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Use of Polyvinyl Alcohol in Pervious Concrete to Increasing the Strength

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Abstract: ***Pervious concrete is a advance concept in sustainable work and construction development. It is relatively use in our country for construction as well as environmental safety impact i.e. Storm water management. Pervious concrete is light in weight and more porosity due to absence of sand. Pervious concrete consist of cement, fine aggregate and coarse aggregate combined together with the help of water. In rural areas pervious concrete is the new concept, it increases water level of ground and decreases runoff. In this project we used different proportions of polyvinyl alcohol are (0%, 0.25%, 0.50%, 0.75%, 1.00%). The proportion is measured by the weight of Cement and arbitrary proportion is 1:2:4 in possible combination of material used. Prepared the cubes and curing takes place for 7th and 28th days, tested and recorded the results. Compare the result with normal pervious concrete i.e. 0% polymer or plane concrete. The strength were recorded earlier of normal pervious concrete was less in the previous research paper and it is found that the polymer implements the mechanical as well as chemical property. It also increases compressive strength of pervious concrete. Due to its good performance durability is also increases, decreases the Corrosion itself and improved the permeability. This technique is advantageous to the construction industry.***

A civil engineer is a base of India and as human being it's a duty of civil engineers to save and secure the environment and invent the ideas and technique for the eco-friendly construction. A water is main factor of the humans, animals, plants and other sources which needs a water but due to the urbanization, infrastructure development, construction development may cause the water absorption problem occurred, so water not directly infiltrates into the ground and runoff increases and water table goes in a deep. The minimization of such problem and increases sustainable development by the use of pervious concrete. The strength of pervious concrete not enough as per conventional concrete.

Keywords: Polyvinyl alcohol, Compressive strength, pervious concrete, mixing proportions

I. INTRODUCTION

In the concrete industry, pervious material is commonly used worldwide. Use of pervious material in concrete company is also called as green construction industry. The pervious concrete is the modern technique of civilization. When the cement and water are mixed, it forms a paste that binds to the coarse aggregate and fine aggregate together in a hardened product with connected pores that allow water to pass through easily called "pervious concrete". According to the Mr. mithun research paper, the pores can range from 0.08 to 0.32 inches (2 to 8 mm), and the void content usually ranges from 15% to 25% with compressive strengths of (2.8 to 28 Mpa). It has much Application in rural as well as urban areas. The pervious concrete is the unique type of concrete which having high permeability or porosity (Mr.Mithun et al.2016). The major applications of pervious concrete is allows the water from precipitation and other sources to pass into the ground easily, therefore minimizing the runoff from the site and recharging ground water levels. It has different kinds of advantages *viz,* sustainable design, pollution control and storm water management.

Some of the admixture i.e. Polyvinyl alcohol is one of the most popular polymer or admixture in present days. In 1924,the polyvinyl alcohol had been prepared by Hermann and Haehnel by the process of hydrolysis of polyvinyl acetate with ethanol. Polyvinyl alcohol increases durability, high versability and it also increases the mechanical as well as chemical properties of the porous concrete. It is soluble in water and it modifies the properties of concrete and its result expressed in voids or pores in the concrete. In the present study we use polyvinyl alcohol to increase the strengths of pervious concrete i.e. compressive strength.

Now a days in India ,rapidly increasing cementation due to this water infiltration is reduce from base and ground water table goes in a deep or decreases at high depth .As an effect of serious water problem arises in our country but used of pervious concrete sustained the natural energy sources like precipitation or rainfall recharge into the ground to increase the water level .The pervious concrete is very advantageous for our country to save the environment ,public agencies and building construction on site but only

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disadvantage of pervious concrete has its low strength .Pervious concrete helps to filter the water into the ground and improves the quality of water , it decreases the temperature in water, increases water flow, minimizes flooding problem. The proper utilization of pervious concrete is beneficial to the environment. According to the reference of Tennis, A "passive" mitigation is an element to decreases the quantity of impermeable surface exchanged by pervious surface according to the Tennis .Passive mitigation not maintain total runoff. An "active" mitigation is also maintain the overall runoff at the specified level to the site with different features. is used an active mitigation system and it must be reduce total runoff from the site.

