"Using residual ceramic tile powder and Styrene Butadiene Rubber (SBR) latex for improving concrete's properties"

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ABSTRACT: *The concrete When used to build structures and then given time to cure, concrete—a mixture of cement, water, sand, pebbles, or crushed rocks (the aggregate or fillers)—hardens into stone. The three essential components are water, aggregate, and cement. In comparison to steel, plastic and polymer are the least expensive and most widely available materials .The cement industry is one of the three primary producers of carbon dioxide, a significant greenhouse gas. As of 2011, it contributed 7% to global human CO2 emissions, mostly as a result of the sintering of clay and limestone at a temperature of 15000 C. Concrete construction and repair projects are using Styrene Butadiene Rubber (SBR) latex emulsions more frequently because of its advantages in terms of flexure strength, compressive strength, adhesion, and impermeability. SBR emulsion can boost the compressive and flexural strength of concrete members when applied in a certain proportion between old and new concrete layers. The ceramics industries are under pressure to come up with a solution for the disposal of the growing volume of ceramic waste. In order to protect the environment, several industrial sectors, especially the building industry, should use ceramic waste powder. As a result, more eco-friendly concrete is being used. By partially substituting leftover ceramic tile powder for cement, concrete can be produced more environmentally friendly. With SBR latex and waste ceramic tile powder, the study's objective is to create an inexpensive and environmentally friendly concrete replacement.*

***Key Words*: Styrene Butadiene rubber latex, Waste ceramic tile powder , eco-friendly concrete, compressive strength, flexural strength.**

1. INTRODUCTION

Concrete is a composite material made of coarse granular material (the aggregate or filler) that is encased in a stiff matrix of material (the cement or binder) that fills the gaps and holds the aggregate particles together. Concrete can alternatively be thought of as a composite material made mostly of a binding medium with embedded aggregate particles or fragments. Concrete can be simplest represented as follows:

Coarse aggregate + fine aggregate + cement + water+ admixture→ concrete

The most common building material worldwide is concrete. It is utilised in a wide variety of structures, including bridges, dams, paving, and building frames. Additionally, compared to other materials, it is utilised the most widely in the world. In terms of tonnage and volume, its global production outpaces that of steel by a ratio of 10 and more than 30 respectively. At the present time, concrete is consumed at a rate of about 10 billion tonnes annually, or more than 1.7 tonnes per person. By weight, it consumes more than ten times as much steel does. Why is concrete so popular if it is neither as tough nor as strong as steel? Economical: The cheapest and most widely-available material is concrete. Comparing concrete to other engineered construction materials, the cost of manufacture is inexpensive. Water, aggregate, and cement are the three main ingredients. Plastic and polymer are the least priced materials as compared to steel and are widely accessible. This makes it possible for concrete to be manufactured locally wherever it is needed, saving on the transportation expenses associated with most other materials.

1.1 SBR LATEX (STYRENE BUTADIENE RUBBER)

Styrene-butadiene rubber, an all-purpose synthetic rubber, is made from a copolymer of styrene and butadiene (SBR). SBR consists primarily of butadiene (CH2=CH-CH=CH2) and styrene (CH2=CHC6H5), around 75% and 25%, respectively. These two compounds are typically copolymerized (their short, single-unit molecules are joined to form long, multi-unit molecules) during the emulsion process. Due to a lack of natural rubber during World Wars I and II, research on synthetic rubber was conducted in Europe and the US, leading to the development of SBR. German chemists started producing synthetic elastomers in 1929 by copolymerizing two substances with a catalyst. After butadiene, one of the copolymers, and sodium, the polymerization catalyst, this series was given the name Buna. As a result of being deprived of its natural rubber sources from

East Asia during World War II, the United States created a number of synthetic materials, including a copolymer of butadiene and styrene.

1.2 CERAMIC TILE POWDER

The ceramics industries are under pressure to come up with a solution for the disposal of the growing volume of ceramic waste. In order to protect the environment, several industrial sectors, especially the building industry, should use ceramic waste powder. As a result, more eco-friendly concrete is being used. Ceramic waste is classified as non-hazardous solid waste since it exhibits Pozzolanic properties. As a result, recycled materials can be applied once more in many different building construction processes. Industrial wastes that are coarser than cement particles generally make up up to 35% of the aggregate in concrete mixtures.

