, kota stone sludge and granite chips are partially replaced by aggregates and cement in concrete or in concrete blocks. This paper provides a review of research era in the area of concrete blocks.*

KEYWORDS: Concrete, industrial waste, concrete blocks, Kota stone chips, Eco friendly

1. INTRODUCTION

In both developed and developing countries waste management problem has already become severe. The problem is compounded by the rapidly increasing amounts of industrial wastes of a complex nature and composition. Energy plays a crucial role in the growth of developing countries like India. In the context of low availability of non-renewable energy resources coupled with the requirements of large quantities of energy for Building Materials like cement, the importance of using industrial waste cannot be underestimated. Many research organizations are doing extensive work on waste materials concerning the viability and environmental suitability. Recent researchers aimed at the conservation in the cement and the concrete industry focused on the use of waste materials waste glass such as glass powder, hypo sludge, ceramic waste, Kota stone chips, granite waste, rice husk ash such as fly ash, slag, silica fume in concrete to increase the strength and permeability of concrete. Many researchers have made attempts to use the waste materials to reduce the disposal problems and to improve the mechanical properties of concrete.

Concrete works in the construction industry are particularly important as it is not only responsible for consuming natural resources and energy but also its capacity to absorb other industrial waste. Presently large amounts of stone wastes are generated in natural stone processing plants with an important impact on the environment due to its disposal. Stone chips aggregate are generated as a waste during the process of cutting and polishing of Marble/Granite/Kotastone. The producing useful shape of stone the various stone wastes are coming out from the various processes in stone industries. From the preliminary waste named as stone chips, due to minimum cost it is taken out to replace the natural basaltic coarse aggregate utilization in concrete. In current time natural basaltic aggregate are using and as it is costly, so it's required to replace by stone waste such as stone chips conserves basaltic aggregate reduces the impact on landfills and for sustainable development. Decreases energy consumption and can provide cost savings also. Stone waste as aggregates are the materials for the future.

2. PREVIOUS REASECH REVIEW BASED ON INDUSTRIAL WASTE MATERIAL

Demirel et al. (2010) studied that the unit weight of the concrete increased as a result of the fact that certain proportions of waste marble dust (WMD) had been added to the concrete as very fine aggregate substitutes. This is an expected outcome due to the high specific gravity of waste marble dust (WMD) and filler effect of marble

dust because it has finer particles than fine sand aggregate and also the Compressive strength of the concrete has increased with increasing percentages of marble dust additions at all curing ages.[5]

Rania et al. (2011) stated that the cement brick samples which contain marble and granite waste had sufficient abrasion resistance according to ASTM C902. [18]

Sivakumar et al (2011) carried out an investigation on the mechanical properties of concrete with quarry dust. They reported that the quarry dust may be used as an effective replacement material for natural river sand which increased the strength. [2]

Patel et al. (2013) proved that Stone industry produces large amounts of Stone waste which causes environmental problems. Stone wastes are generated as a waste during the process of cutting and polishing of Marble/Granite/kotastone. The split tensile strength decreases when replacement of stone waste percentage increases when compare to traditional concrete. Replacement of (OPC) cement with this stone waste material provides maximum Split Tensile strength at 20% replacement and replacement of (PPC) cement with this stone waste material provides maximum Split Tensile strength strength at 10% replacement [11]

Patel et al. (2013) found that the investigation on strength of concrete and optimum percentage of the partial replacement by replacing OPC cement via 0%, 10%, 20%, 30%, 40% and 50% of stone waste so replacement of OPC cement with this stone waste material provides maximum compressive strength at 30% replacement. [12]

Selva et al. (2013) carried out an investigation on quarry dust, concrete with chemical admixture. They reported that the quarry dust improves the mechanical properties of concrete when used along with super plasticizers and also usage of quarry dust it will also reduce the cost of concrete because it is a waste material from quarries. [19]

Nagpal et al (2013) studies the strength and behavior of concrete by using crushed rock dust as fine aggregate, they investigated the possibility of using crushed rock as a 100 % replacement for Sand, with variable compacting factor. [6]

Rajgor et al. (2013) concluded that percentage of stone waste increases, compressive strength increases up to a certain point and maximum strength at the 30% replacement also Stone waste in brick can solve the disposal problem reduce cost and produce a greener Eco-friendly bricks for construction. [17]

Patel et al. (2013) carried out an investigation on an exploratory study on stone waste as foregoing alternatives for green concrete. They reported that the split tensile strength increased up to 20% replacing of stone waste in the PPC and Compressive strength increase when replacement of stone waste percentage increases when compare to traditional concrete. [13]