A research by NRMCA (National Ready Mixed Concrete Association) in Rockville, Maryland to calculate the permeability and porosity and reduces the water contamination.The pervious concrete study shows that reduces the 95% of suspended solids, 85% of total nitrogen,82% of chemical oxides, 65% of phosphorous and 98% of metals. According to the NRMCA pervious concrete control and decrease the pollution in an environment and sustained the atmosphere. The pervious concrete also increases growth of trees in urban area due to water percolation through the pervious concrete (http://perviouspavement.org/index.html.et al.2017)

The pervious concrete provides the economical development and benefits of financial aspects to a community.The pervious concrete also required maintenance over the time and increases infrastructure development (htto://perviousconcrete.com/en/benefit/.et al)

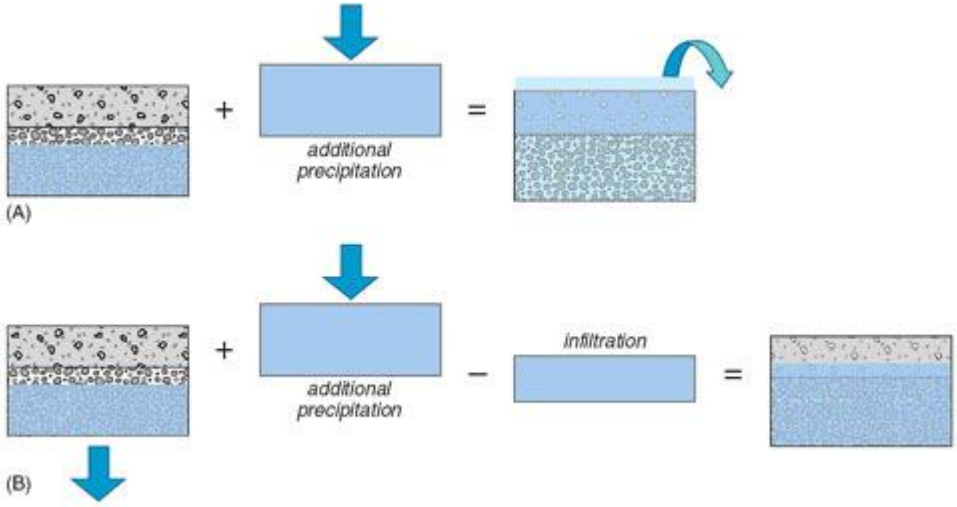


Figure no.1**:** Ground water harvesting using pervious concrete (research paper et al.)

II. EXPERIMENTAL DESIGN

A. Material

In an experiment we used Churi i.e.fine aggregate size range from (2.75 mm to 4.75 mm), coarse aggregate size (4.75 mm to 20 mm) and ultratech 53 grade of cement and we also used the polymer such polyvinyl alcohol to increasing the strength of pervious concrete. The water is used as a universal solvent for making proper proportion of pervious concrete such as 0.4% (w/c =0.4).The general proportion of (cement: fine aggregate: coarse aggregate) are 1:2:4.

Table no.1: Material Used

Sr. No.	Material Used	Unit	Value
1	Cement	Kg	7.5
2	Fine aggregate	Kg	15
3	Coarse aggregate	Kg	30
4	Water	Litre	3.0

B. Composition of Polyvinyl Alcohol

Polyvinyl alcohol is odourless, translucent and it is soluble in water but not soluble in organic material. The molecular weight between 26,300 to 30,000 and degree of hydrolysis is 86.5 to 89%. The polyvinyl alcohol is a material in crystalline structure or form .It has cream colour granular powder, it gives highest strength and impact resistance of pervious concrete. The proper proportion of polyvinyl alcohol could be mixed with hot water (70 to 90 degree celsius) with proper stirring until solution was not prepared.

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Table no.2: Properties polyvinyl alcohol

Sr. No	Particulars	Value and property
1	Specific Gravity	1.19-1.26
2	pH	Neutral
3	Colour	White
4	Nature	Crystalline



Figure no.2: Polyvinyl Alcohol (PVA)



Figure no.3: Gel form of PVA

C. Water

The water is main factor that influence the strength of concrete. For the concrete (quality water) potable water or recycle water is needed which increases the strength of concrete. The optimum water cement ratio produces a paste in semi solid form with high viscosity. The water to cement ratios at optimum level that we use is 0.4% without including admixtures i.e. polyvinyl alcohol, subtract the quantity of water if we add the admixture i.e. polyvinyl alcohol in proportion quantity for making of concrete.

