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Comparison of Physical Properties of Various Brands of Cement, Fine Aggregate, Coarse Aggregate Including M-Sand Available from Local Market

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Abstract – **The projects involves the determination of quality of building materials available in local market. The material studied includes sand , coarse aggregates , cement, which includes m-sand. The various parameter like physical , chemical including strength are studied and compared to IS codes. It was found that the material available in local market conforms to IS codes.**

Keywords – **Cement Aggregate, M-Sand.**

I. INTRODUCTION

Cement in general termed as Ordinary Portland Cement (OPC), and is used as a perfect binding material across the world. It will also commonly available for material for general use around the globe, an ingredient to mortar, stucco and grout [1]. Cement is produced from limestone by grinding, calcining then grinding to produce a fine powder, which intern is mixed with gypsum to retard setting time. The basic cement clinker is a hydraulic mass composes two third mass of calcium silicate (CaO.SiO2), and the rest consists of aluminum and iron associates and other materials [1], with the ratio of CaO to SiO2 to be not less than 2, and magnesium oxide to be not more than 5% by mass. These are the norms proposed by German Standards, published in 1909.

The reacted mass (calcined mass) basically forms nodules like materials of approximately one inch diameter, which acquires the properties of binding, and in order to increase the rate of reaction of binding, surface area is increased by grinding in a ball mill. According to ASTMC 150, the cement posses the properties of hardening as well as water resistance. The nature of hardening retards when grounded 2 calcium silicates present in multiple forms. Nature is gifted with lime stone and is extensively available as a natural resource by way of rocks.

During the advent of technological developments cement has been considered to be the best material to be used in construction [2]. The basic cement nodule (clinker) is produced by heating calcined limestone to an approximate temperature of 1300oC. Iron oxide and aluminium oxide appear as flum and are responsible for strength of cement. There are special cements available like Low Heat and Sulfate Resistant type, which require to control the composition of tricalcium aluminate (3CaOAl2O3), for which lime stone which is used as a conventional raw material for production of clinker substitute alumino silicate, in general practice less pure limestone which contain clay with SiO2 is being used [1]. The percentage of such lime stones may be in the order of 80% and next addition of raw materials depends on percentage purity of limestone. Some of the materials being used include shale, clay, iron ore, sand, fly ash, bauxite and slag. When coal is burned in the kiln, ash generated acts as an essential ingredient to cement.

The so called Portland cement was developed first from natural cements of Great Britain during early period of nineteenth century and its anonymous nature of Portland stone, which is in general a type of rock which was excavated beside Portland in the desert of England [2]. 3 A brick layer Aspidin [1] invented production of Portland cement in the year 1811, and was patented in the year 1822, and was called 'British Cement'. The entitled name of Portland cement was also published in the year 1823, as was associated with William Lockwood, Date Stewart, and others [3].

The production of Portland cement was patented in the year 1824 [2]. During 1826, James Frost had constructed a manufacturing unit for producing the cement [4], and in 1843, Aspidin's ward William [1] reported to have improved the quality of cement and was named 'Patent Portland Cement', though he doesn't possess the patent. In the year 1848, William Aspdin improved the quality, furthermore and

in 1853, shifted to Germany and started cement production [3]. William Aspidin produced the cement, which was called meso-Portland cement mixture of Portland cement and hydraulic lime [5].

II. MATERIAL USED

1 Selection Of Materials

The selection of materials depends on various the physical and chemical properties such as particle size , specific gravity, glass contents , etc. and also compatibility and performance in the presence of the materials when two or more types are available.

2 GENERAL

Concrete is a composite material of cement, fine aggregate, coarse aggregate and water. In this research projects quality of materials are studied

The strength properties of those materials are arrived and compared by with IS Code conducting laboratory test.

- Cement: Specific gravity, Impact, Abrasion, crushing strength test.
- Course aggregates: Devi crusher,Arumadal Road, MM crusher, chettikulam, Vallalar crusher, palayam
- Fine aggregates : Thirumanur, Trichy
- M- sand : Naranamangalam, sengunam

Table 1. Various grade and brands list.

