International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

EXPERIMENTAL INVESTIGATION ON VITRIFIED POLISH WASTE AND RICE HUSK ASH AS PARTIAL REPLACEMENT OF CEMENT

Mr.N.BhaskaraRao, Asst.Professor Department of Civil Engineering Aditya Engineering College Surampalem, India bhaskar.nalli40@gmail.com	E.Rakesh Department of Civil Engineering Aditya Engineering College Surampalem, India rakeshpraveen10@gmail.com	K.Manohar Department of Civil Engineering Aditya Engineering College Surampalem, India manoharmanu1126@gmail.com

Abstract : Rigid pavements are considered superior to other types of pavements due to their ability to with stand traffic loads, thermal stresses acting on the pavement, high flexural strength, durability, and low maintenance cost when compared to flexible pavements. However, Rigid pavements are not a major component of India's transportation system of rules because their construction costs are very high and cement is the primary ingredient. In this study to analyze the optimum replacement of cement with industrially produced materials such as vitrified polish waste (VPW), Rice husk ash (RHA). Mix design is done for varying proportions of Rice husk ash (RHA) and Vitrified polish waste (VPW) as replacement of cement in 0%, 5%,10% 15%, 20% by weight of cement. Specimens were casted, tested and compared in terms of compressive strength and flexural strength to the conventional concrete. These tests were carried out to find out the mechanical properties of concrete such as workability, compressive strength and flexural strength after a curing period of 7days and 28days. Results were obtained at 10 % replacement of cement by Vitrified Polish Waste and Rice husk ash to attained optimum strength of concrete.

Keywords: Vitrified polish waste (VPW),Rice husk ash(RHA),Rigid pavements

1. Introduction:

Vitrified polish waste: Vitrified polish waste can be used as a partial replacement for cement in concrete. Vitrified polish waste is a by product of the polishing process for vitrified tiles, which involves grinding and polishing the tiles with abrasive materials. This process generates a fine powder that contains silica, alumina, and other minerals. When used as a partial replacement for cement, VPW can improve the properties of concrete, such as its compressive strength and durability, while reducing the amount of cement needed. This can lead to cost savings and to the reduced impact on environmental, as cement production is a major contributor to greenhouse gas emissions.

Rice husk ash: Rice husk is one of the waste materials from agricultural industry. Rice husk is the outer shell of rice grain. Rice husk is generating from rice milling industries. The RHA can be blended with ordinary Portland cement to produce concrete. In the present study, Ordinary Portland cement (Grade 53) was replaced by rice husk ash at different percentage such as 2.5, 5, 7.5 and 10% of weight of the cement to find out the suitable percentage of rice husk ash in concrete mix with the help of compressive strength and flexural strength. This can lead to cost savings and to the reduced impact on environmental, as cement production is a major contributor to green house gas emissions and here an attempt is made to use this RHA in cement, there by leading to good quality cement, construction and reducing environmental disposal problems**.**

2. Literature Survey:

Vashisht patil et al. (2020) (1) Studied on partial replacement of cement with Rice husk ash in cement concrete. The tests were carried on M20 grade concrete with replacements by weight of the cement quantity by 0%, 5%, 10%, 15%, 20% and 25% of RHA. Tests were conducted to find out the mechanical properties of concrete such as compressive strength, split tensile strength after a curing period of 7 & 28days. The results indicate that, the maximum compressive strength and split tensile strength is obtained at the 15% optimum replacement of cement with rice husk ash.

Bhargavi et al. (2019) (2) Studied on Effect of Vitrified Polish Waste in Concrete as Partial Replacement to Cement. Mix design is done for varying proportions of 5%, 10%, 15% and 20% and specimens were casted and tested for mechanical properties such as workability, compressive strength, flexural and split tensile strength after a curing period of 7, 14 and 28 days. The maximum strength attained at the mix proportioning of 15% optimum replacement of cement with VPW.

