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Experimental Studies on Corrosion and Durability Analysis in Building Materials

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Abstract : In modern days the stipulate for river sand is increasing due to its lesser accessibility. Hence the preparation of replacing river sand with M-Sand is tacking a tremendous growth. It is also inferred from the literature that replacement of normal sand with M-Sand produces no appreciable increase in compressive strength due to the variation in the pore size of concrete at micro level. This paper presents the optimization of fully replacement of manufactured sand by natural sand with waste recycling paper cupsash partial replacement by cement and additional polyvinyl alcohol used for good bonding &high performance concrete. Using M20 Grade ordinary Portland cement is moderately replaced with waste recycling paper cups ash by 5 %, 10% &adds 10 % of polyvinyl alcohol and natural sand is fully replaced with manufactured sand. The studies make known that the increase in percentage of partial substitute of waste recycling paper cups ash and polyvinyl alcohol increased the compressive, flexural, durability, low permeability, high corrosion resistance and low acid penetration of concrete.

Key words : compressive strength, durability, polyvinyl alcohol, paper cups ash, corrosion resistance M – sand.

I. Introduction

The huge quantity of concrete is consumed by construction industry all over the world. In India, the conventional concrete is produced using natural sand from river beds as fine aggregate. Decreasing natural resources poses the environmental problem and hence government restriction on sand quarrying resulted in scarcity and significant increase in its cost. Normally particles are not present in river sand up to required quantity. Digging sand, from river bed in excess quantity is hazardous to environment. The deep lowest point dug in the river bed, affects the ground water level. In order to fulfill the requirement of fine aggregate, some alternative material must be found. The cheapest and the easiest way of getting substitute for natural sand is obtained from limestone quarries, lateritic sand and crushing natural stone quarries is known as manufactured sand. In this studywaste paper sludge ash was partially replaced as 5%, 10%, 15% and 20% in place of cement in concrete for M-25 mix and tested for its compressive strength, tensile strength, water absorption and dry density up to 28 daysof age and compared with conventional concrete. From the results obtained, it is found that Waste Paper SludgeAsh can be used as cement replacement up to 5% by weight and particle size less than

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90 µm to prevent decrease in workability. Further waste paper sludge has very high calorific value and could be used as a fuel before using its ash as partial cement replacement [1].Steel fiber reinforced concrete is a composite material having fibers as the additional ingredients, dispersed uniformly at random in small percentages, i.e. between 0.3% and 2.5% by volume in plain concrete. SFRC products are manufactured by adding steel fibers to the ingredients of concrete in the mixer and by transferring the green concrete into moulds. The product is then compacted and cured by the conventional methods. Segregation or balling is one of the problems encountered during mixing and compacting SFRC. This should be avoided for uniform distribution of fibers. The energy required for mixing, conveying, placing and finishing of SFRC is slightly higher. In this paper we study to the compressive strength of concrete using waste plastics and also add steel fiber with waste plastics. M-20 grade of concretehaving mix proportion 1:1.66:3.33 with water cement ratio 0 .50 to study the compressive strength of concrete using waste plastics and waste plasti c + steel fiber [2]. Less than 0.25 per cent of the estimated 3 billion paper cups used each year in the UK are currently recycled, meaning the vast majority end up in landfill or energy-from-waste incinerators. However, calls for disposable of waste materials to be more widely recycled are challenged by the make-up of themselves. Concrete mixes containing various contents of the waste were prepared and basic characteristics such as compressive strength and water absorption were determined and compared with a controlmix. Four concrete mixes with 0%, 10%, 15% and 20% of paper waste as an additional material to the concrete were prepared for M-25 concrete. Polyvinyl alcohol fiber (PVA) is an ideal environment-friendly cement reinforced material, which possesses alkali and weather resistance due to its unique molecular structure, taking on good affinity to cement, effectively prevent and suppress the crack formation and development, improve bending strength, impact strength and crack strength, improve permeability, impact and seismic resistance of concrete. This product can be widely used in industrial and civil buildings, walls, roofing, flooring and roads, bridges, tunnels, slope reinforcement. Currently, in cement concrete engineering sector, due to PVA fiber per se unique properties, with a broad prospect for its future in the engineering, PVA fiber is a novel product ideal to completely replace the asbestos in the production of fiber cement corrugate sheet.The current study analyzes the behaviour of polyvinyl alcohol fiber reinforced concrete (PVA-FRC)containing short-length (6 mm) Banana fibers & Sisal fibers with varying fiber content. The mix was dosed with Poly vinyl Alcohol solution at 0.5% volumetric fraction. Fly ash is also used as a partial replacement of Portland cement in all the mixes [4]. The combination of laterite and quarry dust to replace the conventional river sand in the production of concrete for the construction industry. The compressive strengths of concrete using lateritic sand and quarry dust were measured in the laboratory. Compressive strength was found to increase with age as for normal concrete. The 28 - day compressive strength was found to range from 17 - 34.2N/mm^{2}for different mixes. The above strength properties were found to compare closely with normal concrete. The proportion of 25% laterite to 75% quarry dust produced higher values of compressive strength. For the same proportion of 25% laterite and 75% quarry dust at 1:1.5:3 mix and 0.54 water/cement ratio, a logarithmic model has been developed for predicting the compressive strength of concrete between 0 and 28 days [5].When rice husk ash which has a lower loss on ignition value compared to OPC is used to partially replace OPC, resistance to chloride permeation is substantially improved. This may be probably due to a decrease in electrical conductivity of concrete due to lowering of unburnt carbon content in RHA, in addition to pore structure refinement and conductivity of pore solution [6].Hence the practice of replacing river sand with hydro sluiced bottom ash and lateritic is taking a tremendous growth. It is also inferred from the literature that replacement of normal sand with hydro sluiced bottom ash and lateritic sand produces no appreciable increase in compressive strength due to the variation in the pore size of concrete at micro level. This paper presents the optimization of partially replacement ofhydro sluiced bottom ash and lateritic sand by natural sand with nano silica in high performance concrete. The ordinary Portland cement is partially replaced with nano-silica by0.35 %, 0. 5 %, 0.75 % and natural sand is partially replaced with hydro sluiced bottom ashand lateritic sand. Samples of concrete (eg.cubes) are made in M25 grade. The studies reveal that the increase in percentage of partial replacement of nano silica increased the compressive, tensile and flexural strength of concrete. It was found that 0.55 water/cement ratio produced higher compressive strengths, tensile strength and better workability for partially replaced with nano-silica by 0.50 % mix, proportion. These results compare favourably with those of conventional concrete. By practice it shows that conventional mix has more strength than bottom ash sand and lateritic sand mix so we will be adding various % of nanosilica to the bottom ash mix and compare the values of compressive strength, corrosion resistance, tensile strength and economy in practice of conventional mix [7]. The concrete are made using varying contents of bottom ash and lime stone filler as fine aggregate. The quantity of bottom ash was varied from 0% to 100% against lime stone filler at intervals of 25%. Samples of concrete (eg.cubes) are made in three different grades, namely: M15, M20 and M25. It was found that 0.55 water/cement ratio produced higher compressive strengths, tensile strength and better workability for