Grade	Brands
43	Deccan
53	UltraTech
43	Maha
43	Amma
43	Arasu

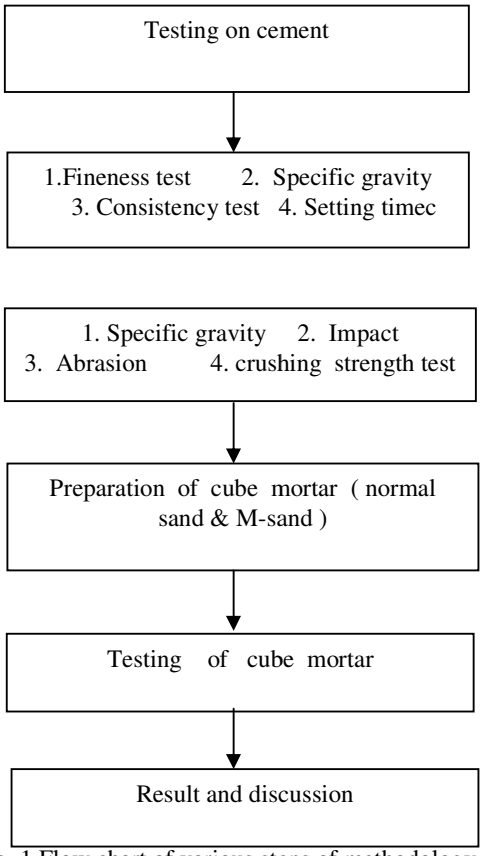

Fig. 1 Flow chart of various steps of methodology.

Table 2. Composite of various brand cement used for experiment.

Brands	Wt Of Sample (W1)	Wt Reduce (W2)	Is Code 4032	Fineness Of Cement %
DECAN (OPC)	100	7	5-7	7
Decan (Opc)	100	6	5-7	6
Ultratech (Opc)	100	8	5-7	8
Maha (Opc)	100	6	5-7	6
Amma (Ppc)	100	7	5-7	7
Arasu (Opc)				

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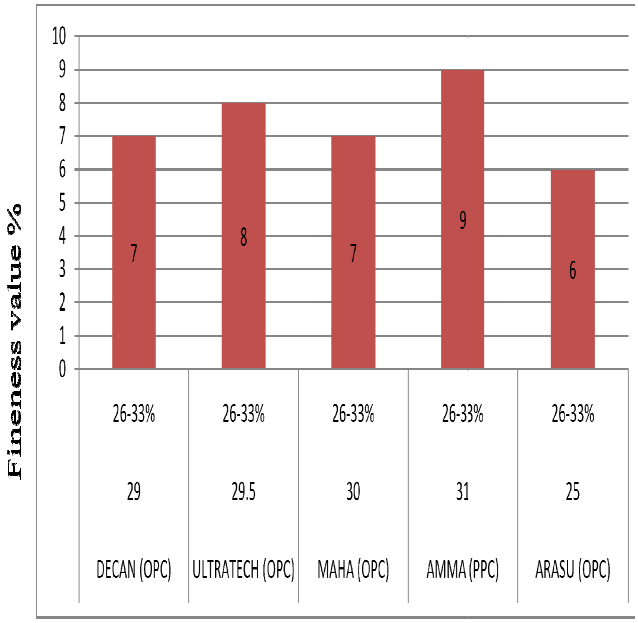

Fig. 2 Comparison of various brand cement finesse values.

Table 3 Standard Consistency.

Name	WT OF CEMENT (G)	WATER %	IS 4031 - Part-4-1998	WATER (Ml)	Reading On The Pointer
Decan (Opc)	400	29	26-33%	116	7
Ultratech (Opc)	400	29.5	26-33%	118	8
Maha (Opc)	400	30	26-33%	120	7
Amma (Ppc)	400	31	26-33%	124	9
Arasu (Opc)	400	25	26-33%	100	6

Table 4 Comparison of Brands on various evaluation parameters.

