*Impact Factor (SJIF): 3.632*

**International Journal of Advance Research in Engineering, Science & Technology**

*e-ISSN: 2393-9877, p-ISSN: 2394-2444*

***Volume 3, Issue 3, March-2016***

# Micro Silica as a Filler Materials in High Performance Concrete

**Umang K. Patel[1], Prof. Himesh Bhavani[2]**

[1]*PG Student, M.E. (Civil) Infrastructure Engineering, L.D.R.P. Institute of Technology & Research, Gandhinagar*
[2] *Faculty, Department of Civil Engineering, L.D.R.P. Institute of Technology & Research, Gandhinagar*

***Abstract*** *— Concrete is most important engineering material. By adding or replacing of some of material may change the properties of concrete. Studies have been carried out to investigate the possibility of utilizing a broad range of materials as partial replacement materials for cement in the production of concrete. This present research work is mainly focused on one of such method in which Micro silica is used to improve the compressive and flexural strength of concrete. It gives the brief information regarding how exactly Micro silica affects strength and durability parameters like compressive strength, flexural strength of concrete*.

***Keywords- High Performance Concrete, Supplementary Cementitious Material, Micro Silica***

## I. INTRODUCTION

### ➢ HIGH PERFORMANCE CONCRETE:

It is mistaken to bestow that supplementary cementitious materials were used in the concrete only because of their availability and just for economic considerations. These materials present some unique desirable properties which cannot be met by using OPC only. For producing high performance concrete (HPC), it is well recognized that the use of supplementary cementitious materials (SCMs), such as Silica Fume (SF), Alccofine and Fly Ash (FA) are necessary. The concept of HPC has definitely evolved with time. Initially it was equated to high strength concrete (HSC), which certainly has some merit, but it does not show a complete and true picture. There is a need Health Analysis of High Performance Concrete by Using Waste Material to consider other properties of the concrete as well which sometimes, may even take priority over the strength criterion. Various authors proposed different definitions for HPC. High Performance Concrete is a concrete which made with appropriate materials, combined according to a selected mix design; properly mixed, transported, placed, consolidated and cured so that the resulting concrete will give an excellent performance in the structure in which it is placed, in the environment to which it is exposed and with the loads to which it will be subjected for its design. Thus, HPC is directly related to durable concretes.

There are numerous ways to measure the durability of concrete. The resistance to chloride, water and air penetration is some of the simplest measures to determine the durability of concrete. The penetration of water, chloride and other aggressive ions into concrete primarily governs the physical and chemical processes of deterioration. The microstructure of concrete mainly controls the physical/chemical phenomena associated with water movements and the transport of ions in concrete. Thus, HPC may be defined as the concrete having high resistance to fluid penetration as well as satisfying the strength requirement.

The mineral materials, when used in HPC, can enhance either or both the physical and durability properties of concrete. Concretes with these cementations materials are used extensively throughout the world. Some of the major users are power, gas, oil and nuclear industries. The applications of such concretes are increasing with the passage of time due to their excellent performance, low influence on energy utilization and environment friendliness. In order to compare the strength and durability performance of the HPC concrete, it is necessary to produce them with the same set of materials and test them under the same environmental conditions. The type of aggregate, curing and testing conditions and strength grades were different between different previous studies which made it difficult to generalize the results for any given application. Nonetheless, in most cases, the effect of using high volumes of SCMs was found to decrease both the early age and long-term strengths. In some cases, SF was added to compensate for the decrease in early strength whilst trying to maintain/enhance the durability characteristics associated with high level replacements of Portland cement with these materials.

All Rights Reserved, @IJAREST-2016

- **MICRO SILICA:**

Micro Silica is an extremely reactive pozzolanic material. It is a by-product obtained from the manufacture of silicon or ferro-silicon. It is extracted from the flue gases from electric arc furnaces. Micro Silica particles are very fine with particle sizes about hundred times smaller than those of average size of OPC particles. It is a densified powder or is in the form of water slurry. The standard specifications of Silica Fume are defined in ASTM 1240. It is commonly used at a replacement level of 5% to 12%by mass of total cementitious materials. It can be used successfully for the structures where high strength is needed or significantly reduced permeability to water is the major concern. Extraordinary procedures are required to be adopted for handling, placing and curing concrete with these very fine Micro Silica particles.

- **STUDY CONTRIBUTION:**

This study helps in identifying Influence of Micro Silica on strength characteristics of HPC. The use of alternative material of Portland cement leads to reduction of emission gases and impact on production capacity of cement plant. This study also provides a strategy to reducing the cost of waste disposal and its related gains. This research work will enhance and accelerates the decision making process in the pre, during and post construction phases of any infrastructure projects.

