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M40 Concrete with Marble Dust, Clay (POP) and Wood Apple

Shilpa Jain[1], Prof. Anubhav Rai[2]

[1]*Currently pursuing Master Degree Program in Structural Engineering in GGITS Jabalpur, RGPV University Bhopal , India*

[2]*Asst. Prof. in Civil Engineering Dept. GGITS Jabalpur (M.P.) India*

***Abstract*--This following work is to Design M40 concrete with marble dust and clay (POP) as a partial replacement of cement by 5%, 10%, 15%,and 20%. The compressive strength test after 7 days and 28 days have also been performed. The constant amount of Wood apple is also used. The result on the basis of compressive strength of the 150mm standard cube has been shown by the graph between varying percentage of marble dust and clay(POP) and compressive strength.**

The idea is to achieve higher strength concrete in economical manner by finding the substitute of cement to some extent.

The comparative study between the concrete with Wood apple and without Wood apple have also done and results have been shown by the graphs.

Index terms-Clay(POP), Compressive strength, Concrete mix, Marble dust, Wood apple .

I. INTRODUCTION

In this work, the M40 concrete is designed and partial replacement of cement with marble dust and Clay(POP) has been done .A comparative study between concrete with wood apple and without wood apple is also done to form a better concrete. A marble powder, obtained as a by product of marble sawing and shaping, was characterised from a strength point of view for evaluating the possibility of using it in concrete production. About 25% marble is resulted as a dust during the cutting process. The POP is a decorative construction material which is used in many work. It gives the fine look and colour to the walls. The wood apple which is a type of fruit, has been used as a construction material in past days. It has a binding properties so the idea was that, it will enhance the binding properties of cement.

The concrete is a most important construction material , which cost is directly proportional to the cost of cement. So finding the substitute of a cement in concrete is very much field of interest now a days. In this paper I have designed a M40 concrete by the design criteria given in the IS10262-2009. A step further I observed the effect on the compressive strength of concrete after 7 days and 28 days by partially replacing the cement by marble dust in one case and by clay (POP) in other case.

The replacement of cement is done in the form of percentage by weight of cement i.e. 5%,10%,15%,20%.

The result which is obtained is represented as a graph between concrete mix with partially replaced cement and the compressive strength of concrete.

II. METHODOLOGY

To carry out the proposed study cubes of concrete (0.4 : 1 : 1.216 : 2.643) with varying partial replacement of cement with the same amount of marble dust were cast and tested at two different intervals of 7 days and 28 days. Also cubes of concrete (0.4 : 1 : 1.216 : 2.643) with partial replacement of cement with same amount of clay were cast and tested in same intervals. Their result were compared with the standard M40 concrete .

Specific gravity of Cement, CA, FA, Clay, Marble dust (Table no.1)

CEMENT	3.15
COARSE AGGREGATE	2.725
FINE AGGREGATE	2.67
CLAY (POP)	2.49
MARBLE DUST	3.15

- Consistency of cement is 35%. Initial and Final setting time of cement is 50 minutes and 540 minutes respectively
- Fine aggregates conforms to Zone II As per IS: 383-1970.

III. MIX DESIGN

Based on the Indian Standard (IS 10262-2009), Design mix for M40 grade concrete was prepared by partially replacing the cement with five different percentage by weight of marble dust and clay (POP) (5%,10%,15%,20%). The mix proportions for M40 grades of concrete with varying percentage of marble dust and clay is presented in table 2 and 3.the amount of wood apple which is used in this work is 20gms, which is only a 0.83% by weight of water.

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(Table no. 2)

Sr No.	Concrete mix	W/C ratio	Water (ltr)	Cement (kg)	Marble dust (kg)	FA (kg)	CA (kg)
1	M40-1	0.4	170	425	0	517.163	1123.12
2	M40-2	0.4	170	403.75	21.25	517.163	1123.12
3	M40-3	0.4	170	382.5	42.5	517.163	1123.12
4	M40-4	0.4	170	361.25	63.75	517.163	1123.12
5	M40-5	0.4	170	340	85	517.163	1123.12

(Table no. 3)

Sr No.	Concrete mix	W/C ratio	Water (ltr)	Cement (kg)	Clay (kg)	FA (kg)	CA (kg)
1	M40-1	0.4	170	425	0	517.163	1123.12
2	M40-2	0.4	170	403.75	21.25	517.163	1123.12
3	M40-3	0.4	170	382.5	42.5	517.163	1123.12
4	M40-4	0.4	170	361.25	63.75	517.163	1123.12
5	M40-5	0.4	170	340	85	517.163	1123.12