NAME	Referenced Indian Standard(IS)	Initial Setting Time (Min)	Reading Of Needle	Initial Setting Time (Min)
Decan (Opc)	IS:269	30	3	30
Ultratech (Opc)	IS:8112	30	3	24
Maha (Opc)	IS:12269	30	5	20
Amma (Ppc)	IS:1489	30	4	28
Arasu (Opc)	IS:455	30	4	27

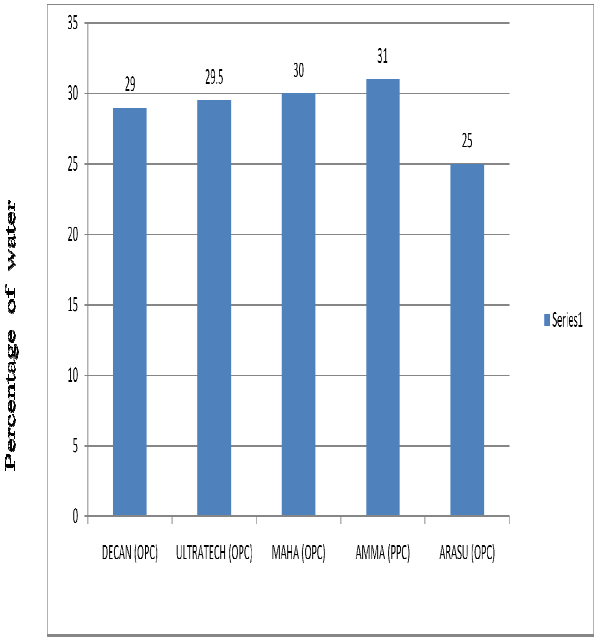

Fig. 3 Various brand cement comparison for different percentage of water.

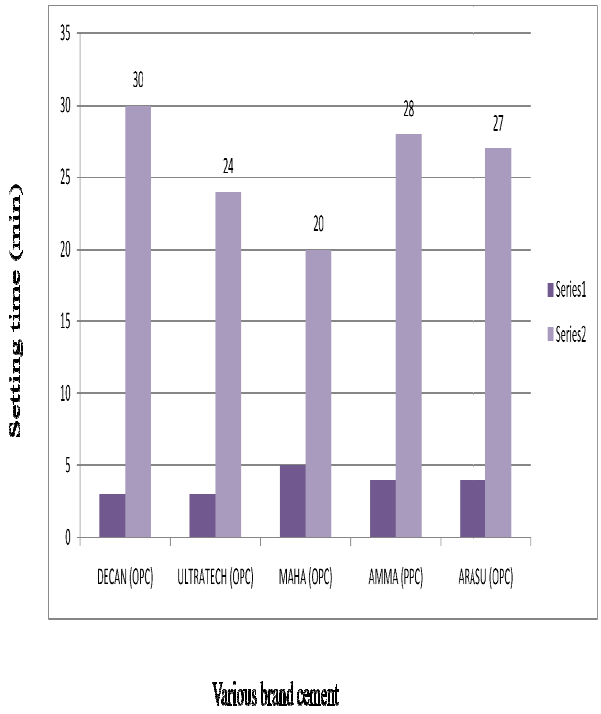

Fig. 4 Initial settlement time for each brand.

Table 5 Final Setting Time In Second.

NAME	Referenced Indian Standard(IS)	Initial Setting Time (Min)	Needile Of Reading	Initial Setting Time
Decan (Opc)	IS:269	600	0	6 hr 8 min
Ultratech (Opc)	IS:8112	600	0	7 hr 56 min
Maha (Opc)	IS:12269	600	0	6 hr 45 min
Amma (Ppc)	IS:1489	600	0	7 hr 24 min
Arasu (Opc)	IS:455	600	0	8 hr 15 min

Specific Gravity Of Cement

Specific gravity of fine aggregate = 2.50
M- Sand = 2.63
IS Code 2386 = 2.70
(Specific Gravity)

Sieve Analysis (Normal Sand & M –Sand), Sieve Analysis Comparison: IS Code 383 Parts - 1

Table 6 Sieve analysis for different grading.

IS Sieve Size	Percentage passing (%)			
	Grading zone I	Grading zone II	Grading zone III	Grading zone IV
10mm	100	100	100	100
4.75mm	90-100	90-100	90-100	95-100
2.36mm	60-95	75-100	85-100	95-100
1.18mm	30-70	55-90	75-100	90-100
600µ	15-34	35-59	60-79	80-100
300 µ	5-20	8-30	12-40	15-50
150 µ	0-10	0	0-10	0-15

Table 6 M- SAND sieve analysis.