Aneeta Anna Raju et al. (2018) (4) Studied on properties of concrete making partial replacement of cement by ceramic powder. using M30 grade concrete, ceramic powder concrete produced by replacing cement in 5%,10%,15%, 20%,25%,and 30% by weight of cement. Concrete mixtures were produced, tested and compared in terms of compressive strength, split tensile strength and flexural strength to the conventional concrete These tests were carried out to evaluate the mechanical properties after 7, 14 and 28 days. Results showed that 15 % replacement of cement by ceramic powder makes a considerable increase in compressive strength, split tensile strength and flexural strength.

Polin Kumar Sahoo et al. (2017) (5) studied on partial replacement of cement by Rice husk ash in concrete. The tests were carried on M20 grade concrete with replacements by weight of the cement quantity by 0%, 10%, 20% and 30% of RHA. The concrete cubes were casted and tested for Compressive Strength after a curing period of 7, 14 & 28days. S0 they observed 20% is optimum replacement of cement by rice husk ash.

Lakshmayya et al. (2017) (6) Study on design of rigid pavements and its cost benefit analysis by usage of vitrified polish waste and recron polyester fiber. The tests were carried on M40 grade concrete with replacements by weight of the cement quantity by 5%, 10%, 15%, 20%, and 30% of Vitrified polish waste. Tests were conducted to find out the mechanical properties of concrete such as workability compressive strength, split tensile strength after a curing period of 7, 14 and 28days. The results indicate that, the maximum compressive strength and split tensile strength is obtained at the 15% optimum replacement of cement with VPW.

3. Materials and Methodology:

Specification of materials:

Vitrified polish waste: Vitrified polish waste refers to the waste generated from the polishing process of vitrified tiles. Vitrified tiles are ceramic tiles with low porosity and are commonly used for flooring and wall cladding in buildings. Vitrified polish waste is generated during the final stage of the tile manufacturing process, where the surface of the tile is polished using abrasive discs.

Rice husk ash: Rice husk is one of the waste materials from agricultural industry. Rice husk is the outer shell of rice grain. Rice husk is generating from rice milling industries. RHA are contained about 80 to 95% silica, which is highly reactive in different temperature of incineration [600c-800c].

Cement: Cement is a binder, a fine material powder used for all sorts of construction that sets, harden and adheres to other materials to bind them together. Cement is made by grinding together a mixture of lime stone and clay which is heated at a temperature of 1450C.

Coarse aggregate: Coarse aggregates having size ranging from 10mm to 20mm and specific gravity of coarse aggregate 2.93 with water absorption of, grading zone II The tests are carried out on coarse aggregates as per IS 2386.

Fine aggregate: Fine aggregate passing through 4.75mm IS sieve is used and it has a specific gravity of 2.66 with water absorption of 1.02% .The grading zone of fine aggregate is Zone III. Physical properties of fine aggregates determined per IS 2386.

Super plasticizer: super plasticizer also known as high range water reducers, are additives used in making high strength concrete. As super plasticizer is proposed to be used, a minimum of 20% water content can be reduced.

