IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# COMPARATIVE STRENGTH STUDY ON WASTE FOUNDRY SAND WITH MICRO SILICA BLENDED CONCRETE

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***Abstract***: There was a severe scarcity of river sand, which was ideal for a new study area. The depletion of river sand and the necessity for scientific management and use of the available resource have been studied. Foundry sand can be used as a partial or complete substitute for fine aggregates, as well as a supplemental addition to achieving various concrete qualities. By weight, Micro Silica was used in place of cement, and waste foundry sand was used in lieu of fine aggregate. At the ages of 28, 56, and 90 days, compressive and split tensile strength tests were performed. At 15% foundry sand replenishment, the maximum strength was obtained. When compared to ordinary cement concrete, blended concrete with micro silica has been shown to be more effective. Non destructive test was carried out to evaluate the strength property.

**Keywords**: Compressive strength; Foundry sand; Micro silica; Split tensile strength.

## 1. INTRODUCTION

The scarcity of landfill space and the rising expense of disposal, repurposing trash and byproducts has become a viable option. WFS (waste foundry sand) is an example of an industrial byproduct. Several million tones of byproducts are produced by the ferrous and non-ferrous metal casting industries worldwide. WFS is by product of the metal casting industry. However, due to the rapid rise in disposal prices, the use of waste foundry sand for land filling is becoming an issue.

## 2. OBJECTIVES

a. The purpose of this study was to use the discarded foundry sand as a partial replacement for fine aggregate of M40 concrete.
b. To optimize the micro silica and waste foundry sand content.
c. To evaluate the mechanical properties of optimized micro silica and waste foundry sand.

## 3. MATERIALS

**3.1 Cement:** Cement from locally available 53 grade utilized.

**3.2 Fine Aggregate:** The fine aggregate in this study was made from locally accessible river sand.

**3.3 Coarse aggregate:** As coarse material, a local source of machine crushed angular granite metal with a nominal size of 20mm was utilised.

**3.4 Foundry Waste Sand:** Mak's Casting Uppal, Hyderabad, provided the waste foundry sand (WFS). WFS was utilised to replace fine aggregate in some cases (natural river sand). Table 1 lists the physical characteristics of WFS.

**Table1 Physical properties of waste foundry sand**

| Property | Test results |
|---|---|
| Fineness modulus | 1.66 |
| Specific gravity | 2.35 |
| Bulk density(kg/m$^3$)<br>Loose<br>Dense | <br>1230<br>1350 |

**3.5 Micro Silica**

Amorphous Micro Silica of Grade 920-D used for the casting of concrete.

## 4. RESULTS AND DISCUSSION

The compressive strength and split tensile strength are determined for the cast specimens and furnished in table 2 to 7.

**Table 2 Compressive strength of concrete with waste foundry sand**

| Mix ID | Compressive strength, N/mm$^2$ | | |
|---|---|---|---|
| | 28 days | 56 days | 90 days |
| WF0 | 52.14 | 56.72 | 60.60 |
| WF5 | 56.08 | 60.91 | 65.30 |
| WF10 | 58.26 | 63.32 | 67.74 |
| WF15 | 60.74 | 66.14 | 71.05 |
| WF20 | 58.76 | 63.57 | 68.56 |
| WF25 | 55.86 | 60.38 | 65.18 |

**Table 3 Split tensile strength of concrete with waste foundry sand**

| Mix ID | Split tensile strength, N/mm$^2$ | | |
|---|---|---|---|
| | 28 days | 56 days | 90 days |
| WF0 | 5.05 | 5.47 | 5.87 |
| WF5 | 5.42 | 5.88 | 6.30 |
| WF10 | 5.54 | 6.01 | 6.48 |
| WF15 | 5.82 | 6.32 | 6..80 |
| WF20 | 5.52 | 5.99 | 6.40 |
| WF25 | 5.22 | 5.68 | 6.08 |

**Table 4 Compressive strength of concrete with micro silica**

| Mix ID | Compressive strength, N/mm$^2$ | | |
|---|---|---|---|
| | 28 days | 56 days | 90 days |
| MS0 | 52.14 | 56.72 | 60.60 |
| MS5 | 60.27 | 65.68 | 70.13 |
| MS7.5 | 61.83 | 67.26 | 71.95 |
| MS10 | 64.53 | 69.92 | 75.06 |
| MS15 | 57.19 | 62.31 | 66.55 |

**Table 5 Split tensile strength of concrete with micro silica**

| Mix ID | Split tensile strength, N/mm$^2$ | | |
|---|---|---|---|
| | 28 days | 56 days | 90 days |
| MS0 | 5.05 | 5.47 | 5.87 |
| MS5 | 5.84 | 6.36 | 6.79 |
| MS7.5 | 6.02 | 6.52 | 7.01 |
| MS10 | 6.35 | 6.87 | 7.42 |
| MS15 | 5.58 | 6.06 | 6.52 |