Patel and Raval et al. (2013) found that Compressive strength of the concrete has increased with increasing percentages of marble dust additions. [14]

Patel et al. (2013) Marble waste is generally a high polluting waste due to both its high alkaline nature, and its manufacturing, processing techniques, which impose a health threat to the surroundings and During the cutting process 33% waste can be produced. And this waste is used for making other important material or items like bricks, blocks, etc. Uses of marble waste in concrete can save the stone industry disposal costs and produce a 'greener' concrete for construction. [15]

Vekariya et al. (2013) found that natural basaltic aggregate are using and as it is costly, so it's required to replace by stone waste such as stone chips conserves basaltic aggregate reduces the impact on landfills and for sustainable development. Decreases energy consumption and can provide cost savings also. Stone waste as aggregates are the materials for the future [23]

Saiyed et al. (2013) conclude that Presently large amounts of stone wastes are generated in natural stone processing plants with an important impact on the environment due to its disposal. Stone chips aggregate are generated as a waste during the process of cutting and polishing of Marble/Granite/Kotastone and Stone chips are providing a cost effective alternative to conventional natural aggregates by reducing the cost of concrete. [20]

Lakhani et al. (2014) inferred that stone waste can be utilized for developing low cost building materials such as block, brick, tiles etc., [8]

Arshad et al. (2014) stated that The Marble Slurry Wastes (MSW) produced by marble industry are left unattended in the environment which causes serious environmental problems. The primary chemical composition of the MSW indicated that it contains high contents, nearly 97% of lime (CaO) and compressive and splitting tensile strength of concrete was observed to be increased by 15% and 6% by the addition of 10% MSW. A similar increase in strength was also observed by adding the 20% of MSW additionally to the normal 1:2:4 concrete. [1]

Lakhani et al. (2014) conclude that The utilization of stone waste, in the form of a mineral admixture as a pozzolanic and non-pozzolanic material for mortar and concrete so it can be inferred that stone waste can be utilized for developing low cost building materials such as block, brick, tiles etc., [9]

Sakalkale et al. (2014) studied that Marble powder is produced from processing plants during the sawing and polishing of marble blocks and about 20 - 25% of the processed marble is turn into powder form. Dispose of the marble powder material from the marble industry is one of the environmental problems worldwide today and

With the inclusion of Marble powder upto50%, there is a 10.72 % increase in compressive strength and 13.13% increase in flexural strength for 28 days curing. [21]

Malpani et al. (2014) concluded that the replacement of the Marble Sludge Powder and Quarry Rock Dust as replacement of the fine aggregates in concrete gives better results in strength as well as The concrete achieves more bonding (results not shown) with steel and it is observed that in normal concrete corrosion may occur at 28 days but this can be avoided by using marble sludge powder and quarry rock dust. [10]

Thirougnaname et al. (2014) concluded that compressive strength at 28 days of unprocessed stone dust used as fine aggregate in concrete gives 35% higher strength for M15 and 4% for M20 grade concrete when compared to the reference concrete. [7]

Pathan et al. (2014) proved that The physical and chemical properties of marble dust are suitable for use in concrete and also Compressive strength and Split Tensile strength of Concrete can be increased with addition of waste marble powder up to 10% replace by weight of cement. [16]

Anwar et al. (2014) found that the 28-day compressive strength with the optimal percentage for replacement of cement with marble dust powder was increased about 10% of the conventional strength. It resulted as less on the production of carbon dioxide and solving the environmental pollution from cement production, thereby enhances the urban surroundings. [4]

Singh et al. (2015) conclude that There is an increase in the Compressive strength of the concrete produced from waste marble powder as partial replacement of cement up to 10% and crushed tile aggregate as partial replacement of natural coarse aggregate up to 30%. And also There is a decrease in the compressive strength of concrete if the replacement level increased from 10% to 15% for waste marble powder and 30% to 45% of tile aggregates. [22]

Adanagouda et al. (2015) found that quarry dust can be used as an alternative material to the natural river sand. The physical and chemical properties of quarry dust satisfy the requirements of fine aggregate. It is found that quarry dust improves its mechanical property of concrete if used along with super plasticizer. [3]

Following fig 1 shows the development related to use of the waste materials in concrete.

Figure 1: Historical development related to the use of waste materials in concrete

3.MAJOR FINDINGS OF THIS LITERATURE REVIEW

From above literature review identified the various different industrial waste materials they are used in the concrete for the different purpose and properties.