IV. OBSERVATION TABLE

M40 concrete mix
(Table no. 4)

Mix No. And Name	Strength in MPa	
	7 Days strength	28 Days strength
M40 1	31.5	48.8
M40 2	32.8	51.1
M40 3	33.33	52

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Concrete mix Design with Marble dust without Wood apple
(Table no. 5)

Mix No. And Name	Strength in MPa		MD
	7 Days strength	28 Days strength	
M40 4	24.5	40	5%
M40 5	24.6	44.44	
M40 6	26.67	44.44	
M40 7	33.33	48.5	10%
M40 8	31.11	51.2	
M40 9	28.88	51.2	
M4013	24.44	42.22	15%
M4014	20	40	
M4015	21.33	39.11	
M4016	22.22	40	20%
M4017	22.22	37.77	
M4018	20	38.66	

Concrete mix Design with Marble dust with wood apple
(Table No. 6)

Mix No. And Name	Strength in Mpa		MD
	7 Days strength	28 Days strength	
M40 19	26.95	44.4	5%
M40 20	27.06	49.3284	
M40 21	29.337	49.3284	
M40 22	36.663	53.835	10%
M40 23	34.221	56.832	
M40 24	31.768	56.832	
M40 25	26.884	46.8642	15%
M40 26	22	44.4	
M40 27	23.463	43.4121	
M40 28	24.442	44.4	20%
M40 29	24.442	41.9247	
M40 30	22	42.9126	

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Concrete Mix Design with Clay (POP) without Wood Apple
(Table no. 7)

Mix No. And Name	Strength in MPa		Clay
	7 Days strength	28 Days strength	
M4031	17.77	44.44	5%
M4032	20	37.77	
M40 33	20	39.11	
M40 34	35.56	48.6	10%
M40 35	33.33	51.2	
M40 36	33.33	52	
M40 37	28.88	40	15%
M40 38	28.88	42.22	
M40 39	31.11	35.55	
M40 40	22.22	37.77	20%
M40 41	24.44	31.11	
M40 42	25.77	33.33	

Concrete Mix Design with Clay (POP) with wood apple
(Table No. 8)

Mix No. And Name	Strength in Mpa		
	7 Days strength	28 Days strength	
M40 43	19.3693	48.884	5%
M40 44	21.8	41.547	
M40 45	21.8	43.021	
M40 46	38.7604	53.46	10%
M40 47	36.3297	56.32	
M40 48	36.3297	57.2	
M40 49	31.4792	44	15%
M40 50	31.4792	46.442	
M40 51	33.9099	39.105	
M40 52	24.2198	41.547	20%
M40 53	26.6396	34.221	
M40 54	28.0893	36.663	

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V. RESULT

Mix Design With Marble Dust
(Table No. 9)

CONCRETE MIX	Strength with Marble dust			
	without wood apple		with wood apple	
	7 DAYS	28 DAYS	7 DAYS	28 DAYS
0	32.54	50.63	32.54	50.63
5%	25.256	42.96	27.78	47.68
10%	31.11	50	34.22	55.83
15%	21.92	40	24.11	44.89
20%	21.48	38.81	23.628	43.07