M20 mix, proportion. Specifically compressive and tensile strength ranged from 21.06 -35.2 N/mm^2 and 10.06 - 15.5 N/mm^2 for the mixes considered. These results compare favourably with those of conventional concrete. The concrete was found to be suitable for use as structural members for buildings and structures, where bottom ash content did not exceed 50%.[8].Corrosion is a natural process, which converts a refined metal to a more chemically-stable form, such as its oxide, hydroxide, or sulphide. It is the gradual destruction of materials (usually metals) by chemical and/or electrochemical reaction with their environment. Corrosion engineering is the field dedicated to controlling and stopping corrosion.In the most common use of the word, this means electrochemical oxidation of metal in reaction with an oxidant such as oxygen or sulphur. A survey and review of recent patents on electrochemical methods for corrosion monitoring from 1999 to 2009 are presented in this paper. The patents were classified into 4 groups according to different electrochemical theories, which are potential, polarization, electrochemical impedance and electrochemical noise. A future outlook of the development on new research aspects particularly on methods based on electrochemistry is prospected [9].One solution to this problem, developed by Fiber Optic Systems Technology Inc. (FOX-TEK), combines very sensitive nonintrusive FT fiber-optic wall thickness sensors with networked monitoring instrumentation and a satellite- or cell-based modem. This system allows accurate remote tracking of pipeline corrosion from virtually anywhere [10].So we are going build up the strength and durability performance of the concrete and corrosion analysis using solid waste materials like waste paper cups(ash from burning paper cups is replaced for some percentages like 5% and 10% of cement along with poly vinyl alcohol).

II Experimental Investigation

2. 1 Materials

2.1.1Cement:

Portland pozzolanic cement 53 grade conforming to IS 8112 – 1989, and specific gravity of cement is found to be 3.15. The properties of cement given in Table .1and Sieveanalysis of river Sand & M – Sand Table2

Table. I: Properties of Cement

Physical properties of cement		
Fineness, m^2/kg	313	Minimum 300
Initial setting time(minutes)	114	Minimum 30
Final setting time(minutes)	156	Maximum 600
Standard consistency	27.1	-
Soundness, Le Chatelier, mm	2.0	Maximum 10
Mechanical properties of cement(Compressive strength, Mpa)		
3-days	23	Minimum 16
7-days	30	Minimum 22
28-days	40	Minimum 33
Chemicalproperties of cement		
Component	**Results (%)**	**Requirements of IS:1489**
Sio_2	21.8	-
$A1_20_3$	4.8	-
Fe_20_3	3.8	-
CaO	63.3	-
$S0_3$	2.04	Maximum 3
$Mg0_3$	0.91	Maximum 6
Na_20	0.21	-
K_20	0.46	-
CI	0.06	Maximum 0.1
P2O5	<0.05	-
Loss of ignition	1.36	Maximum 5
Insoluble residue	17.96	-

Table 2: Sieve analysis of river Sand & M – Sand

IS sieve designation	River sand% Passing	M- sand% Passing
4.75 mm	99.43	98.1
2.36mm	95.84	98.23
1.18mm	66.27	43.35
600nm	47.27	29.6
300um	30	23
150um	9.27	5.3

2.1.2 Fine aggregate:

Locally available river sand having bulk density 1860 kg /m^3 is used and the specific gravity 2.83 and fineness modulus of river sand is 2.98

2.1.3Manufactured sand:

M-Sand is replaced is fully replacement of river sand.It is collected from BAG Groups Coimbatore, India. The bulk density of manufactured Sand 1360 kg/m^2 and the specific gravity 2.33 and fineness modulus of rive Sand is 3.0.

2.1.4 Course aggregate:

Considering all the above aspects, blue granite crushed stone aggregate of 12.5mm as maximum size and of typical particle shape "average and cubic" are used as the course aggregate for the present investigation. The aggregates are tested as per the procedure given in BIS: 2386- The bulk density of coarse aggregate 1760 kg/m^2 and the specific gravity 2.88 and fineness modulus of coarse aggregate 7.13

2.1.5 Waste paper cups:

The waste paper cupsare partially replaced for cement. Less than 0.25 per cent of the estimated 3 billion paper cups used each year in the UK are currently recycled, meaning the vast majority end up in landfill or energy-from-waste incinerators. However, calls for disposable of waste materials to be more widely recycled are challenged by the make-up of themselves.