## II. LITERATURE REVIEW

Several studies and reports have documented the potential use of stone slurry waste as construction materials are shown in table1.

**Table: 1: Usage of Micro Silica in different application**

| Usage of Micro Silica | Main Conclusion | Reference |
|---|---|---|
| The Use of Micro-Silica to Improve the Compressive and Flexural Strength of Concrete | From concluded that 7.5% replacement of cement by Micro silica can induce higher strength properties to Normal Concrete. | Amar Devendra Shitole, Sandhya Mathapati,2014 |
| Experimental Investigation of Influence of Micro Silica on High Strength Concrete Properties | it can be concluded that the compressive strength of concrete increases with increase in micro-silica content. Compressive strength of concrete gets substantially increased on increasing the amount of micro-silica in it (i.e. 0%, 5%, and 10%) | Anil Kumar, Poonam, Ashok K. Gupt,2014 |
| Effect On Compressive Strength Of High Performance Concrete Incorporating Alccofine And Fly Ash | The maximum compressive strength of concrete is achieved by using Alccofine 10% at Fly Ash 30%. | Sidhharth P. Upadyay, Prof. M.A.Jamnu,2014 |
| Study On Effect Of Mineral Admixtures In Mix Proportioning Of HPC | It is concluded that maximum workability and compressive strength is achieved when 10% Fly Ash and 15% Micro Silica is added. The concrete is becoming stiffer as the percentage of Fly Ash beyond 10% and 15% of micro Silica is added. | Patil Shreekedar A, Kumbhar P. D,2013 |
| A Review for Characterization Of Silica Fume And Its Effect On Concrete With Pozzolanic Portland Cement | The optimum increase in the strength of M 25 concrete was found on 15% addition of silica fume by weight of cement | Ajay Verma, Dr Rajeev Chandak, R.k.Yadav-,2013 |
| Effect of Micro silica and fly ash on the strength of concrete | the cement content has been reduced by 48% with 43% fly ash and 5% MicroSilica. These materials have been substantially | Aditya Dhagat, Manav Mittal,2013 |

All Rights Reserved, @IJAREST-2016

| | | |
|---|---|---|
| | reduced the cement content and added strength much more that the prior situation | |
| Effect of Micro Silica on The Strength of Concrete with Ordinary Portland Cement | Silica fume increases the strength of concrete more 25%. micro silica with concrete decrease the air pollution | Verma Ajay, Chandak Rajeev and Yadav R.K.,2012 |

## III. OBJECTIVE OF STUDY

- To check Possibility of utilization of the thermal waste called Fly ash as a partial solution of the environmental pollution issue.
- To contribute in the reducing environmental burden, this might be proving beneficial for environmental friendly construction material.
- To determine the workability of fresh concrete containing Fly ash and Micro silica.
- To establish the behaviour and strength of concrete using Fly ash and Micro silica.
- Find out characteristic of hardened concrete such as compressive strength and also find out the cost comparison between normal and utilized concrete.

## IV. SCOPE OF STUDY

- Materials are specified for the concrete mix for that various test are perform on it. Tests are aggregate gradation report, Specific Gravity, Aggregate impact value, Flakiness and Elongation index, Water Absorption.
- Detailed laboratory investigations for determination of mechanical properties of Concrete like compressive strength, flexural strength, split tensile strength test and slump test were performed with different proportions and combinations of Micro Silica
- To asses and analyze the laboratory results of mechanical properties obtained at 7 & 28 days.
- Performing the statistical analysis of results obtained from experimental investigation.
- To make cost comparison of conventional concrete and Renewal concrete.