2. OBJECTIVE

1. To investigate the effects of Styrene Butadiene Rubber (SBR) latex on the compressive strength, flexural strength, and workability of concrete.
2. To establish the best ratio of styrene butadiene rubber latex to powdered discarded ceramic tile for the best concrete mix.
3. To look into new materials as possible alternatives for current ones in order to make concrete that is more reasonably priced and environmentally friendly.

3. METHODOLOGY

1. Several literature reviews were undertaken to better understand the subject before the project was started.
2. Specific tests on the materials utilised in the dissertation work were conducted to determine their specifications and quality.
3. Using IS 10262-2009, the mix design for M25 grade concrete was completed.
4. The prepared and mixed M25 grade concrete's compressive and flexural strengths were evaluated after 28 days.

4. MATERIALS USED

1. Ordinary Portland cement
2. Fine aggregate
3. Coarse aggregate
4. Admixtures
5. Styrene Butadiene Rubber (SBR) Latex
6. Waste ceramic tile powder

5. TESTS

5.1CEMENT

- Setting time of the cement
- Compressive strength of cement

5.2 TESTS ON AGGREGATES

- Sieve analysis of fine aggregate
- Sieve analysis of coarse aggregate

5.3 TESTS ON CONCRETE

- Slump test
- Compressive strength test of concrete

- Flexural strength test concrete.

5.4 TESTS ON WASTE CERAMIC TILE POWDER

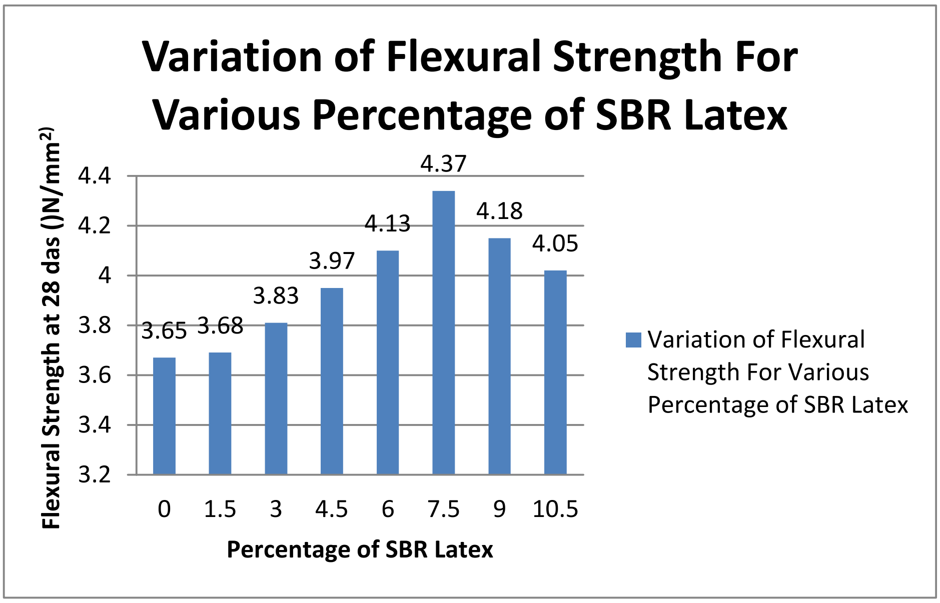
- Specific gravity of ceramic tile powder

6. RESULTS

6.1 FLEXURAL TEST RESULTS

Table -1: For Flexural Strength at various percentage of SBR Latex and 0% ceramic powder