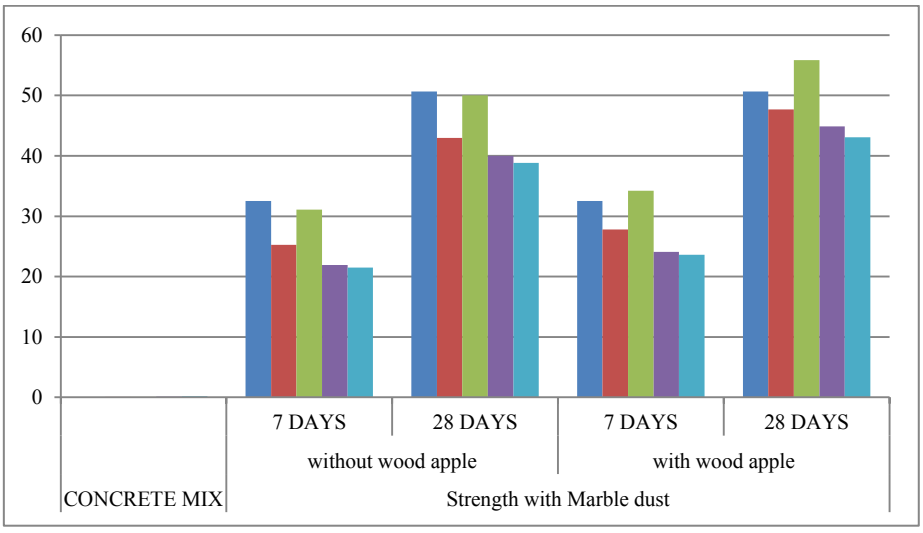

Figure no. 1

Mix design with Clay(POP)
(Table no. 10)

CONCRETE MIX	Strength with clay (POP)			
	without wood apple		with wood apple	
	7 DAYS	28 DAYS	7 DAYS	28 DAYS
0	32.54	50.63	32.54	50.63
5%	19.25	40.44	20.98	44.48
10%	34.07	50.61	37.13	55.66
15%	29.62	39.25	32.28	43.18

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20%	23.47	34.07	26.31	37.87

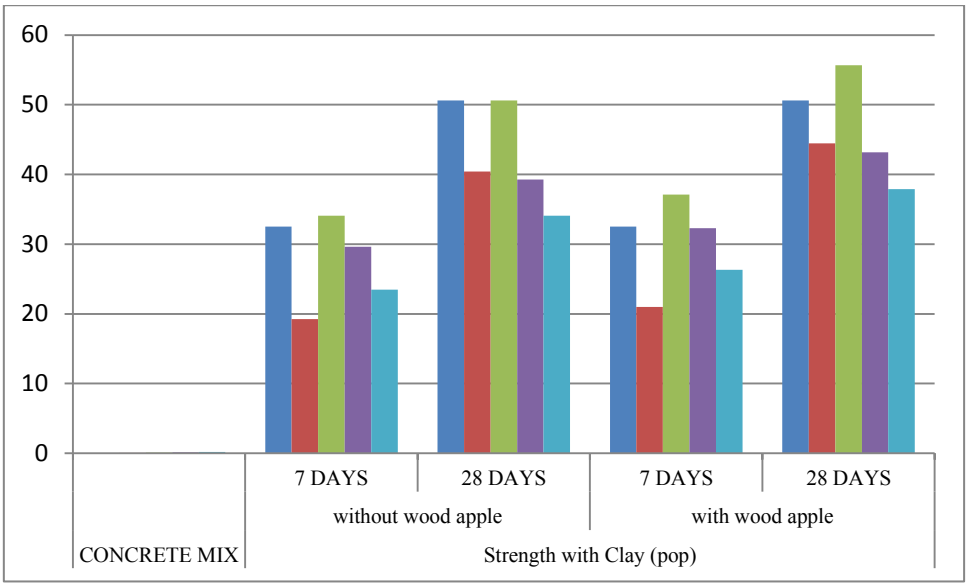

Figure No. 2

The result of compressive strength at 7 and 28 days were investigated , table (9) and figure (1) shown, represent the average result of compressive strength test of concrete specimens containing marble dust with percentage ratio 0%, 5%, 10%, 15%, 20% as a partial replacement by weight of cement respectively at age 7 and 28 days .with Wood Apple and Without Wood Apple. And table (10) and figure (2) shown, represents the average result of compressive strength test of concrete specimens containing clay(POP) with percentage ratio 0%, 5%, 10%, 15%, 20% as a partial replacement by weight of cement respectively at age 7 and 28 days with and without Wood Apple.

VI. CONCLUSION

Based on the experiment investigation concerning the compressive strength of M40 concrete, the following observations are made regarding the partially replaced marble dust and clay (POP).

(a) Compressive strength increases at 10% replacement of cement by marble dust and clay separately.
(b) We can not decrease or increase the quantity of cement replacement by 10% because it will give the compressive strength lower then the target mean strength of M40 concrete.
(c) Clay (POP) provides greater strength then the marble dust when replaced the 10% cement in the concrete.
(d) We can use Wood apple as a admixture in the concrete because it will enhance the binding properties of cement in the concrete.
(e) The small amount of wood apple (about 0.83% by weight of water) can increase the strength about 10%.
(f) It will be economical to partially replaced the cement by marble dust and clay(POP) in high strength concrete (M40 grade of concrete).

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