- Various industrial wastes like marble, granite, stone waste, Kota stone chips, crushed rock aggregates, marble slurry are used as the replacement of the various ingredients of the concrete.
- Due to the high specific gravity of waste marble dust (WMD) and also filler effect of marble dust because it has finer particles than fine sand aggregate and also the Compressive strength of the concrete has increased with increasing percentages of marble dust additions at all curing ages.[5]
- Marble and granite waste had sufficient abrasion resistance. [18]
- The split tensile strength decreases when replacement of stone waste percentage increases when compare to traditional concrete. Replacement of (OPC) cement with this stone waste material provides maximum Split Tensile strength at 20% replacement and replacement of (PPC) cement with this stone waste material provides maximum Split Tensile strength at 10% replacement. [11]
- Replacement of OPC cement with this stone waste material provides maximum compressive strength at 30% replacement. [12]
- Percentage of stone waste increases, compressive strength increases up to a certain point and maximum strength at the 30% replacement also Stone waste in brick can solve the disposal problem reduce cost and produce a greener Eco-friendly bricks for construction. [17]
- The compressive strength of the concrete has increased with increasing percentages of marble dust additions. [14]
- Stone chips aggregate are generated as a waste during the process of cutting and polishing of Marble/Granite/Kotastone and Stone chips are providing a cost effective alternative to conventional natural aggregates by reducing the cost of concrete. [20]
- The primary chemical composition of the Marble Slurry Wastes (MSW) indicated that it contains high contents, nearly 97% of lime (CaO) and compressive and splitting tensile strength of concrete was observed to be increased by 15% and 6% by the addition of 10% MSW. [1]
- Dispose of the marble powder material from the marble industry is one of the environmental problems worldwide today and With the inclusion of Marble powder upto50%, there is a 10.72 % increase in compressive strength and 13.13% increase in flexural strength. [17]
- Unprocessed stone dust used as fine aggregate in concrete gives 35% higher strength for M15 and 4% for M20 grade concrete when compared to the reference concrete. [7]

Refrence	Original Material	Replace Material	Percentages	Optimum Percentage
Demirel (2010)	Fine sand	Waste marble dust	0%, 25%, 50%, 100%	100%
Rania (2011)	Cement	Marble and granite slurry	10-40%	10%
Sivakumar(2011)	Sand	Quarry dust	100%	100%
Patel (2013)	Cement(opc,ppc)	Stone waste	0-50%	OPC-20%,PPC-10%
Patel (2013)	OPC cement	Stone waste	0-50%	30%
Selva (2013)	Fine aggregate	Quarry dust	0%, 10%, 20%, 30%, 40%, 50%, 100%	100%
Nagpal (2013)	Fine aggregate	Crushed stone dust		
Rajgor (2013)	Fly ash	Stone waste	0-60%	30%
Patel (2013)	PPC cement	Stone waste	0-50%	20%
Patel and Raval (2013)	Fine aggregate	Marble waste	0-20%	15%
Patel (2013)	All material	Marble waste	100%	100%
Vekariya (2013)	Coarse aggregate	Stone Chips(kotastone/ Granite/ Marble) , Natural Basaltic Aggregate		
Saiyed (2013)	Aggregate	Stone chips	10-50%	30%
Lakhani (2014)	Cement	Marble,lime stone,granite stone	0-20%	20%

		waste		
Arshad (2014)	Cement	Marble slurry waste	0-100%	7%
Lakhani (2014)	Cement	Marble,lime stone,granite stone waste	20-40-60	20%
Sakalkale (2014)	Sand	Waste marble powder	0-25-50-100%	50%
Malpani (2014)	Fine aggregate	Quarry stone dust	0-100%	40%
Thirougnaname (2014)	Fine aggregate	Unprocessed stone dust		
Pathan (2014)	Cement	Waste marble powder	10%	10%
Anwar et al. (2014)	Cement	Marble dust powder	0-25%	10%
Singh et al. (2015)	Cement,fine aggregate	Waste marble powder,tile aggregates	0-50%	10%(cement)-30%(agg.)
Adanagouda et al. (2015)	Sand	Stone waste	0-100%	30%

4. CONCLUSION

It is clear that by using waste material by partial replacement of aggregates and cement in concrete, overall cost of making of concrete can reduce. It can also reduce the disposal problems of waste materials and also consume the aggregates and cement used for making of concrete. When aggregates and cement is replaced by various industrial waste compressive strength, flexural strength and split tensile strength is increased up to the some percentages of the replacement and after that decreases in the strength of the concrete. Also from this litreture we conclude that very less work on the kota stone waste so in future there is a large scope of research on kota stone waste use in concrete.

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