2.1.6. Polyvinyl alcohol

PVA, like proteins, is a water-soluble polymer. PVA is partially crystalline upon formation and is characterized by properties such as chemical resistance, water solubility, and biodegradability. The similarity in physical properties makes it compatible with human tissues. Chemical Composition of Polyvinyl alcohol Table 3

Table.3: Chemical Composition of Polyvinyl alcohol

Chemical formula	$(C_2H_4O)_x$
Density	1.19-1.31 g/cm^3
Melting point	200 °C (392 °F; 473 K)
Boiling point	228 °C (442 °F; 501 K)
Refractive index (n_D)	1.477 @ 632 nm
Chemical formula	$(C_2H_4O)_x$

Melting point:

230 °C and 180–190 °C (356-374 degrees Fahrenheit) for the fully hydrolysed and partially hydrolysed grades, respectively. It decomposes rapidly above 200 °C as it can undergo pyrolysis at high temperatures.

Molecular weight = 14,000
Appearance: Dense, white flakes Viscosity of 4% aqueous solution ~ 4-6 cps
Ash = max 1%

III. Experimental Procedure

The mix ratio is all set for M20 grade concrete for equally conventional sand and as well M-Sand. The Cube size of (150 x 150 x 150) mm Specimen is prepared for compressive strength. The specimens are tested for 7 days and 28 days with every one proportion of polyvinyl alcohol &Waste paper cups ashand M-Sand mix. Totally there are 42 cubes are casted. For durability test mortar specimen is ready in a mix ratio of 1:3, the cube size of (70 x70 x 70) mm is prepared for water absorption test, permeability test. For corrosion analysis mortar specimen is prepared in a mix ratio of 1:3, the disc of size 100 mm diameters and 50 mm thickness.(50 x 10x10) cm prism is prepared for flexural strength. The specimens are tested for 7days, 14 days and 28 days.All the specimens are remoulded after 24 hours, and curing is done in water for 28 days.

IV Result and Discussion

The Compressive strength of concrete are presented in table 4

Table 4- Compressive strength of concrete

S.No	Type of mix	7 Days Strength N /mm^2	28 Days Strength N /mm^2
1	Conventional mix	21	29
2	M –Sand Mix	16.5	21
3	M - Sand + 5% ash	11	20.5
4	M - Sand + 5% ash + 5% PVA	16	23
5	M - Sand + 10 % ash	11	22
6	M - Sand +10% PVA	27.5	32
7	M - Sand +10 % ash + 10 % PVA	17.7	27.5

4.1- Compressive strength of concrete

The test is carried out conforming to IS 516 -1959 to obtain compressive strength of concrete at the 7days and 28 days. The cubes are tested using 400 tonne capacity HELICO compressive testing machine (CTM) .The results are presented in Fig.1&2

