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Uses of Thermocol Waste in Civil Engineering

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Abstract: The seepage of water through the roofs in the rainy seasons is a very common problem for old houses as well as newly constructed houses.
This problem has tensioned every common man who has spent their every penny for the construction of their dream house. The leakage of roofs can be because of many reasons but it has very harmful effects on the reinforcement as well as on the atheistic appearance of the house.
So, the objective of this paper is to study the causes of leakage and provide a very simple and user-friendly technique which can be used in preventing the leakage of water through roofs and the safe disposal of foam waste like polystyrene (thermocol).
Keywords: Seepage, Reinforcement, Polystyrene, Atheistic.

I. INTRODUCTION

In our country(India) where more than 60% of the population lives in the village (according to 2011 census data), where modern construction techniques have not been reached yet and due to lack of proper knowledge houses made by the rural people, began to show various types of defects and deformations after some years of constructions. Cracks that occurs on the roof surface is one of the common problem (both for rural and urban area) which led the rainwater to penetrate into the rooms. So, these problems can be overcome with the help of thermocol and petrol upto some extent.

1) *Causes of these cracks* - Such cracks can occur because of improper construction techniques or use of inferior types of materials. Improper compaction can also be major cause behind the seepage. Electricity pipes that that installed during the construction process also weakens the roof structure and hence results in the seepage. Similarly, cracks on the road pavements is also a major issue. Cracks on the roads occur due to improper construction techniques and materials. Ultimate differential settlement on the soil on which road pavements are laid also leads to cracks on the road pavements.
2) *Effects of these cracks* - Theses cracks have very harmful effects on the structures. When these cracks occur on the roof surface, the rain water penetrates through it and enters into the room also when water comes into the contact with the reinforcement, the steel provided into the reinforcement with the contact of water starts rusting thereby weakens the strength of that structural area. Due to penetration of water through the roof, water may come into the contact with the electric socket that has been installed into the house and can cause huge electric accidents. Due to continuously penetration of water the putty and finishing that has been applied on the wall surface starts removing from the surface which disturbs its aesthetic appearance.

II. LITERATURE SURVEY

Gracia M.T 2009 performed the dissolution of polystyrene with suitable solvents like benzene, toluene, xylene, tetrahydrofuran, chloroform, 1,3-butanediol, 2-butanol, linalool, geraniol, d-limonene, p-cymene, terpinene, phellandrene, terpineol, menthol, eucalyptol, cinnamaldheyde, nitrobenzene, N,N-dimethylformamide and the various solubility parameters have been studied.
Thermocol is a polystyrene material which is basically used as packing material for heavy materials (generally electrical, glass, clay material) to protect them from breaking and after being used it is thrown away as a waste product. Polystyrene is a synthetic aromatic hydrocarbon polymer made from the monomer styrene.
Polystyrene can be solid or foamed. Its chemical formula is $(C_8H_8)_n$ .Its density lies between 0.96-1.04 g/cm^3. It is insoluble in water but soluble in acetone
. Generally it comes in plastic category and consdirede as a waste material after being used.
Petroleum is the refined form of crude oil which is extracted beneath the earth's surface. It is the yellow blackish liquid which is highly inflammable. Petroleum is a fossil fuel derived from ancient fossilized organic materials, such as zooplankton and algae.

Table 1.
Classification of plastic waste

Sr. No.	Type of Plastic Waste	Plastic Waste Classification and their Common Applications
1	PET	Polyethylene Terephthalate E.g. Bottles, Films
2	HDPE	High density Polyethylene E.g. Packaging, Detergent, Shopping Bags
3	PVC	Polyvinyl Chloride E.g. Water pipes, Curtains, Credit card, Packaging films, Water Films
4	LDPE	Low density Polyethylene E.g. Plastic bags, Wire cloth
5	PP	Polypropylene E.g. Plastic bag and toy
6	PS	Polystyrene E.g. Disposable cups and plates, Fast food boxes
7	Other	Acrylonitrile butadiene styrene, High impact polystyrene, General purpose polystyrene, Polyamide, Polycarbonate, etc.

A. Effects of waste thermocol on human and animals[2]

1) The burning of polystyrene polymers such as foam cups, meat trays, egg containers, yogurt and deli containers releases styrene. Styrene gas can readily be absorbed through the skin and lungs.

2) At high levels styrene vapour can damage the eyes and mucous membranes.

