Recycling of Hazardous Paint Waste in Constructions Material

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Abstract – The main objective of this paper is to envisage possible opportunity of recycling of paint waste residues generated from automobile and storage solution industry in ready mix concrete with substitution of fine aggregates. Water based and solvent based paints are extensively used in automobile and storage solution industry to safeguard metal parts and for their aesthetical betterment. This painting process generates large quantum of paint wastes that are hazardous by nature and their conventional disposal mechanism involves negative environmental impacts. The study involved utilization of this waste to replace fine aggregates in concrete in various percentages is for M15 concrete and analysis of results for compressive strength characteristics are as per IS standards.

Thus, attempt has been made in this paper to explore new avenue of utilization of hazardous paint waste in construction materials so as to minimize harmful impact of its disposal. It thus has abundant scope in various construction applications.

Index Terms – Hazardous Waste, Paint waste, recycling options.

Declaration: This paper is part of research work under patent review with CBR No 11363 and application no 201621021937

1. INTRODUCTION

Hazardous waste is waste that poses substantial or potential threats to public health or the environment. The increase in industrialization in India has also lead to increase in quantum of industrial waste.

Present generation of - 4,15,794 MTA Incinerable waste in the country. Deficit of Incineration capacities - 88,089 MTA.

This deficit is critical parameter from hazardous waste disposal point of view. Suggesting unscientific management of this incinerable waste and creating alarming situation from environmental impact point of view

With increasing stringency in environmental legal requirements the hazardous waste disposal operation is becoming difficult and costly.

The same time, waste management by traditional landfilling and incineration methods exert pressure on ecosystems. These operations are responsible for generation of large quantity of green house gases that are responsible for global warming and increase overall carbon footprint. Also, incineration plants incorporate use of varied natural resources such as petroleum and other resources.

Thus, exploring recycling opportunity for industrial waste is need of time.

This study thus has chosen one major industrial hazardous waste viz. paint waste residues and will check the recycling opportunity of the same. Thus, objectives of study are-

2. Study of inherent properties of industrial waste under scope i.e. paints waste residues and Study of Current disposal processes for identified wastes
3. Study and minimization of Environmental impacts of disposal of these wastes
4. Study of possible opportunity of recycling and reutilization of these wastes in ready mix concrete
5. Study with development of recycling model and its benefits over current disposal system
6. Evaluation and establishing co-relation between the field as well as laboratory results

2. RELATED WORK

Some researches in paint waste recycling for varied applications can be given as below-

- Use of paint waste in sealant Industry
- Use for colored concrete
- Use of paint waste in bitumen for road construction

2.1) Use of paint waste in sealant Industry

A method for treating waste paint sludge in selant industry makes use of water, uncured resin and liquid hydrocarbons.

The waste material, typically in the form of sludge, is processed in a heating and resin curing procedure whereby water and VOCs, in the form of liquid hydrocarbons, are evaporated so that the solid discharged after heating is in a substantially dried particulate solid form. The heating step is also designed to cure the uncured polymeric paint resins

2.2) Use for colored concrete

In this method paint is dried and crushed. Centrifuges are used to separate pigments which then in turn are used along with concrete ingredients that give peculiar color to concrete. Or simply impurities from liquid paint are filtered out and liquid paint is applied along with concrete ingredients. This improves aesthetics of concrete.

2.3) Use of paint waste in bitumen for road construction

It is observed through literature that, use of paint waste is possible in road construction. This is either by replacing slag used for construction application or by adding resin to the heated sludge and bitumen mixture in the form of a solution in a solvent selected from the group consisting of toluene, toluene with butyl acetate, benzene with butyl acetate and benzene with xylene or any other conventional solvent used for paints.

3. PROPOSED MODELLING

3.1 Resources

Resource requirement can be given as- Paint waste samples, cement, coarse and fine aggregates, water and admixtures, pan mixer, slump cone, Compressive testing machine

3.2 Methodology includes

3.2.1 Preliminary Study for properties of components of waste materials

Collection of sample hazardous paint waste got done from Industrial premises. Analysis done to understand nature of hazardous waste and to confirm its hazardous characteristics. The report validated by third party testing from MoEF approved laboratory.

This testing is first point critical check for project

Parameter	**Unit**	**Method**	**Result**	**CPCB:HAZAMS/2009-2010**
Specific Gravity	g/cm 3	ASTM D5057-2010	0.79	Not specified
Calorific Value	**Cal/g**	**IS 1350:Part 2- 1975**	**3274**	**<2500 Cal/gm**
Flash Point	Degree c	USEPA 1998 SW-846;1020 A	>65	>65
LOD @105c	%	USEPA 1998, SW-846;1684	31.16	Not specified
LOI @550	%	USEPA 1998, SW-846;1684	45.26	<20
pH at room temp.	-	APHA 22nd edition 2012;4500 H+B	7.87	>4 to < 12
WSI	%	APHA 2540 C	1.82	Not specified

Table 1: Test Result of Paint Waste

3.2.2 Preparation of sample specimens

Sample is partly in wet condition and with high moisture content and it is to be tested for recycling in construction material as replacement to fine aggregates; Thus, it is necessary to control the moisture content. The procedure followed for moisture removal by oven drying is as below:

i) Weighing of sample prior heating

ii) Water removal by simple separation

iii) Take porcelain vessel and empty weighing of porcelain vessel

iv) Keep samples in porcelain vessel and again weighing

v) Set temperature of furnace @ 95 degree C.

vi) Periodic check of sample to achieve total drying condition. Time required for drying was approximately 5-7 day.

The similar procedure adopted for open sun drying just by replacing mode of heating.

However, both the tests give similar moisture removal hence any of drying method can be adopted.

b. Crushing of heated sample to achieve powdered form

To match up with physical properties of fine aggregates; heated sample should be powdered which will also ensure uniformity of sample.

2.2.2 Mix design formulation

The mix designs prepared for M15 grade concrete with replacement of fine aggregates by 1% Mix design considerations

Cement used- Ambuja OP- 53 grade

Admixture : CAC superflow 35 U Free

W/C: 0.547

Cementitious content 320 kg/m3

A/C : 6.044

2.2.4 Parametric testing and evaluation for concrete properties

Trials conducted as per IS codes for defined concrete mixes and essential concrete parameters viz workability by slump cone test, Compressive Strength by Compressive Testing Machine and colour by visual inspection method checked to check cohesiveness.

4. RESULTS AND DISCUSSIONS

The Results include testing done for workability and compressive strength performance against normal concrete.

Sr.No.	Test	Compressive Strength M15-Mixed paint	Compressive Strength M15-redoxide paint	Compressive Strength M15- normal
1.	Accelerated curing test	10.56	11.06	11.93
2.	24 hrs test	5.87	5.42	6.23
3.	7 day test	12.04	12.81	13.82
4.	28 day test	23.45	24.07	26.57

Table 2: Comparison of performance for compressive strength

5. CONCLUSION

After primary studies on material testing suitability of paint waste as construction material got tested and verified as ok for further research.

The result of 1% replacement of fine aggregates in concrete demonstrate that design under consideration for use of paint waste in construction material is successfully tested

No quality related issues observed w.r.t performance of concrete due to this substitution

The results demonstrate that the design under consideration is successfully tested

There are no quality related issues observed w.r.t performance of concrete with substitution and alteration in mix design

Results of workability and compressive testing are within comparable range of normal M15 concrete.

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