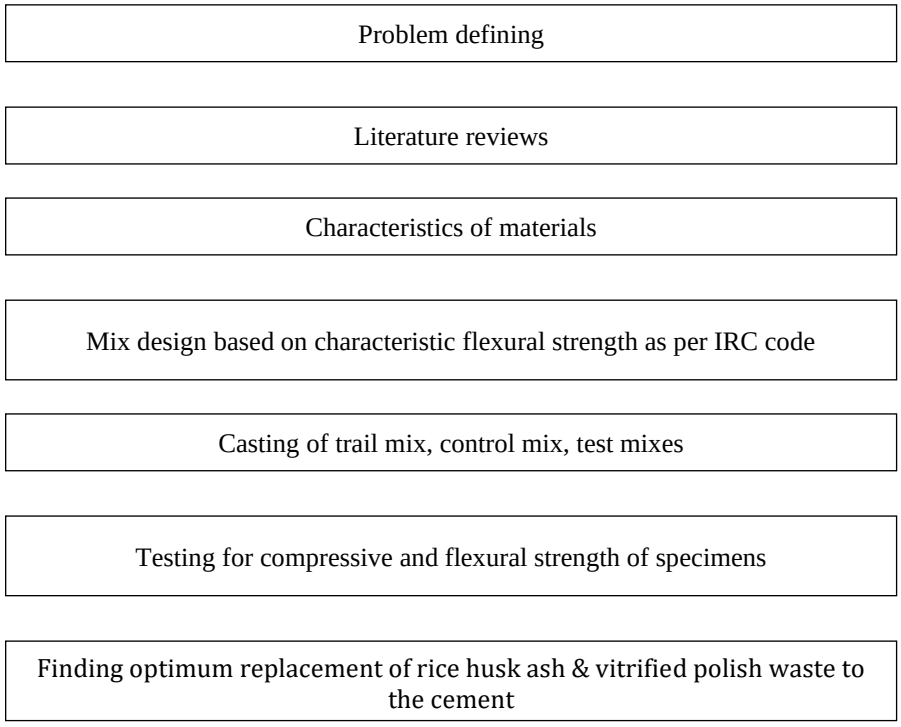

Fig 1: Flow chart of methodology

4. Mix Design:

Table 1: Mix proportion of 1m^3

Cement	388.042 kg/m^3
Fine aggregate	627.363 kg/m^3
Coarse aggregate	1403.02 kg/m^3
Water/cement	0.38
Water	147.456
Super plasticizer	3.686

5. Results and Discussions

Compressive Strength Test:

Table 2. Results of compressive strength

S. No	Mix proportions	Compressive strength (Mpa)	
		7 Days	28 Days
1	C.C	30.05	42.85
2	mix-1	32.48	42.92
3	mix-2	34.57	43.76
4	mix-3	22.17	32.47
5	mix-4	18.14	30.48

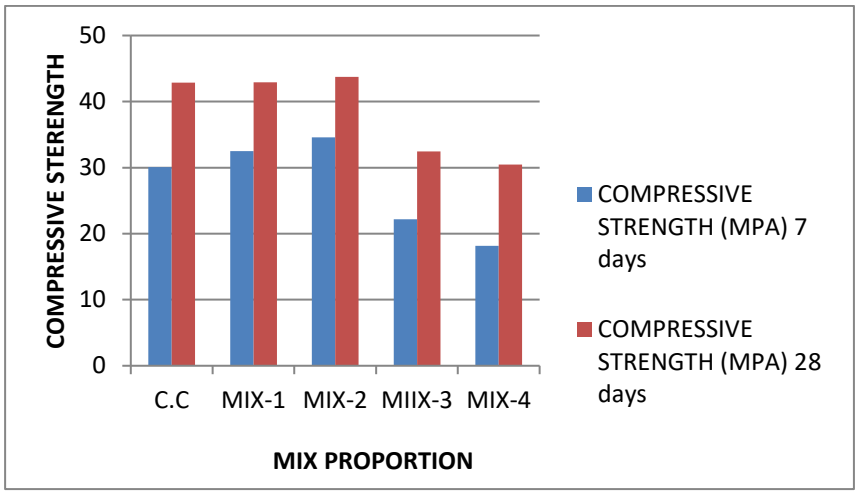

Figure 2: The graphical representation of compressive strength result

- The graph 5.2 represents the average compressive strength results having 0%, 5%, 10%, 15%, 20% of replacement of cement by using vitrified polish waste, rice husk ash in concrete at age of 7 days and 28 days respectively.

- The compressive strength is increasing of days. In these results 10% replacement gives high compressive strength value 43.76 Mpa at age of 28 days, the 20% replacement gives low compressive strength 30.48 Mpa at age of 28 days. The compressive strength results increases with increasing replacement up to 10% then decrease gradually till 30%.

Flexural Strength Test:

Table 3. Results of flexural strength of beams

S. No	Mix proportion	Flexural strength (Mpa)	
		7 days	28 days
1	C.C	3.69	4.52
2	Mix – 1	3.77	5.17
3	Mix – 2	3.95	5.34
4	Mix – 3	3.16	4.35
5	Mix – 4	2.96	3.96