3) It can increase the risk of heart disease; aggravate respiratory ailments such as asthma and emphysema, and cause rashes, nausea or headaches, damages in the nervous system, kidney or liver, in the development system.

4) Animals while grazing inhale the waste thrown polystyrene which affects their health.

III. METHODOLOGY

Firstly the cracked portion of the roof (and road pavements) was investigated to determine from where the leakage is taking place. Than that portion of areas was cleaned and washed. Thermocol pieces were collected from here and there; they were also cleaned to remove any dust particle on them. Required amount of petrol is taken in the steel/iron bucket (in our case in the transparent beaker to perform test). Than the thermocol pieces were dipped into the petrol and the solution obtained was continuously stirred with the iron rods. After a while when no more thermocol dissolve in it, the addition of thermocol pieces was stopped and the solution was allowed to stand still for 1-2 minutes. We will find that the bucket/beaker is filled with white, thick and adhesive like substance. These resultant mixtures were applied to the cracked portion of the roof (or road) gently with the help of equipment (spoon). Now the cracks with the resultant mix on it were allowed to dry under the sunlight for 1-2 days.

Note-In place of petrol Acetone/ toluene can also be used to prepare mix.

PETROL THERMOCOL

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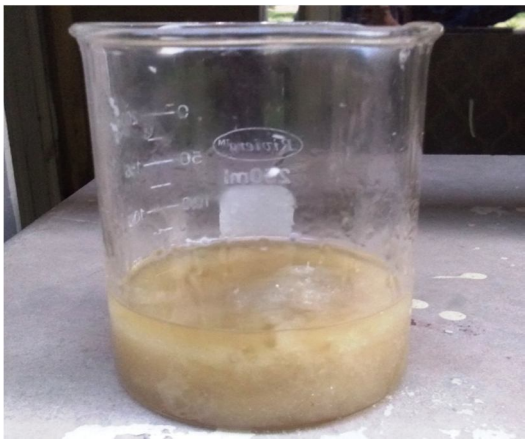
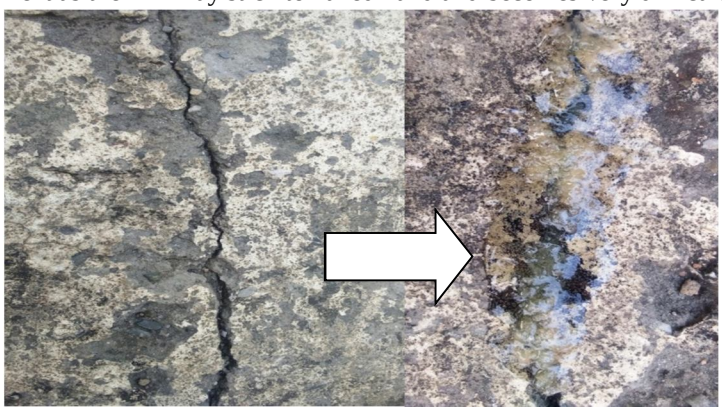


Mix prepared by mixing Petrol and Thermocol

Table 2.
Comparative data

Name of solvent (Quantity – 25ml)	Minimum quantity of thermocol taken	Nature of mix -
Petrol	25 ml	Homogeneous, viscous liquid with sticky nature
Acetone	25 ml	Homogeneous, viscous liquid with less sticky nature than Petrol

1) *Observation:* After 1-2 days we will find that the resultant mix has formed a plastic coated surface over the cracked portion which ultimately does not allow the rain water to penetrate through the cracked surface. Proper precautions should be taken while performing the experiment as the mix may stick to naked hand and becomes very difficult to remove.



Cracked floor surface Applying the mix

After 1-2 days of proper sunlight this type of harden plastic form on the harden concrete surface

2) *Advantages:* Since this method is very simple, economic and cost-effective, it can be used up by every common man to protect their houses from being deterioration. This method helps in reducing the thermocol and its waste products in a very eco-friendly manner. The resultant mixes that have been formed can acts as good adhesive substance which an even used to stick two bricks.
3) *Disadvantages:* The solution form this method is temporary. Sometimes the paste strikes off from the cracked surfaces and hence number of times this procedure has to be performed on the cracked surface.

IV. FUTURE SCOPE

A. The adhesive prepared can be use in the construction purpose and hence reducing the cost of binding material (cement).
B. By adding some suitable admixture its binding and water proofing property can be increased.
C. Disposal problems of thermocol waste products can be solved.