## V. RESEARCH METHODOLOGY

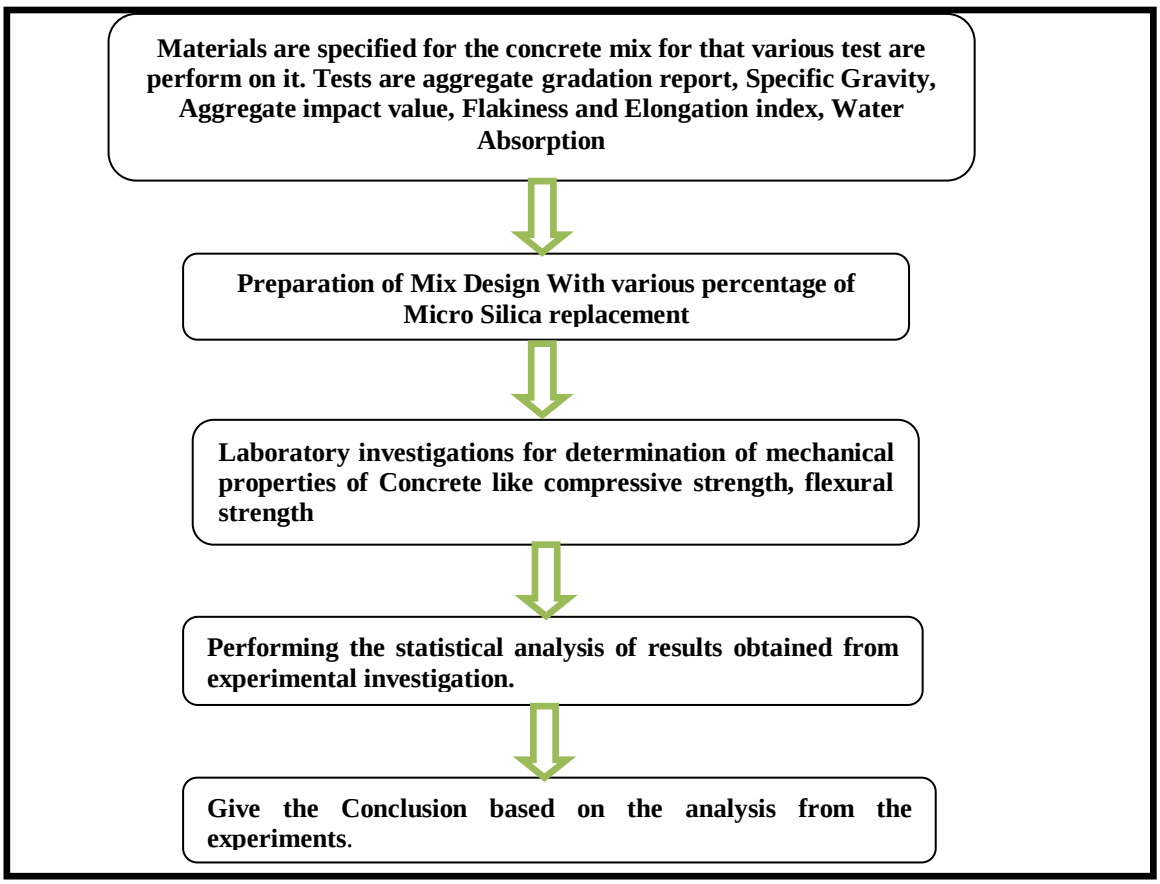


**Figure: 1: Research methodology**

All Rights Reserved, @IJAREST-2016

## VI. CONCLUSION

Based on the above literature review the following observations are made regarding the utilization of Micro Silica in High Performance Concrete.

- We can produce the durable concrete with the use of Micro Silica with the replacement of cement.
- We achieve the high strength of concrete with Micro Silica then conventional Concrete.
- We can produce the low cost concrete and reduce the Air pollution effect by using the Micro Silica in the concrete.

## REFERENCES

[1] Amar Devendra Shitole, Sandhya Mathapati (2014). "The Use Of Micro-Silica To Improve The Compressive And Flexural Strength Of Concrete"
[2] Indian standard code IS 10262:2009 "Concrete mix proportioning guide lines"
[3] Anil Kumar, Poonam, Ashok K. Gupt (2014). "Experimental Investigation of Influence of Micro Silica on High Strength Concrete Properties"
[4] M.S. SHETTY "Concrete technology – Theory and Practice"
[5] Sidhharth P. Upadyay, Prof. M.A.Jamnu (2014). "Effect On Compressive Strength Of High Performance Concrete Incorporating Alccofine And Fly Ash"
[6] Praveen Nayak S,H. S. Narashimhan, Raghunandan V.Kadaba (2014). "Hardened Properties of Concretes made with Micro Silica and Alccofine-A Performance Optimization based Comparative Study"
[7] Madhusudhan T (2014). "Utilization of micro silica as partial replacement of OPC & SRC in concrete"
[8] Patil Shreekedar A, Kumbhar P. D (2013). "Study On Effect Of Mineral Admixtures In Mix Proportioning Of HPC"
[9] Ajay Verma, Dr Rajeev Chandak, R.K.Yadav (2013). "A Review For Characterization Of Silica Fume And Its Effect On Concrete With Pozzolanic Portland Cement"
[10] Aditya Dhagat, Manav Mittal (2013). "Effect of Micro silica and fly ash on the strength of concrete"
[11] Mr Sarath S, Mr R Vandhiyan, Dr.E B Perumal Pillai (2013). "Corrosion Properties Of Concrete Containing Micro Silica"
[12] Verma Ajay, Chandak Rajeev and Yadav R.K. (2012). "Effect of Micro Silica on The Strength of Concrete with Ordinary Portland Cement"

All Rights Reserved, @IJAREST-2016