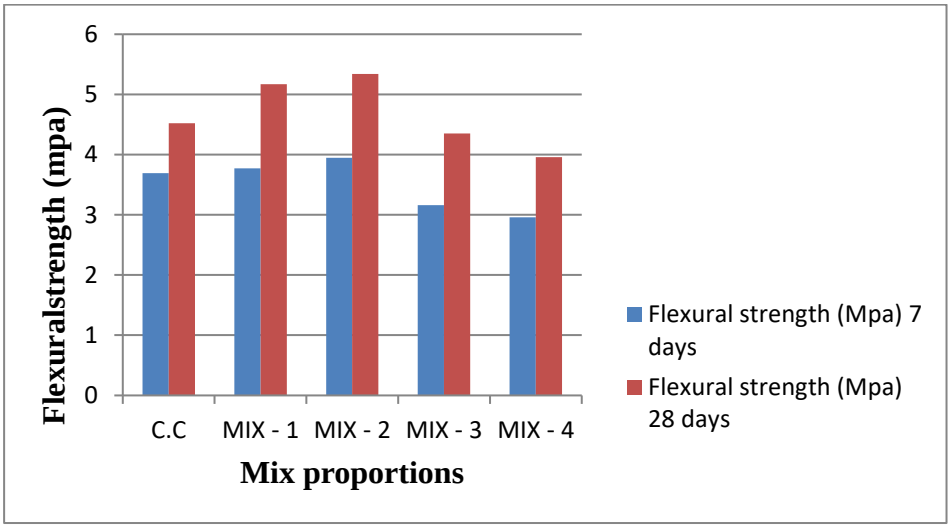

Figure 3: Results of flexural strengths of varying mix proportions

- The graph 5.3 represents the average flexural strength results having 0%, 5%, 10%, 15%, 20% of replacement of cement in concrete at age of 7days and 28 days respectively.

- In these results 10% replacement gives high flexural strength value 5.34 Mpa at age of 28 days, the 20% replacement gives low compressive strength 3.96 Mpa at age of 28 days.

6. Conclusion:

1. When cement is replaced with vitrified polish waste and rice husk ash, the optimum compressive strength and flexural strength of concrete attained at 10% (5% of VPW & 5% of RHA) replacement of cement.
2. When the percentage of vitrified polish waste and rice husk ash is increased more than 10% replacement of cement the compressive strength and flexural strength of concrete is decreases.
3. The maximum compressive strength and Flexural strength of concrete attained at 10% replacement of cement increases up to 32.6% and 32% for 7 days when compared to conventional concrete mix.
4. For 28 days, the maximum compressive strength and Flexural strength of concrete attained at 10% replacement of cement increases up to 13.4% and 19.07% when its compared to Conventional concrete mix.

7. Future scope:

- Further investigation can be carried on several industrial waste suitability in concrete making individually or compositely .Rice husk ash and vitrified polish waste usage with combination of other industrial wastes in concrete making can be analyzed.
- Studies should be encouraged towards innovative materials usage in concrete making which is beneficial in both constructional and environmental aspects.

8.References :

[1] Vashisht Patil, M. C. Paliwal “Partial Replacement of Cement with Rice Husk Ash in Cement Concrete”, International Journal of Engineering Research and Technology (IJERT) e-ISSN: 2278 -0181 Volume: 09 Issue: 12 | Decemeber-2016.

[2] K. Srujan Kumar, Y. Priyanka, V. Bhargavi ”Effect of Vitrified Polish Waste in Concrete as Partial Replacement to Cement” International Journal for Scientific Research & Development| Vol. 7, Issue 10, 2019 | ISSN (online): 2321-0613.

[3] Somy Daniel, Aneeta Anna Raju “A Study of Properties of Concrete Making Partial Replacement of Cement by Ceramic waste Powder” International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 05 Issue: 03 | Mar-2018, p-ISSN: 2395-0072.

[4] George Washington , Kshyana Prava Samal, Zishane Haider, Polin Kumar Sahoo International Journal of Advance Research In Science And Engineering (IJARSE) e-ISSN:2319-8354 Volume No:06, Issue No:12, December 2017.

[5] M. T. S. Lakshmayya, G. Aditya “Design of rigid pavement and its cost benefit analysis by usage of vitrified polish waste and recron polyester fiber” International Journal of Civil Engineering and Technology (IJCIET) Volume 8, Issue 1, January 2017, pp. 409–417, Article ID: IJCIET 0801046.