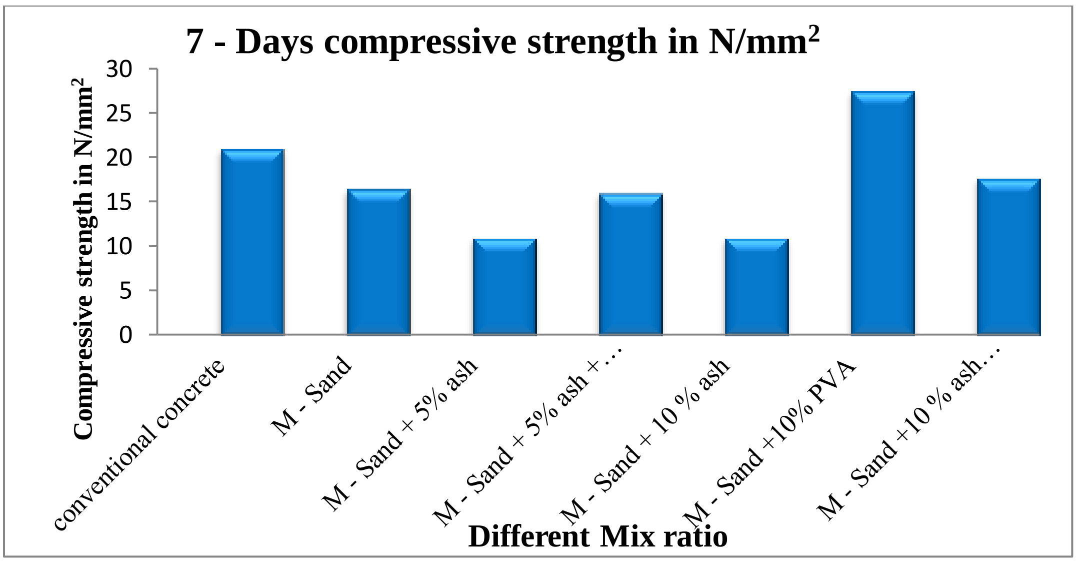

Figure .1 7 – Days Compressive Strength

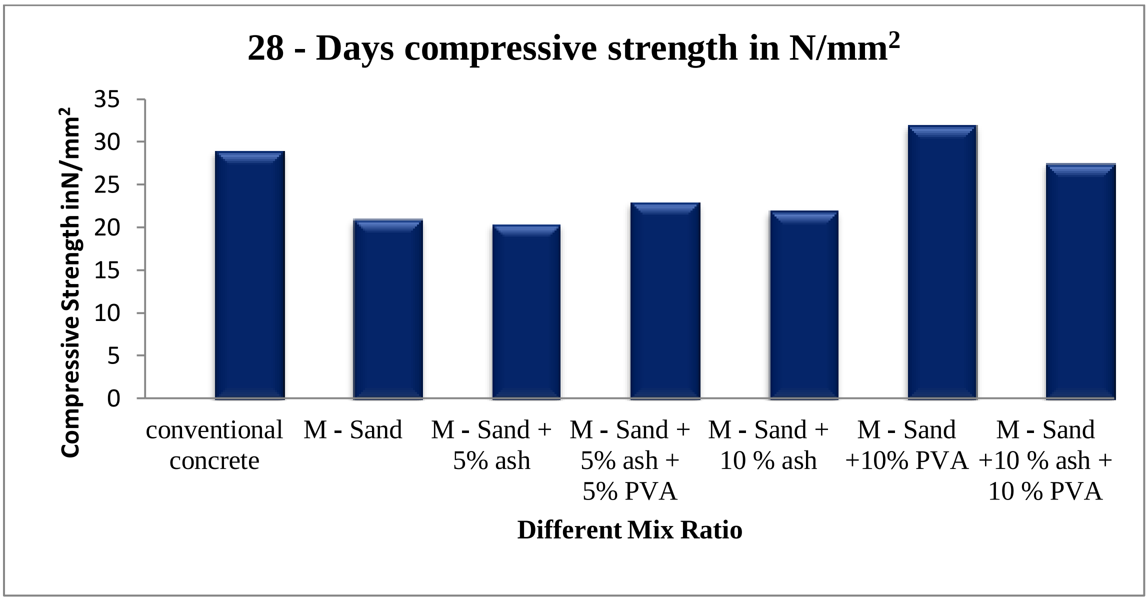

Figure .2 28 – Days Compressive Strength of concrete

The 7days compressive strength of M-Sand with 5% and 10% recycling paper cup ash concrete 47.65% & 33.33% of compressive strength is reduced when compared to the normal river sand and M-Sand concrete. The compressive strength of normal river sand, M-Sand concrete and of M - Sand +10 % ash + 10 % PVA concrete is essentially same. The compressive strength of M - Sand with 10 % PVA concrete is 10.63% superiorto the conventional concrete. M - Sand +5 % ashes,M - Sand +10 % ash and M - Sand + 5% ash + 5% PVA concrete is comparatively same.

The 28 days compressive strength of M-Sand with 5% and 10% recycling paper cup ash concrete 29.31% & 24.13% of compressive strength is reduced at what time compared to the normal river sand. The compressive strength of normal river sand and of M - Sand +10 % ash + 10 % PVA concrete is more or less same. The compressive strength of M - Sand with 10 % PVA concrete is 9.37% higher than the conventional concrete. The 28 days compressive strength M - Sand +5 % ashes,M - Sand +10 % ash and M - Sand + 5% ash + 5% PVA concrete is roughly same.

4.2. Flexural Strength of concrete

The test is carried out conforming to IS 516 -1959 to obtain flexural strength of concrete at the 7days,14 days and 28 days are tested using loading frame 750 kN. The results are presented in Table 5 &Figure.3

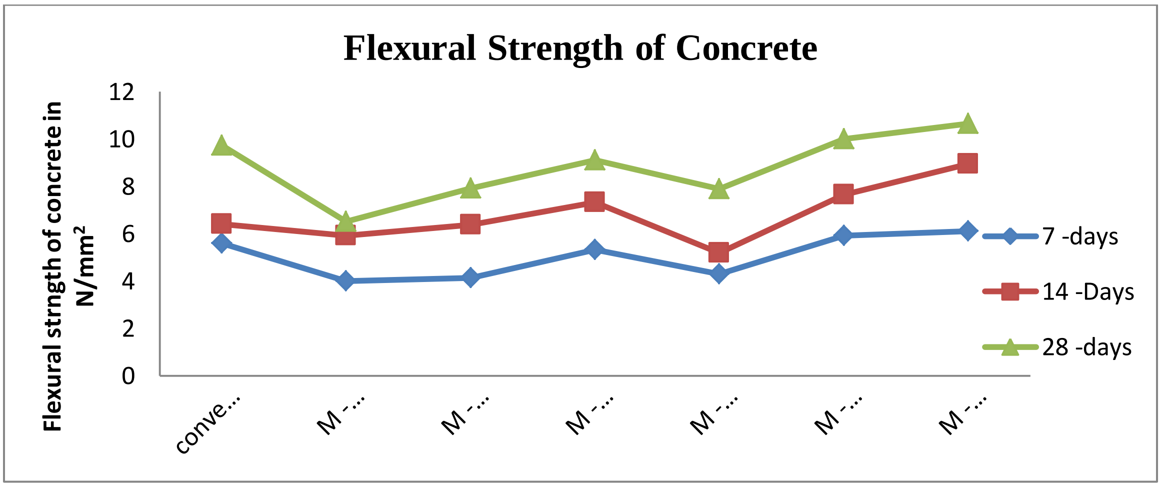

Figure .3 - Flexural Strength of concrete

Table .5 - Flexural Strength of concrete

S.No	Types of mix	7 -days	14 -Days	28 -days
1	Conventional concrete	5.6	6.4	9.72
2	M - Sand	4.01	5.91	6.52
3	M - Sand + 5% ash	4.12	6.38	7.92
4	M - Sand + 5% ash + 5% PVA	5.32	7.32	9.1
5	M - Sand + 10 % ash	4.3	5.2	7.9
6	M - Sand +10% PVA	5.92	7.65	10.01
7	M - Sand +10 % ash + 10 % PVA	6.12	8.94	10.65

The 7days flexural strength of M - Sand +10 % ash + 10 % PVA concrete is 15.76 % is increased compared than conventional concrete.M - Sand +10 % ashes + 10 % PVA concrete is 14 days and 28 days flexural strength also increased compare than predictable concrete. The Polyvinyl alcohol is good flexural strength also good workabilityof concrete. The M- Sand concrete is 7 days, 14 days and 28 days flexural strength of concrete is 28.38 %, 7.6 % and 32.92 % concentratedmeasure up to than the conventional concrete. M - Sand + 5% ash and M - Sand + 10 % ash concrete is flexural strength is more less same and 18.52% and 25.63 % of flexural strength is condense than conventional concrete&M - Sand +10 % ash + 10 % PVA also 17.67% of flexural strength is increased compared than M-Sand concrete.The flexural strength is M - Sand + 5% ash + 5% PVA and conventional concrete is abound with same.