Sieve Size (mm)	% fines of manufactured sand		
	Trial - 1	Trial -2	Trial – 3
4.75mm	100	100	100
2.36mm	90	90.4	85.3
1.18mm	61.2	62	52
0.6mm	47.6	48	39.4
0.425mm	35.8	38	31
0.3mm	24.8	27.6	24.5
0.15mm	12.8	13.6	8.6
0.075mm	4	3.6	3
PAN	0	0	0

Table 7 Normal Sand Sieve Analyses.

Sieve Size (mm)	% fines of manufactured sand		
	Trial - 1	Trial -2	Trial - 3
4.75mm	100	100	100
2.36mm	92.5	92.2	92.6
1.18mm	64.2	63.5	59
0.6mm	49.6	50	51
0.425mm	41.8	39	39.5
0.3mm	29.5	28.6	29.5
0.15mm	12.8	13.6	8.6
0.075mm	4	3.6	3
PAN	0	0	0

Specific Gravity Test Course Aggregates

Calculation

Specific gravity = w4 / [w3-(w1-w2) = 2.65
IS:2836 – Part - 4 =2.7

Result

Specific gravity of coarse aggregates = 2.65
It is compare to IS:2836 Part – 4 =2.7

Crushing Strength Test

Observation

Weight of sample retain in
12.5mm sieve (W1) = 3400g
Weight of sample passing In
2.36mm sieve(W2) = 800g
(W2/W1)*100 = 23.52%

Table 8 observation for different samples.

Detail Of Sample	Trial 1	IS 2386 Part - 4	Trial 2
Wt of the sample w1g	1500g	-	5000g
Wt of the sample after abrasion test coarse 1.70mm IS sieve w2 g	4600g	-	4560g
% coarse w1-w2/w1 × 100	8%	10%	8.8%

Table 9 Impact Test.

S.NO	DETAILS OF SAMPLE	TRIAL 1	IS:2386 Part – 4	TRIAL 2
1	Total wt of aggregate sampling cylinder –w1	400g	-	400g
2	Weight of the aggregate 2.36mm sieve test w2	90g	-	82g
3	Wt of the aggregate retained 2.36mm sieve after the test W3	310g	-	318g
4	W1-W2 + W3	620g	-	636g
5	W2/W1 × 100	22.5%	24%	20.5%

Average = 21.5%
IS:2386 Part – 4, Average:24%

ABRASION TEST

Table 10 Compressive strength test of cement mortar

Type	3 Days (Mpa)	7 Days (Mpa)
DECAN	27	27
ULTRATECH	24	36
MAHA	22	30
AMMA	23	33
ARASU	16	22

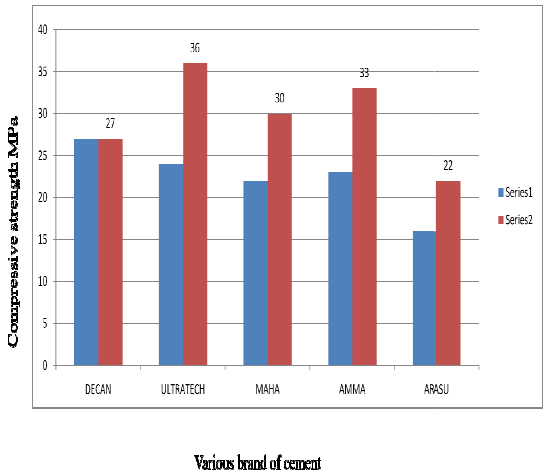

Fig. 5 Three & seven days compressive strength.

V. CONCLUSION

Concrete is a stone like material obtained by permitting carefully proportioned mixture of cement, sand gravel or other aggregate and water to harden in forms of the shape and dimension of the desired structure. The most important binding material is cement and lime. The inert materials used in concrete are termed as aggregates. Fine and coarse aggregate all important for every RCC and high way works. We must tests the fine aggregate and coarse aggregate. The quality of materials must be controlled for the sustainable development of concrete technology.

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