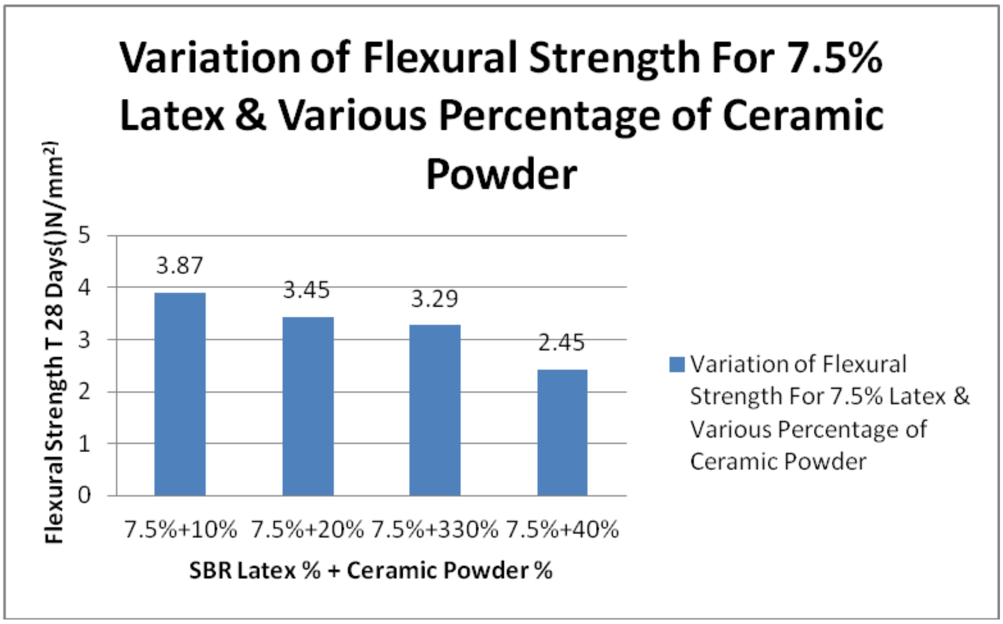
SBR latex percentage	Flexural strength at 28 days (N/mm²)
0	3.65
1.5	3.68
3.0	3.83
4.5	3.97
6.0	4.13
7.5	4.37
9.0	4.18
10.5	4.05



Graph -1: Graph For Flexural Strength at Various % of SBR Latex

Table-2: For Flexural Strength at 7.5% SBR Latex and various Percentage of Ceramic Powder

7.5% SBR Latex & Ceramic Powder Percentage	Flexural Strength at 28 Days (N/mm²)
10	3.87
20	3.45
30	3.29
40	2.45



Graph-2: Flexural Strength at 7.5% SBR Latex & various % of ceramic powder

7. CONCLUSIONS

On the basis of various test findings from laboratory experiments, the present study has estimated the mechanical properties of three types of concrete: plain concrete, latex modified concrete, and latex modified ceramic tile powder reinforced concrete.

The following conclusions are reached based on these findings and the observations obtained during this experimental research study:-

1. At 0% SBR latex and 0% ceramic the flexural strength is seen to be 3.67 N/mm^2 after 28 days.
2. At 7.5% SBR latex and 0% ceramic the flexural strength is seen to be 4.37 N/mm^2 maximum from all the results.
3. It is seen that as we increase the percentage of SBR at 0% ceramic the flexural strength of the concrete first starts to increase then it starts decreasing.
4. At 7.5% SBR latex and various percentage of ceramic powder the flexural strength is calculated.
5. At 7.5% SBR latex and 10% ceramic powder flexural strength is seen to be maximum.
6. As we increase the percentage of ceramic powder the flexural strength of concrete decreases thus specific percentage of ceramic powder is used.

REFERENCES

1. T.Subramani, B.Suresh, Experimental Investigation Of Using Ceramic Waste As A Coarse Aggregate Making A Light Weight Concrete, International Journal of Application or Innovation in Engineering & Management, 2015.

2. Abdullah Anwar, Sabih Ahmad, Syed Mohd. Ashraf Husain and Syed Aqeel Ahmad, Replacement Of Cement By Marble Dust And Ceramic Waste In Concrete For Sustainable Development, International Journal of Innovative Science, Engineering & Technology, 2015.

3. Garima Arora, and M. Parvez Alam, Utilization of Pozzolonic Material for the Enhancement of the Concrete Strength: A Comprehensive Review Paper, Journal of Civil Engineering and Environmental Technology, 2015.

4. Amir Javed, Salman Siddique, Ram Prasad V S, Investigation on ceramic waste and stone dust as aggregate replacement in concrete, International Journal of Engineering Technology, Management and Applied Sciences, 2015.

5. Aruna D, Rajendra Prabhu, Subhash C Yaragal, Katta Venkataramana, studies on usage potential of broken tiles as partial replacement to coarse aggregates in concretes, International Journal of Research in Engineering and Technology, 2015.

BIOGRAPHIES

I have completed my B.tech in civil engineering from G.L Bajaj institute of technology in the year 2017 Gr. Noida. Now I am pursuing M.tech in civil engineering from Lucknow Institute of technology.

Mr. Rajneesh Kumar is working as Head of Department in Lucknow institute of technology in civil department and have working experience of 10 years.