4.3 Durability test

4.3. 1Water absorption test and permeability test

This test is done as per procedure given in ASTM C 642-97 by oven-drying method. For this test 70mm x 70mm x 70mm cubes are cast. After 24 hours of remoulding, the specimens are kept immersed in water. At the end of 28 days, the specimens are taken from the curing tank and air-dried to remove the surface moisture then taken the initial weight (W1) is taken.

The final weight (W2) is taken to the specimens are dried in an oven at a temperature of 100+10^{o} C for 48 hrs, and allowed to cool at room temperature. Results of this test are show in table .6&7

Table.6 - Water Absorptions Test

S.No	Type of mix	% of Water Absorptions Test
1	Conventional mix	1.25
2	M –Sand Mix	3.034
3	M - Sand + 5% ash	1.549
4	M - Sand + 5% ash + 5% PVA	1.423
5	M - Sand + 10 % ash	4.3
6	M - Sand +10% PVA	1.69
7	M - Sand +10 % ash + 10 % PVA	1.44

Table.7- Permeability Test

S.No	Type of mix	% of Permeability Test
1	Conventional mix	10
2	M –Sand Mix	79.48
3	M - Sand + 5% ash	25
4	M - Sand + 5% ash + 5% PVA	15.2
5	M - Sand + 10 % ash	78.72
6	M - Sand +10% PVA	10.44
7	M - Sand +10 % ash + 10 % PVA	10.19

Conventional concrete specimen, Polyvinyl alcohol5% and 10 % of concrete resulted to 58.5 % and 70% decrease of the water absorption and permeability of the concrete when compare to M-Sand mix and M-Sand with ash. The effect of polyvinyl alcoholin reducing the permeability of conventional mix and M-Sand mix

% of Water absorption
% of water absorption = [(W2 – W1)/W1] x 100
Where,
W1 = weight of oven dried sample in air.
W2 = weight of surface dry sample in air after immersion in water.

The constituents are weighted and the material is mixed by hand mixing. The mixes are compacted using table vibration. The water binder ratio (W/B) adopted is 0.4 concrete and mortar. here is a significant improvement in the strength of concrete because of high binder and pozzolanic nature of the polyvinyl alcohol and ash its void filling ablity. The results are presented in Figure.4 & 5

