ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

Investigational Study on Strength Properties of Metacolin Concrete

E.Prudhvi Kumar
Assistant Professor,
Department of Civil Engineering,
Ramachandra College of Engineering.

Abstract:

Concrete is the most versatile material due to the per- sistent and continuous demands made on concrete, En- gineers are continually pushing the limits to improve its performance. Since concrete is a composite material made from cement, Fine aggregate , Coarse aggregate but pres- ent researches are interest of finding new cement material by waste material or waste products produced from indus- tries which are harmful to environment. Partial replace- ment of cement is carried out with Metakaolin which are having silica used as admixture for making concrete,. Ce- ment replaced with beneficial value of Metakaolin as con- stant, 2.5%, 5.0%, 7.5%, 10.0%, 12.5% Metakaolin was made in partial replacement of cement and results were calculated that Metakaolin usage in partial replacement to cement can be made.

Introduction:

The cost of concrete made up of the cost of materials plant and labour the variation in the cost of material arise from the fact that the cement is several times costly than the aggregates thus the aim is to produce a mix as possible from the technical point of view the rich mixes may lead to high shrinkage and cracking in the structural concrete and to evolution of high heat of hydration is mass con- crete which may cause cracking. The actual cost of con- crete is related to cost of materials required for producing a minimum mean strength called characteristic Strength that is specified by designer of the structures. Metakaolin is refined kaolin clay that is fired (calcined) under care- fully controlled conditions to create an amorphous alumi- na silicate that is reactive in concrete.

Like other pozzo- lans (flyash and silica fume are two common pozzolans), met kaolin reacts with the calcium hydroxide (lime) by products produced during cement hydration. Calcium hy- droxide accounts for up to 25% of the hydrated Portland cement, and calcium hydroxide does not contribute to the concrete strength or durability. Metakaolin combines with the calcium hydroxide to produce additional cementing compounds, the material responsible for holding concrete together. Less calcium hydroxide and more cementing compounds means stronger concrete.

Physical Properties of Metakaolin:

Properties	Value
Density (gm/cm^3)	2.17
Bulk density (gm/ cm^3)	1.26
Particle shape	Spherical
Colour	White
Specific gravity	2.7

Chemical composition of Metakaolin:

Constituents	Values
Silica	53%
Alumina	43%
Iron oxide	0.5%
Sulphate	0.1%
Calcium oxide	0.1%
Sodium oxide	0.05%
Potassium oxide	0.4%

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

MIX DESIGN NOMINAL MIX DESIGN

Mix proportion
For M30=1:1.64:2.45
Cement=21.864Kg
Fine aggregate=35.85Kg Coarse aggregate=53.56Kg
W/c ratio=8.736liters

M30 WITH 25% QUARRY DUST

Cement: 20.92kg Quarry dust: 5.228kg Fine aggregate: 36.32kg
Coarse aggregate: 54.05kg Water: 8.356lit

M30 WITH 25% QUARRY DUST AND 2.5% OF METAKAOLIN

Mix proportions are Cement: 14.55kg Quarry dust: 5.01kg Metakaolin: 0.5016kg

Fine aggregate: 36.681kg Coarse aggregate: 54.55kg Water cement ratio: 8.026lit

M30 WITH 25% QUARRY DUST AND 5% METAKAOLIN

Mix proportions are Cement: 13.75kg Quarry dust: 4.913kg Metakaolin: 0.9826kg Fine aggregate: 36.65kg
Coarse aggregate: 54.798kg Water cement ratio: 7.8612lit

TEST RESULTS

M30 WITH 25% QUARRY DUST AND 7.5% OF METAKAOLIN

Mix proportions are Cement: 12.95kg Quarry dust: 4.799kg Metakaolin: 1.43965kg
Fine aggregate: 37.0265kg Coarse aggregate: 55.057kg Water cement ratio: 7.6784lit

M30 WITH 25% QUARRY DUST AND METAKAOLIN OF 10%

Mix proportions are Cement: 12.1951kg Quarry dust: 4.688kg Metakaolin: 1.8759kg Fine aggregate: 37.206kg
Coarse aggregate: 55.3498kg Water cement ratio: 7.4948lit