D. Casting Process

In the concrete placing in the mould with proper finishing. In next day remove the mould and place the cube for curing 7^{th} days and 28^{th} days.

E. Compression Strength Test

The compression strength test is ultimately used to calculate the compressive strength in N/mm^2. In this project we preferred 7^{th} and 28^{th} days for curing and recorded compressive strength of pervious concrete and get the results in N/mm^2.



Figure no.4: Permeability of water



Figure no.5: compression strength machine

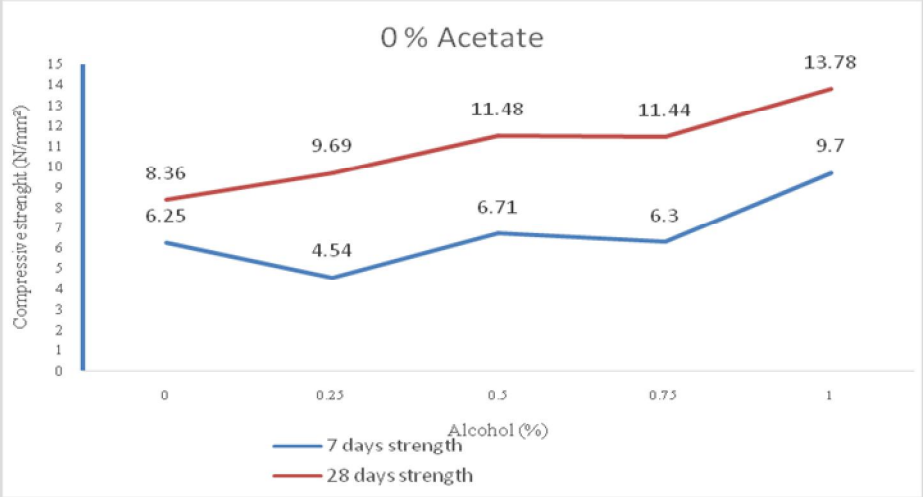
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III. EXPERIMENTAL RESULTS AND GRAPH

The following are results that we get after performing an experiment and graph are also attached below the table.

Table no.3: PVA Proportion and Results

Sr. No	PVA Proportion%	7th days strength in N/mm2	28th days strength in N/mm2
1	0	6.25	8.36
2	0.25	4.54	9.69
3	0.5	6.71	11.48
	0.75	6.3	11.44
5	1.00	9.57	13.78



Graph no.1: compressive strength of pervious concrete with %of alcohol i.e. (0.0, 0.25, 0.5, 0.75, 1.00)

In this project we got the maximum strength at 1.00% polyvinyl alcohol for 7th and 28th days.

IV. DISCUSSION

In this project we get the results that increase the compressive strength of pervious concrete with the used of polyvinyl alcohol in proper proportion. The previous results had been nearly same as compared to this result that we get. Once the proportion of PVA always changes which mean leads to changes the strength of pervious concrete. The compressive strength of pervious concrete using polyvinyl alcohol is found to be 9.7 N/mm2 for 7th days and 13.78 N/mm2 for 28th days. We will increases the compressive strength of pervious concrete by using types of admixtures and polymers with different proportions.

V. CONCLUSION

The pervious concrete is beneficial to environment and safety impacts. The special benefit of the pervious concrete in the presence of polymers is improving the strength and supports the sustainable construction, sustainable drainage and maintained the eco-friendly environment. It is the used influence the society to increases plant and trees. Through percolation of water at high depth aquifer level should be increases by the stream lines under the ground and ground water table improves. The pervious concrete helps for the drivers in the ponding or submerges water on the street area. It always capture rainfall water and ground water table recharges due to minimization of total runoff and less flooding occurred .

A. The pervious Concrete has Its Own Applications

1) For boundary features and commercial development.
2) For sustainable drainage construction,
3) Less intensity traffic area.

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4) For walkways and parking street.
5) Green roof application to Water harvesting.
6) Residential roads and driveways.

The pervious concrete limits its low strength and Water logging problem occurred in deep areas. The pervious concrete has such advantages, it produces quality of concrete and gives maximum permeability ,it should have light in weight, less shrinkage occurred and unit weight is lower (K. Rajasekhar et.al.)