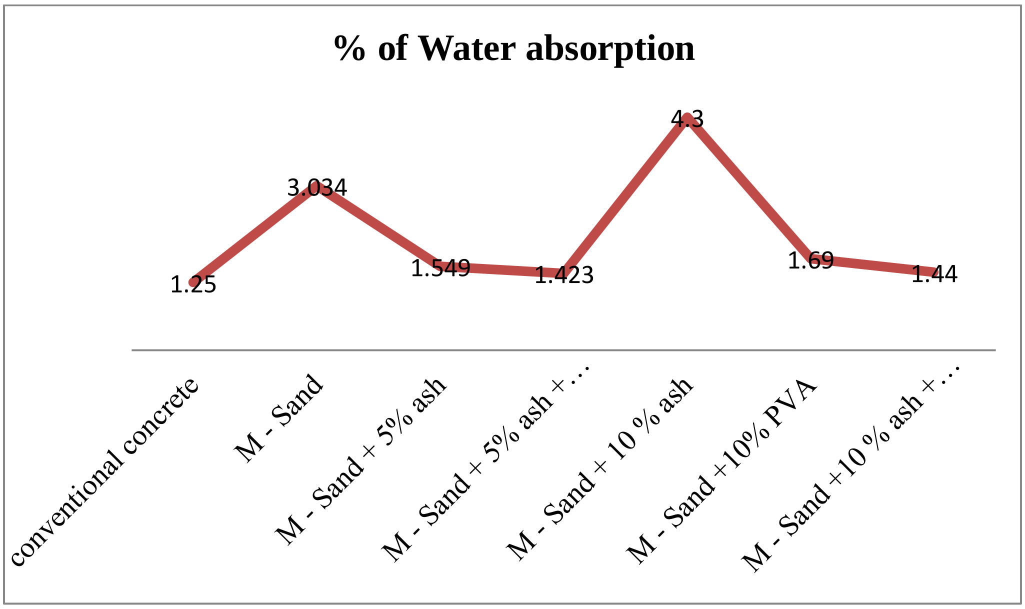

Figure .4 % of Water Absorptions Test

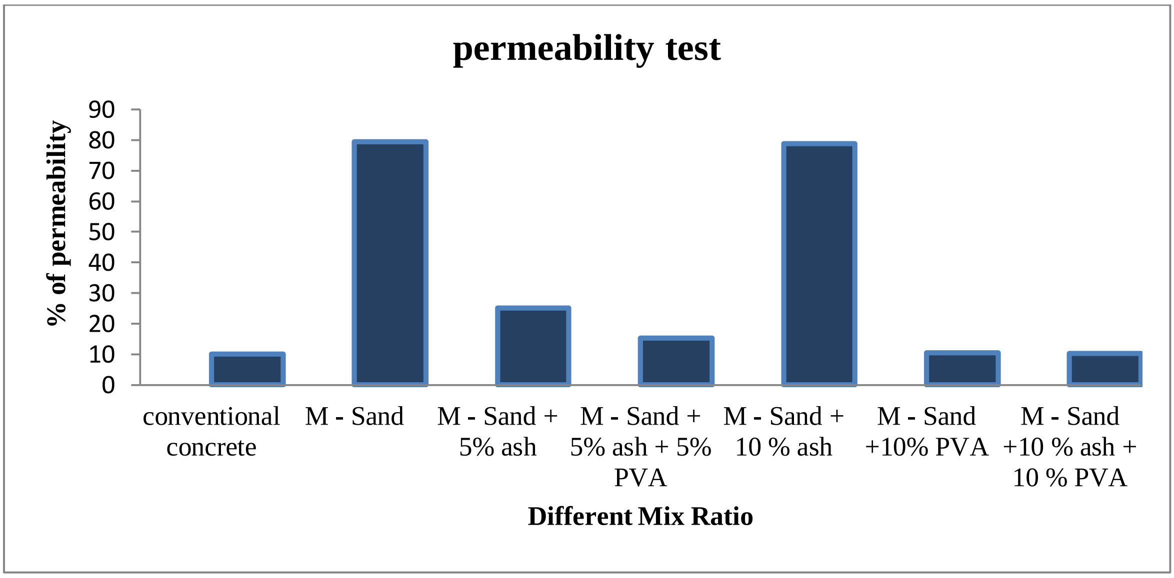

Figure .5 % of permeability test

4.4 Corrosion Analysis

4.4.1 Open circuit potential (OCP) measurements

Cylindrical mortar specimens were cast 10mm diameter steel rod 8cm length using c:m 1:3 mix. After 24 hours, the mortar specimens were demoulded and cured for 28 days in portable water. The specimens were alternatively kept wet & dry conditions after 30 days in 5% Nacl solutions. The half-cell potential measurements on concrete using external reference. The positive terminal of the voltmeter was connected to the working electrode i.e., reinforced steel. The common terminal was connected to the external reference electrode (SCE). The corresponding potentials were recorded. OCP for all the specimen were monitored over an exposure period of 14 days as per ASTM C -876-1994. The results are presented in table 8and Figure.6

Table .8 - Open Circuit Potential (OCP) measurements

Systems	**OCP mV. Vs. SCE**		
	3 - days	**7- days**	**14- days**
Conventional mix	193	183	145
M –Sand Mix	352	352	381
M - Sand + 5% ash	166	156	178
M - Sand + 5% ash + 5% PVA	145	145	195
M - Sand + 10 % ash	190	190	220
M - Sand +10% PVA	221	325	201
M - Sand +10 % ash + 10 % PVA	208	182	177

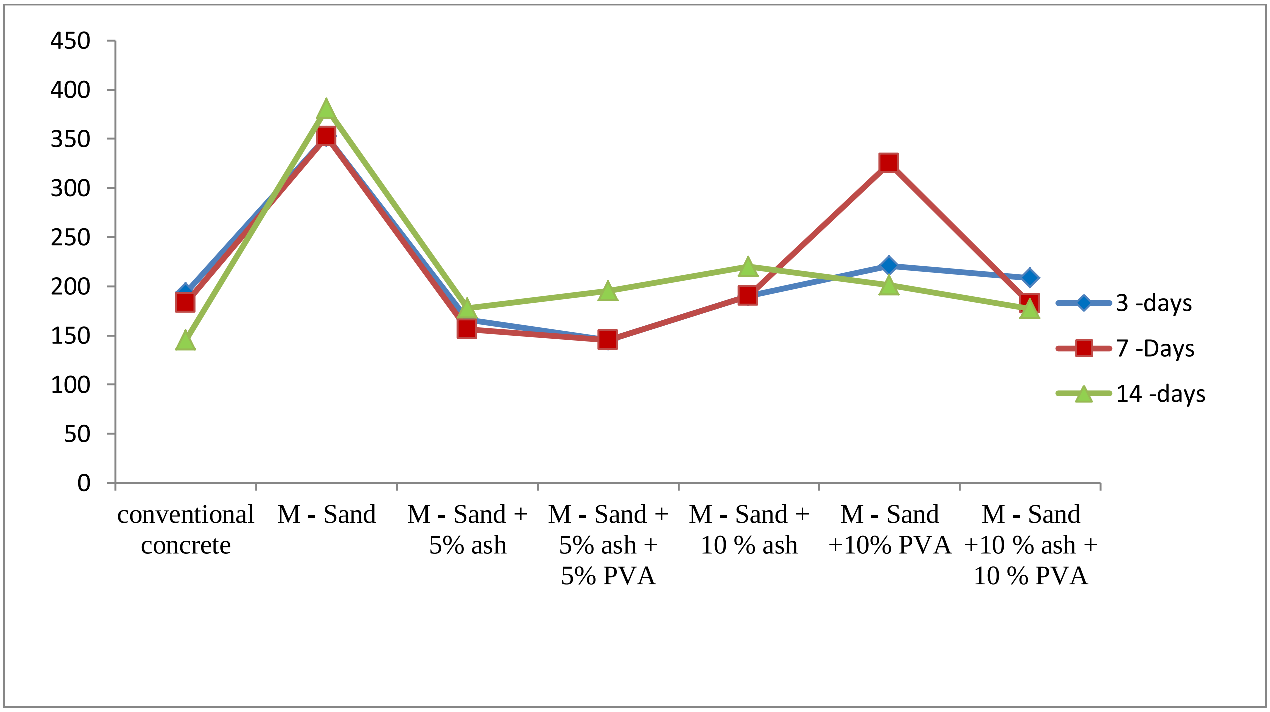

Figure.6 - Open Circuit Potential (OCP) measurements

The potential is measured by voltmeter in different mix concrete specimen. The Conventional concrete specimen and M - Sand +10 % ash + 10 % PVA of concrete resulted is low potential compared other concrete specimen. The M-Sand mix and M- Sand with ash high potential compare than other concrete mix specimen.The effect of polyvinyl alcohol and conventional in reducing the permeability of M-Sand mix.