Adhesive property of mix

V. CONCLUSION

The resultant mix of petrol and polystyrene not only give a good water proofing compound and adhesive material, but also generate a method of disposal of waste plastic material in a very effective way. This method can help in protecting the reinforcement from being rusted and roofs from leakage upto some extent. The adhesive property shown by petrol and better than acetone, however, toluene can also be used in this procedure. This method is simple and easy and does not require any experience. In future with the help some advance procedure this method can help in reducing the price of binding material used in the arena of civil engineering.

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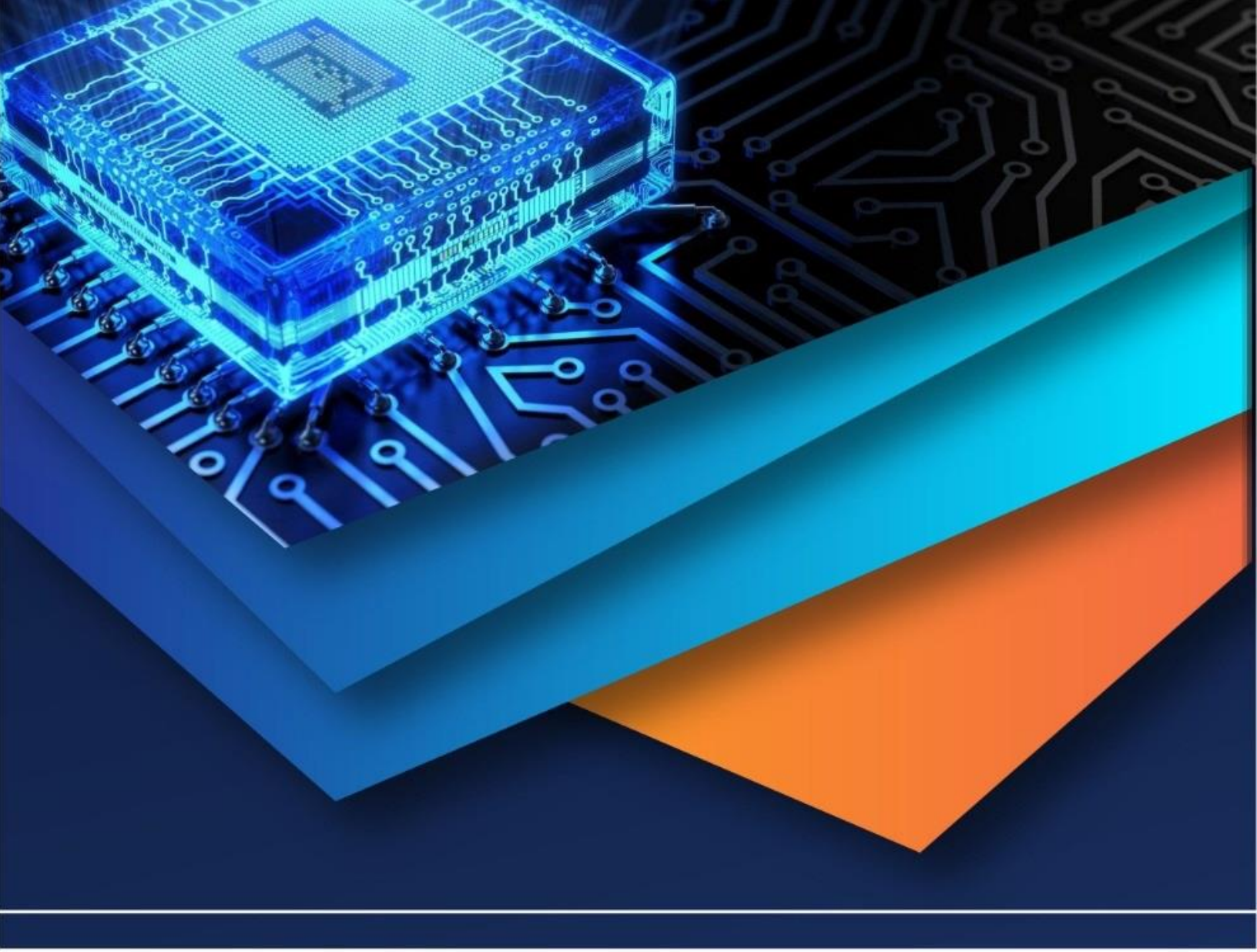

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