STUDY ON EFFECTIVE UTILIZATION OF CERAMIC WASTE AS A RAW MATERAIL IN CONCRETE

R.Ranjith Assistant Professor, Department of Civil Engineering Narayana Engineering College(Autonomous) Gudur, Andhra Pradesh, India.
S.Srinivasulu, B.Vivek Sanjeev , G.Dileep, P.Satheesh Kumar, V.Rajasekhar UG Students, Department of Civil Engineering Narayana Engineering College (Autonomous) Gudur, Andhra Pradesh, India.

ABSTRACT-- This paper presents the ceramic waste by replacing the coarse aggregate. Concrete is a versatile engineering composite material made with cement, aggregates and admixtures in some cases. Due to the increasing demand of construction material and degradation of environment, there is needed to explore alternative construction material from industrial as well as household waste and recyclable materials. Ceramic wastes are often dumped as waste material after it becomes useless. But it can recycle and can be used as a construction material in present world which is seeking for alternative construction materials which is economical. This report is to study the suitability of waste crushed ceramic in the concrete mix .In this experimental study, different mixes are casted, waste crushed ceramic are used to partially replace the coarse aggregate by 5%,10%,15% ,20%,25%,30%. According to this total 6 types of mixes of M20 grade were prepared. A brief study on workability and compressive strength for 7, 14 and 28 days of all total 6 types of mixes has been carried out and will observed that increase in ceramic waste leads to the increase in strength and workability of concrete like Ready Mix Concrete (RMC).
Keywords: Ceramic waste, broken tiles, Compressive strength, Split Tensile Strength and Modulus of Elasticity.

1. INTRODUCTION

Natural sources required for various constructions are getting depleted at a rapid rate, due to which there is always a rise in their price. This led the engineers and researchers in finding other substitutes for the production of construction materials keeping in mind of maintaining the quality, strength and durability. One of the most important constituents of concrete being coarse aggregate the fact being that it occupies 70-80% of the volume of concrete; thus making a big impact on the characteristics and properties of concrete.

However, with the urbanization and rapid rise in the population especially in a country like India the demands for this particular construction material cannot be met easily. Hence, to overcome this problem is by using waste products such as waste ceramics.

In India the Ceramic Tile Industry approximate worth is Rs.21,000 Crore and was reported, the Indian Ceramic Tiles industry grew by around 11% in 2013-14 and expected to reach a size of Rs.301 billion by 2016. As in a present report of *Global Ceramic Tiles Market* of February 2016, the global ceramic tiles market will grow at a CAGR(Compound Annual Growth Rate) of 9.59% during the period of 2016-2020.rd

Globally India is ranked 3 and accounted for over 6% of total global production. Even with a tremendous growth in the ceramic production there is an inappropriate consumption. Thus resulting to a huge wastage which is reported to be around 15%-30% annually, generated from the total production.

Ceramic products are manufactured at extremely high temperatures between 1000°C- 1250°C which results in very hard, highly resistant to chemical, freezing and thermal shock. Considering the properties of ceramics their waste such as broken tiles should be included in concrete as a substitute to conventional construction material. This will help to solve problems like cost, scarcity as well as other environmental issues that may arise due to improper dumping of such waste.

II. REVIEW OF LITERATURE WORKS

R.M. Senthamarai et al. (2005) substituted conventional crushed stone aggregate with ceramic

electrical insulator. Different water cement ratio of 0.35, 0.40, 0.45, 0.50, 0.55 and 0.60 were adopted. Compressive strength, split tensile strength, flexural strength and Modulus of elasticity were found out. It is found that the compressive, split tensile and flexure strength of ceramic coarse aggregate are lower by 3.8%, 18.2% and 6% respectively when compared to conventional concrete.

A.Mohd Mustafa et al. (2008) studied on various types of ceramic waste like flower pots, tiles and clay bricks. Different water cement ratios were adopted such as 0.4, 0.5 and 0.7 with concrete of characteristics strength of 20 MPa. Flower pots gave the best results for compressive strength of about 2.50% lesser than that of conventional concrete.

C. Medina et al. (2012) investigated on the reuse of waste as recycled coarse aggregate in partial substitution of 15%, 20% and 25% in the manufacture of structural concrete. Compressive strength is found out t 7, 28 and 90 days. There is an increase in strength with increase of percentage replacement, the best results shown is at 25% with increase of 21.12%, 11.04% and 6.70% at 7, 28 and 90 days respectively.

R.M.Senthamarai et al. (2011) studied the durability properties of ceramic industry waste as coarse aggregate in concrete. Water cement ratios from 0.35- 0.60 were used and properties such as volume of voids, water absorption, chloride penetration and sorption were studied. Water absorption ranges from 3.74-7.21% whereas that of conventional concrete from 3.1 – 6.52%. Concrete with Ceramic shows higher results in all tests.

T. Sekar (2011) studied on strength characteristics of concrete utilizing waste materials viz: ceramic tiles, ceramic insulator waste and broken glass pieces. Ceramic tiles gave the best results when compared to the other two type of waste. The concrete produced by ceramic tile aggregate produced similar strength in compression, split tensile and flexure as conventional concrete.