M30 with 25% quarry dust and metakaolin of 12.5%

Mix proportions are Cement: 11.4127kg Quarry dust: 4.565kg Metakaolin: 2.2825kg Fine aggregate: 37.376kg
Coarse aggregate: 55.6531kg Water cement ratio: 7.304lit

CASTING AND TESTING DETAILS:

9 cubes, 9 cylinders conforming to IS: 516-1964 are cast- ed After 24 hours the moulds were demoulded and sub- jected to water curing. Before testing the cubes were air dried for 2 hours. Crushing loads, split tensile strength, flexural strength were noted and average of 3 specimens was determined at 7days and 21days, 28days.

No.of days(n)	Compressive strength (N/mm²)						
	Normal M30	M_{30}+30% quarry dust (QD)	M_{30} +30% (QD)+2.5% metakaolin	M_{30}+30% (QD)+5% metakaolin	M_{30} +30% (QD)+7.5% metakaolin	M_{30} +30% (QD)+10% metakaolin	M_{30} +30% (QD)+12.5% metakaolin
7 days	21	28	31.7	33.5	35.2	36.7	27
14 days	26	33.4	47.2	43.2	46.2	47.2	32
28 days	32	37.4	43.5	41.2	42.2	43.4	36

CONCLUSION:

Compare with nominal concrete (M30) with adding of quarry dust the concrete is give more strength. In the con- crete the replacement of cement with quarry dust with 25% of cement is give good result, like the cement was replaced with 25% quarry dust and 5% metakaolin and tested in laboratory. The quarry dust percentage was con- stant (25%) and the metakaolin was increing like 2.5%, 5%,7.5%,10%,12.5% . From the mix like quarry dust with 25% and metakaolin was at 12.5% was the streangth was going to decrease. Nominal concrete (M30) with adding of quarry dust the concrete is give more strength. In the concrete the replacement of cement with quarry dust with 30% of cement is give good result, like the cement was replaced with 30% quarry dust and 5% metakaolin and tested in laboratory. The quarry dust percentage was con- stant (25%) and the metakaolin was increing like 2.5%, 5%,7.5%,10%,12.5% .

ISSN No: 2348-4845
International Journal & Magazine of Engineering, Technology, Management and Research
A Peer Reviewed Open Access International Journal

From the mix like quarry dust with 25% and metakaolin was at 12.5% was the streangth was going to decrease. Compare with The nominal con- crete mix, quarry dust25% and 30% replacement with ce- ment with constantly changeing the metakaolin the 25% of quarry dust is got good strength for 28 days.

REFERENCES:

[1]J.M.Khatib, E.M.Negim and E.Gjonbalaj, 2012, "High volume metakaolin as cement replacement in mortar". World journal of chemistry 7(1), 07-10.

[2]Dr.P.Srinivasa rao, P.Sravana, Z.Abdul Rahim, Dr.T.Seshadri Sekhar, Dr.Ms.P.Aarathi, 2012, "Cracking behavior of metakaolin blended high strength concrete in flexure by using crimped steel fibers", Journal of Civil Engineering science9, Vol:1, 15-19.

[3]Muhammad Burhan Sharif, Abdullah Anjum, Mu- hammad Akram Tahir, Muhammad Yousaf, 2013, "Per- formance of pozzolanic concrete using different mineral admixtures". Pak.J.Appl.Sci, Vol.12. 73-81.

[4] Dr.P.Srinivasa Rao, Dr.Sravana, Dr.Abdul Rahim, Dr.T.Seshadri Sekhar, "Durability studies on steel fibre reinforced metakaolin blended concrete". AKGEC Inter- national journal of technology, Vol:3 (1) 38-43.

[5]E.Arunakanthi, H.Sudarsana Rao, I.V.Ramana Reddy, 2012. "Effects of hydrochloric acid in mixing and curing water on strength of high performance metakaolin con- crete". IJAET, Vol:2(2), 68-76.