VI. FUTURE WORKS OF PERVIOUS CONCRETE

The Pervious concrete is always save the environment and sustained nature energy sources. In future work strength could be enhanced or improved using the properties of polymers in the previous concrete. Due to enhancing the strength of pervious development going increasingly and it is friendly to the environment, total runoff management. Pervious concrete will prepared as standard concrete with increases its durability. In future we will used different techniques and polymers could be used in pervious concrete to enhance the strength and durability.

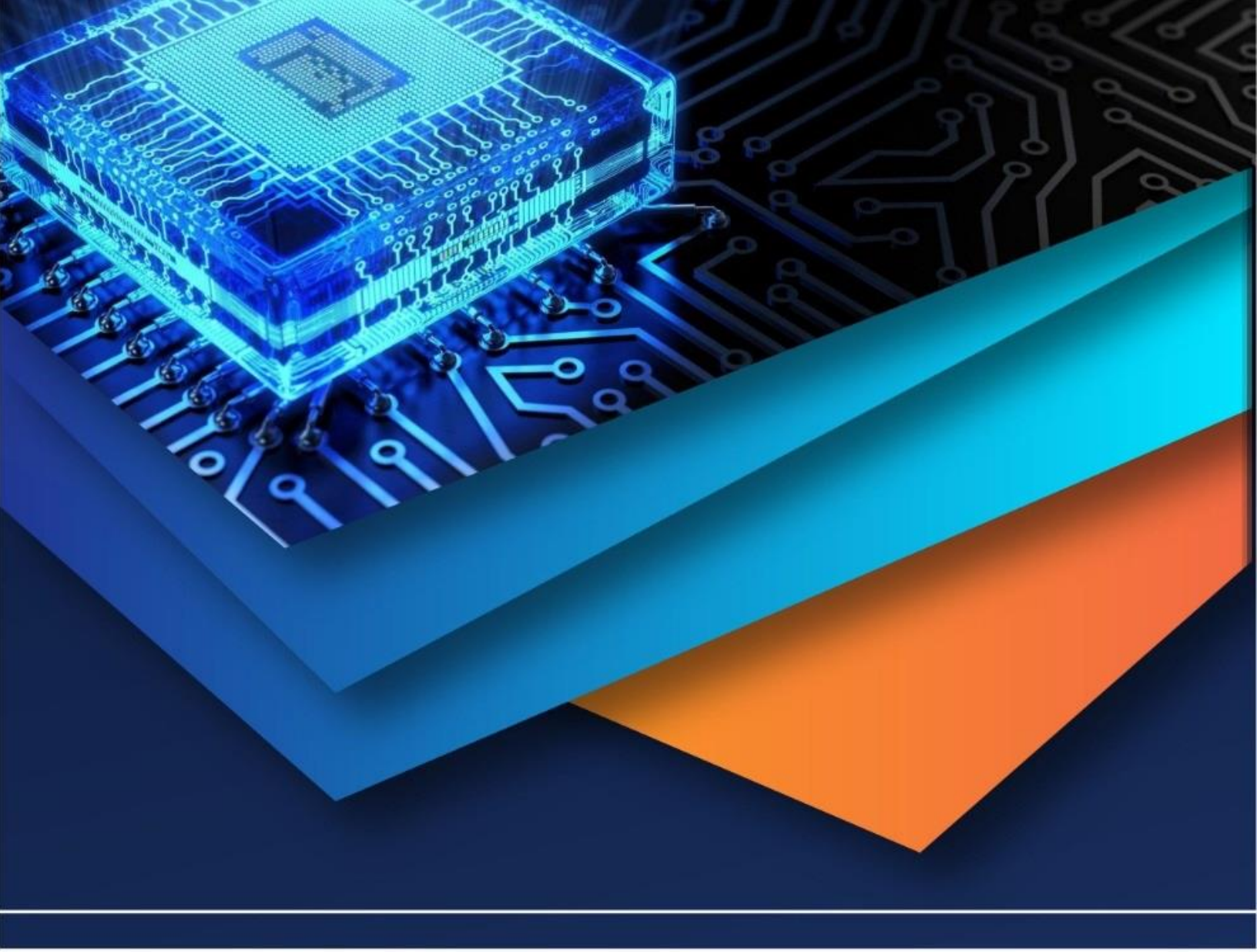
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