**Table 6. Optimized compressive strength 10% micro silica with different % of waste foundry sand**

| Mix ID | Compressive strength, N/mm$^2$ | | |
|---|---|---|---|
| | 28 days | 56 days | 90 days |
| MS10WF0 | 52.14 | 56.35 | 60.68 |
| MS10WF5 | 66.51 | 72.14 | 77.80 |
| MS10WF10 | 67.60 | 73.25 | 78.41 |
| MS10WF15 | 68.84 | 74.72 | 79.81 |
| MS10WF20 | 71.57 | 77.37 | 83.08 |
| MS10WF25 | 66.37 | 72.23 | 77.60 |

**Table 7. Optimized split tensile strength 10% micro silica with different % of waste foundry sand**

| Mix ID | Split tensile strength, N/mm$^2$ | | |
|---|---|---|---|
| | 28 days | 56 days | 90 days |
| MS10WF0 | 5.16 | 5.60 | 5.99 |
| MS10WF5 | 6.56 | 7.11 | 7.63 |
| MS10WF10 | 6.65 | 7.24 | 7.77 |
| MS10WF15 | 6.81 | 7.38 | 7.96 |
| MS10WF20 | 6.94 | 7.54 | 8.10 |
| MS10WF25 | 6.37 | 6.90 | 7.41 |

## 5. CONCLUSIONS

Waste foundry sand and micro silica were found economical and eco friendly.

1. The maximum compressive strength of concrete with 15% of waste foundry sand for 28, 56 and 90 days is 60.74, 66.14 and 71.05 N/mm$^2$.
2. The maximum split tensile strength of concrete with 15% of waste foundry sand for 28, 56 and 90 days is 5.82, 6.32 and 6.80 N/mm$^2$.
3. The maximum compressive strength of concrete with 10%of micro silica for 28, 56 and 90 days is 64.53, 69.92 and 75.06 N/mm$^2$.
4. The maximum split tensile strength of concrete with10%of micro silica for 28, 56 and 90 days is 6.35, 6.87 and 7.42 N/mm$^2$.
5. The maximum compressive strength of concrete with combined 10% micro silica and 20% waste foundry sand for 28, 56 and 90 days is 71.57, 77.37 and 83.08 N/mm$^2$.
6. The maximum split tensile strength of concrete with combined1 0% micro silica and 20% waste foundry sand for 28, 56 and 90 days is 6.94, 7.54 and 8.10 N/mm$^2$.

## REFERENCES

1) Rafat Siddique, Geert de Schutter and Albert Noumowe, (2008), "Effect of used-foundry sand on the mechanical properties of concrete", Construction and Building Materials,vol. 23,pp976–980.

2) Yogesh Aggarwal, Paratibha Aggarwal, Rafat Siddique,El-Hadj Kadriand Rachid Bennacer,(2010),"Strength, durability, and micro-structural properties of concrete made with used-foundry sand(UFS)",Construction and Building Materials,vol.25,pp1916–1925.

3) Gurpreet Singh and Rafat Siddique,(2011),"Effect of waste foundry sand (WFS) as partial replacement of sand on the strength, ultrasonic pulse velocity and permeability of concrete", Construction and Building Materials, vol. 26, pp416–422.

4) Khatib JM and Ellis DJ. (2001), "Mechanical properties of concrete containing foundry sand". ACI special publication (SP-200), American Concrete Institute;pp. 733–748.

5) SiddiqueR.,Gupta Rand KaurI.,(2007),"Effect of spent foundry sand as partial replacement of fine aggregate on the properties of concrete". In: 22nd International conference on solid waste technology and management, Widener University,Philadelphia,USA.

6) Gurpreet Singh and Rafat Siddique,(2011),"Abrasion resistance and strength properties of concrete containing waste foundry sand (WFS)", Construction and Building Materials, vol. 28, pp421–426.

7) Chandra Mouli, K. "Improvement of silica fume on concrete by using mix proportions of M40 grade "Journal of Applied Science and Computations; ISSN NO: 1076-5131; Volume VI, Issue IV, and Page No: 187-192; April/2019.

8) Chandra Mouli, K. "Experimental studies on concrete with Metakaolin by partial replacement of cement for M40grade concrete" Journal of Applied Science and Computations; ISSN NO: 1076-5131; Page No: 202-205;April/2019.

9) Chandra Mouli, K. "UPV Test on Light Transmitting Concrete", Journal of Applied Science and Computations; ISSNNO: 1076- 5131; Vol. VI, Issue VI; Pg No: 2949-2955; June2019.

10) Chandra Mouli, K. "Experimental Study on Fresh and Hardened Concrete by incorporating flyash, Metakaolin and Brick Powder by Partial Replacement of Cement for M40 Grade Concrete", International Journal of Advance Research Ideas and Innovations inTechnology,Vol.4,Issue 03,ISSN:2454-132X.

11) Chandra Mouli, K. "Improvement of Silica Fume on Concrete by using Mix Proportions of M40 Grade", Journal of Applied Science and Computations; ISSN NO: 1076-5131;Volume VI,IssueIV,PageNo:187-192;April/2019.

12) Chandra Mouli, K. "Effect of Strength Properties of Concrete by Partial Replacement of Cement With Metakaolin and Fly ash" International Journal of Research; ISSNNo:2236-6124; Vol. VIII, issue VI; Page No: 5261-5264; June2019.