4.4.2 LCR -Q meter method.

In this Method 100x60 mm size mortar cylinders of 12 mm dia. rebar of 7.0cm length were embeddedat 25 mm cover from one side of the specimen. Initially the resistance of the rod is checked before it is keptinside the specimen. After that the specimen is casted and subject to 28 days of curing in water. After that 5%Nacl Solution is prepared as an electrolyte solution and Stainless steel covering is prepared to keep thespecimen inside. With the help of the Rectifier the positive side of the terminal is connected with theReinforcement bar and negative side of the terminal is connected with the Stainless steel covering. A constantVoltage of 12 V is applied for a constant period of 7 Days. After that period specimen is broken down andresistance of the rod is noted down. It can be used to compare the rate of corrosion of metals in different mixes.The Rod resistance is very high in M-Sand +10% ash has high corrosion resistance than other concrete mix design. The M- sand concrete is low current resistance compare than other concrete mix same time adding polyvinyl alcohol high corrosion and low current resistance. The ash is good corrosion resistance compare than other concrete mix. The results are presented in table 9 and Figure.7

Table .9- LQR Method

S.No	Different types of mix	Current resistance in OHM
1	Conventional concrete	0.31
2	M - Sand	0.56
3	M - Sand + 5% ash	0.41
4	M - Sand + 5% ash + 5% PVA	0.45
5	M - Sand + 10 % ash	0.22
6	M - Sand +10% PVA	0.45
7	M - Sand +10 % ash + 10 % PVA	0.39