Y. Tabak et al. (2012) studied on the mechanical and physical properties of concrete produced form Floor Tiles Waste Aggregate (FTWA). Two samples were made, the first one substitution by Floor Tile Waste Dust (FTDA) and the other a combination of Floor Tile Waste Dust (FTDA) and Floor Tile Waste Aggregate (FTWA).Best result is shown b FTWA substitution. Increase in compression strength is 13.53%, 16.70% and 2.91% for 2, 7 and 28 days. Similarly there is an increase of 23.21%, 0.1% and 19.47% respectively for flexure strength. There is a reduction of specific density and water3 absorption of 0.284Kg/m and 0.158% respectively when compared to conventional concrete.

D. Tavakoli et al. (2013) investigated on the possibility of using ceramic tile in concrete. Coarse aggregate is replaced in the range of 0-40%. There is an increase in compressive strength by 5.13% whereas there is a decrease in slump, water absorption and unit weight by 10%, 0.1% and 2.29% respectively with 10% substitution.

Maya et al. (2014) studied the mechanical properties of roof tiles as coarse aggregate with different ratios of 0.40, 0.45 and 0.50, subjected to elevated temperature. There is a decrease in compressive strength and Split Tensile with increase in water cement ratio and temperature.

Umapathy et al. (2014) studied on Rice Husk Ash(RHA) as cement at 10%, 15% and 20% and waste tiles as coarse aggregate at 20%, 30% and 50%. Compression strength is found out and the best results is with 20% tiles and 10%RHA of 80.60% to that of conventional concrete.

Amir Javed et al. (2015) analysed the compressive and flexural strength of concrete with stone dust as natural sand at 20%, 40%, 60%, 80% and 100% along with ceramic waste as stone aggregate at 20% replacement. It is found that at 40% stone dust and 20% ceramic waste compressive strength reaches upto 77.32% of that of conventional concrete whereas there is an increased in flexure strength by 25.62%.

J.Swathi et al. (2015) partially replaced fine aggregate with copper slag as 20%, 40% and 60% and coarse aggregate with waste ceramic tiles as 10%, 20% and 30%.M40 grade 2 of concrete was used. Compressive strength increased by 7.59N/mm at a combination of 40% copper slag with 10% waste ceramic tiles and also Flexure increased by 4.07%.

III. DISCUSSION

Based on various studies, it is observed that with the inclusion of ceramic waste in concrete the

properties of concrete improves and even far better than conventional coarse aggregate itself. It is observed that in most of the papers the mechanical properties such as compressive, split tensile and flexure have improved. In addition there is a decrease in density thus resulting in a light weight concrete. There is also promising results regarding the durability properties.

IV. CONCLUSION FROM THE REVIEW

- The optimum level of ceramic waste replacement should be between 5 to 30% in order to obtain maximum strength of the concrete.
- The best possible ceramic waste must be found out which will be suitable to be used as a substitute for conventional coarse aggregate.
- Research should be made with ordinary concrete like M15 and M20 as this type of concrete only is commonly adopted, after which research can be carried with high strength concrete.
- The ceramic waste to be used should be deglazed and a lower cement ratio should be adopted so as to achieve the desired targeted strength.

V. REFERENCES

1. R.M.Senthamarai and P. Devadas Manoharan, “Concrete With Ceramic Waste Aggregate”, Elsevier, Cement and Concrete Composites, No. 27, Pp. 910-913, 2005.
2. Mohd Mustafa Al Bakri, M.N. Norazian, H.Kamarudin and G.Che Mohd Ruzaidi, “The Potential of Recycled Ceramic Waste as Coarse Aggregates For Concrete”, Malaysian Universities Conferences on Engineering and Technology, Pp.1-3, 2008.
3. C.Medina, M.I.Sanchez de Rojas and M.Frias, “Reuse of Sanitary Ceramic Wastes as a Coarse Aggregate in Eco-Efficient Concrete”, Elsevier, Cement and Concrete Composites, No.34, Pp. 48-54, 2012.
4. R.M.Senthamarai, P.Devadas Manoharan and D.Gobinath, “Concrete Made From Ceramic Industry Waste: Durability Properties”, Elsevier, Construction and Building Materials, No. 25, Pp. 2413-2419, 2011.
5. T.Sekar, “Study on Strength Characteristics on Utilisation of Waste Materials As Coarse Aggregate in Concrete”, International Journal of Engineering Science and Technology, Vol. 3, No.7, Pp. 5436-5440, 2011.
6. Y.Tabak, M.Kara, E.Gunay, S.t.Yildirimand and S.Yilmaz. “Ceramic Tile Waste As a Waste Management Solution For Concrete”, CRETE 2012.
7. D.Tavakoli, A.Heidari and M.Karimian “Properties of Concrete Produced with Waste Ceramic Tile Aggregate”, Asian Journal Of Civil Engineering, Vol. 14 No.3, Pp. 369- 382, 2013.
8. Shler Saeed Qadir, “Strength and Behavior of Self Compacting Concrete with Crushed Ceramic Tiles as Partial Replacement for Coarse Aggregate and Subjected To Elevated Temperature”, International Journal of Engineering Technology, Management and Applied Sciences, Vol. 3, No. 4, ISSN.2349-4476, 2015.
9. V.Giridhar, H.Sudarsana Rao and G.Ghorpade “Development of Regression Models For Stregth Of Ceramic Waste Aggregate Concrete”, International Journal Of Emerging Trends In Engineering and Development, Vol. 1, N0.5, ISSN. 2249-6149, 2015.