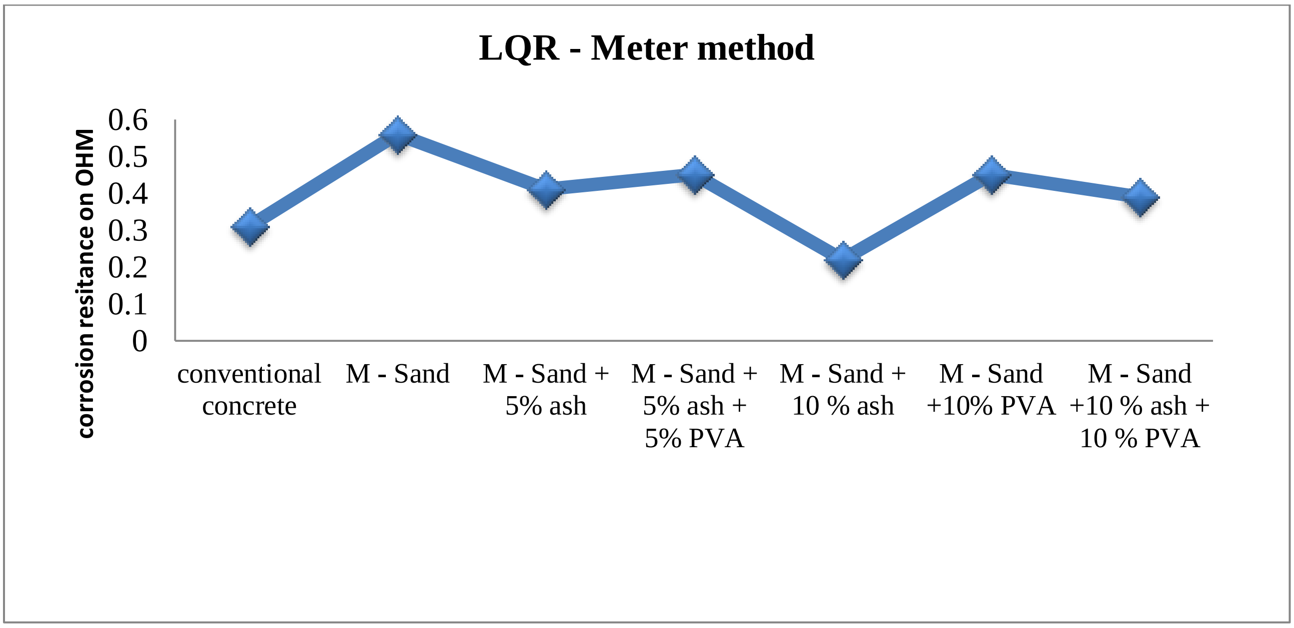

Figure. 7–LQR –Meter method

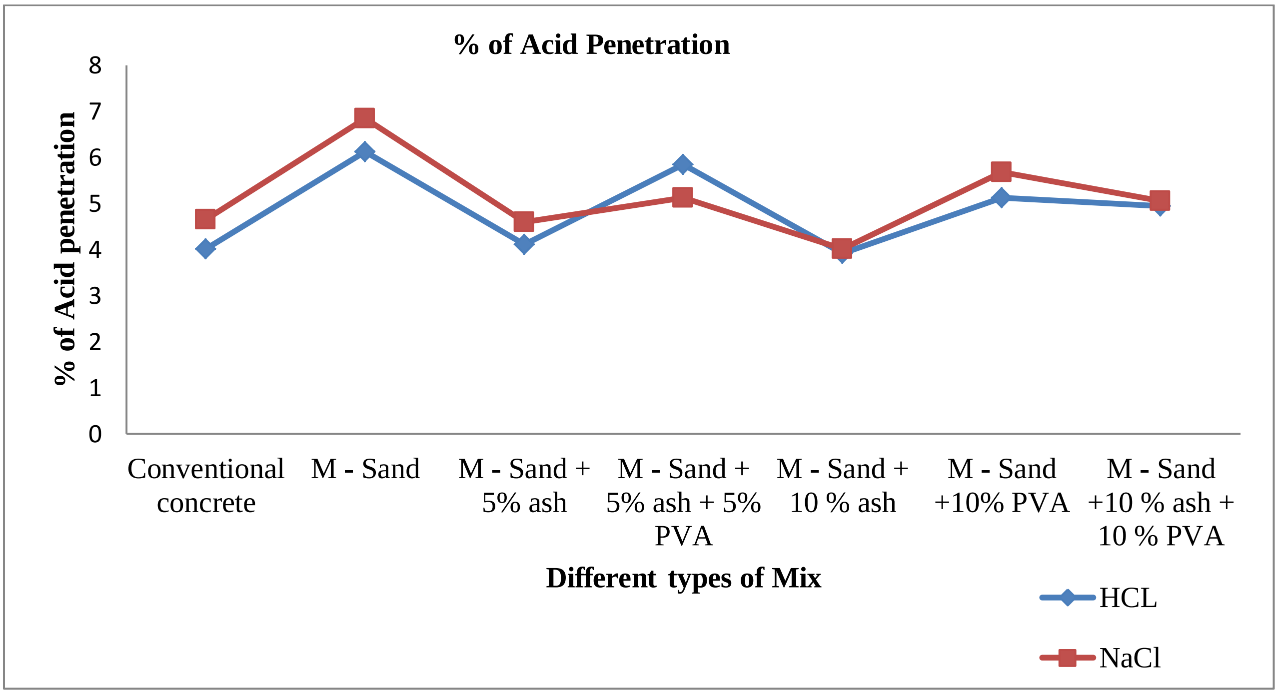

Figure.8 – Acid penetration test

4.4.3. Acid Penetration Test

This test is done as per procedure given in ASTM C 642-97 by oven-drying method. The results arepresented in Figure.8for these tests 50mm x 50mm x 50mm cubes are cast. After 24 hours of remoulding, the specimens are taken the initial weight (W1) after kept immersed in different types of solution (Nacl, & HCL (pickling solution). At the end of 28 days, the specimens are taken the finialweight (W2) is taken. After 28 days the test is done M - Sand + 10 % ash concrete ishigh conflict low permeability and high durability of concrete in solution of Nacl and HCL solution measure up to the other mix ratio. M –Sand concrete is low confrontation and high durability judge than other concrete specimen. Conventional concrete is more resistance and high durability in both solutions. Results of thistest are show in table 10 and figure .8

Table 10- Acid penetration test

Types of mix	HCL	NaCl
Conventional concrete	4.01	4.65
M - Sand	6.12	6.85
M - Sand + 5% ash	4.12	4.6
M - Sand + 5% ash + 5% PVA	5.85	5.123
M - Sand + 10 % ash	3.92	4.02
M - Sand +10% PVA	5.12	5.68
M - Sand +10 % ash + 10 % PVA	4.94	5.06

V. Conclusions

- Adding together of polyvinyl alcohol leads to a significance increase in the characteristic strength, durability and low corrosion of concrete.
- In this revision M - Sand +10 % ashes + 10 % PVA of gives ancillary strength than the M-sand mix and as wellas durability has been increased and high corrosion resistance comparedto the M-Sand mix.
- The self weight of the recycling of paper cup ash is lighter than the M-sand and the conventional mix.
- The workability decreases and flexural strength is increase addition of polyvinyl alcohol compared to the conventional mix up and the M-Sand mix.

- The penetration level of chlorides and acids are less in conventional,M - Sand + 10 % ash and M - Sand + 5% ash concrete comparedthan M-Sand mix and prior mix concrete.
- In addition to polyvinyl alcohol in concrete good flexural strength and percentage increases, flexural strength and compression strength also will be increase but acid penetration and corrosion resistance will be decreases.
- besides to the percentage of ash is increase in concrete the compressive strength and, flexural strength reduced however high intensity corrosion resistance and good acid confrontation of acid in all the solutions.
- The both combination of ash and polyvinyl alcoholaffix in river sand concrete mix high compression strength, flexural strength and good durability recital also good acid and corrosion fight, in same time include to M- Sand concrete mix decrease the strength also petite corrosion resistance.
- Finally this excremental suggestion, the M- Sand not suitable for building construction. The strength of concrete 50 % reducing weighs against than conventional concrete.

Further work is obligatory to get data for other structural properties of the experimental concrete.

References

1. Sajad Ahmad, M. Iqbal Malik, Muzaffar Bashir Wani, Rafiq Ahmad (2013) "Study of Concrete Involving Use of Waste Paper Sludge Ash as Partial Replacement of Cement" IOSR Journal of Engineering (IOSRJEN) Vol. 3, Issue 11
2. Khileshsarwe (2014) "Study of Strength Property of Concrete Using Waste Plastics and Steel Fiber" International Journal of Engineering And Science (IJES) Volume 3 , Issue 5.
3. Lodhi Ravindra Singh, Akhtar Saleem, Batham Geeta (2015) "Application of Paper Waste in Cement Concrete" Int. Journal of Engineering Research and Applications Vol. 5, Issue 4.
4. Kaushal Jatti, Preeti Vaishnav, Abhyuday Titiksh (2016) "Evaluating the Performance of Hybrid Fiber Reinforced Concrete Dosed with Polyvinyl Alcohol" International Journal of Trend in Research and Development, Volume 3.
5. Joseph O. Ukpata, Maurice E.Ephraim and GodwinA. Akeke.(2012). "Compressive strength of Concrete using Lateritic Sand and Quarry Dust as Fine Aggregate."Arpn Journal of Engineering and Applied Sciences, Junuary 2012.Volume 7,No.1.
6. K. Ganesan, K. Rajagopal, K. Thangavel, (2008). " Rice husk ash blended cement: Assessment of optimal level of replacement for strength and permeability properties of concrete." Constr. Build. Mater., 22 (8) (2008) pp.1675-1683.
7. A jayaraman (etal) " Eco friendly building materials used for high strength and high performance concrete." International journal of chemtech research vol.10 no.11, pp 23-38, 2017.
8. A Jayaraman (etal)"Experimental Study on Fully Replacement of River Sand by Bottom Ash and Lime Stone Filler" International journal of ChemTech ResearchVol.9, No.05 pp 870-886, 2016
9. Don Morison " sensors" Fiber-Optic Sensors for Corrosion Monitoring Oct 1, 2007
10. Walter D. Leon-Salas, "Ieee Sensors Journal" A RFID Sensor for Corrosion Monitoring in Concrete, 10.1109/JSEN.2015.2476997.

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