iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL
FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** IX **Month of publication:** September 2023

DOI: https://doi.org/10.22214/ijraset.2023.55705

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue IX Sep 2023- Available at www.ijraset.com

A Review on Enhancing Quality of Self-Compacting Concrete by Used Cement Plastic Bag

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Abstract: Plastic waste is a vital solid waste due to its un-decaying properties with respect to time, but plastic waste has interlocking properties that lead to enhancing the interlocking properties of the concrete. Self-compacting concrete is concrete with high workability and does not need vibration it is good for complex structural elements. So high-strength concrete production becomes typical but the interlocking properties of the plastic waste can be given a suitable direction for the strength parameter of self-compacting concrete. The major plastic waste source at the site is the cement plastic bags, cement bags are made of polypropylene polymer therefore they cannot react with cement, but are fibrous in nature and perform good interlocking properties.
Keywords: Self Compacting Concrete, Cement bags, polypropylene polymer, Plastic Waste

I. INTRODUCTION

Infrastructure development is increasing day by day due to the high speed of urbanization and technology, Concrete structures are the major component of the present infrastructure, therefore, concrete production is going very high nowadays and increasing with respect to time, concrete is made up of the following basic elements as present in the table below -

Table 1: Elements of the concrete

S. No.	Elements	Significance
1	Coarse aggregate	It works as filler material in concrete providing strength to the concrete
2.	Fine aggregate	It fills in between the voids made by the coarse aggregate, it also full fills the strength criteria to make concrete homogeneous.
3.	Cement	It works as binder material
4.	Water	It hydrates the cement for the binding process.
5.	Admixture	It is used to improve to properties of concrete i.e, Workability, setting time

1) *Concept of Self-Compacting Concrete (SCC):* Self-compacting concrete is concrete with high workability and does not need vibration it is good for complex structural elements. Self-compacting concrete is used for High rise buildings where concrete has to pump to achieve elevation.
2) *Plastic Waste on Construction Site:* Used cement bags are a major plastic waste on site, cement bags are made up of plastic so these are abiotic and un-biodegradable materials, therefore, it causes solid waste accumulation.

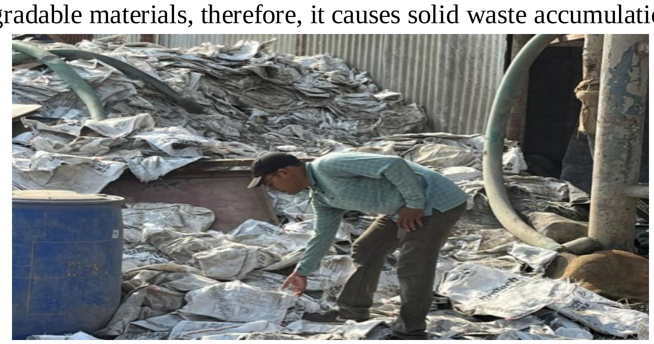

Fig. 1: Plastic bags waste on site

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II. PROBLEM STATEMENT

Utilized cement sacks are major plastic squander on site, cement sacks are made up of plastic so these are anti-microbial and un-biodegradable fabric hence it causes strong squander collection. Self-compacting concrete possesses a high-flowing nature and very high workability due to the unavailability of extra compaction through vibration in complex building elements therefore strength may be compromised to maintain the workability condition.

To maintain the workability of concrete admixtures are used, admixtures are very expensive therefore it increases the overall cost of the project. Plastic waste is a chemically inert material, therefore, it can be used as an ingredient in concrete production, plastic bags of cement are made of polypropylene polymer therefore it cannot react with cement, but the fibrous nature of making interlocking between the concrete and enhance the compressive as well as flexural strength.

III.RECYCLED AGGREGATE DEMAND

A. *Global C&D solid waste production-*

EIA Annual energy outlook (2005) & United Nation World Urbanization Prospects (2007) Indicate the solid waste accumulation problem according to income class and urbanization of the population, and its hazardous impact over the period due to significant increment in urban population and solid waste accumulation.

Table 2: Solid waste accumulation in 2005 and 2025

Class	*Currently available data*			*Data projection of 2025*			
	Urban Population (million)	Urban waste		Population Projected (million)		Projected urban waste	
		Kg/cap/Day	Tons/Day	total	urban	Kg/cap/Day	Tons/Day
Lower class	343	0.6	204802	1637	676	0.86	584272
Lower middle class	1293	0.78	1012321	4010	2080	1.3	2618804
Upper middle class	572	1.16	665586	888	619	1.6	987039
Upper class	774	2.13	1649547	1112	912	2.1	1879590
Total	2982	1.19	3532256	7647	4287	1.4	6069705

(source - EIA Annual energy outlook(2005) & United Nation World Urbanization Prospects(2007))

B. *Current Stage of Recycling Coarse Aggregate*

Construction and demolition waste bulking is increasing but there are few initiatives are there to utilize the construction and demolition waste as recycled aggregate from the Sustainable development union website of the UN(2020) and Source-website of the European Demolition Association and the Website of EPA, the USA(2020) industries setup in following countries for RCA

Table 3: Major countries using recycled aggregate and number of recycled aggregate industries (Sustainable development union website of UN(2020))

S. No.	*Countries*	*Plants*
1	Belgium	60
2	France	50
3	U.K.	120
4	Netherland	70
5	Germany	220
6	Denmark	20
7	Italy	43

Source-website of European Demolition Association and Website of EPA, USA(2020)

Singapore uses 100% of its recycled C&D waste in new construction and repair works. India is also developed some recycle aggregate plants Guideline of Environmental Management of Construction & demolition waste march 2017 shows working plants as where waste production is very large scale due to new projects and old repairs.

Table 4: Indian recycled aggregate industries 2017

Name/Place	Establishment /Formation	Production
Burari (New Delhi)	2009 first registered plant	500ton/day -2009 1200ton/day-2014 2000 ton/ day – permission
Sastri Park (New Delhi)	LT & FS	500 tons/day
Ahmadabad	2014 Ahmadabad environs project ltd.(AEPL)	100 tons/day
Vikroli (Mumbai)	CIDCO- YUVA Building center	1500ton production in 2002-06
East Kiwai nagar (New Delhi)	2014 NBCC	-

(Source - Guideline of Environmental Management of Construction & demolition waste march 2017)

C. Research and Developing Technology

Adhesive impurity makes difference in strength and durability between natural coarse aggregate (conventional aggregate) and recycled coarse aggregate. In the present time, these impurities like mortar, Bitumen, Organic matter, Chloride and sulfates, Soil, and filler materials can be removed by different processes which reduces the risk of failure and increase durability and strength.

1) Purushothaman Revathi and R. S Enthamil Selvi (2019) treat RCA with 10% HCl solution for 24 hours to reduce the layer of impurities(mortar) from recycled coarse aggregate up to 70% by this research shows significant results in water absorption, specific gravity, Bulk density, Abrasion resistance, impact value, and crushing value. They process RCA with Hydrochloric acid which removes mortar up to 10-35% and shows the relation between mortar attach and water absorption, specific gravity, abrasion resistance, bulk density, impact value, and crushing value that shows the result as :-

a) *Water Absorption:* Decreasing with decreasing of mortar attached,
b) *Specific Gravity:* Increasing with decreasing mortar attached,
c) *Bulk density:* Slightly increasing with decreasing mortar attached,
d) *Abrasion Resistance:* Slightly decreasing with decreasing mortar attached,
e) *Impact Value:* Increasing with decreasing mortar attached,
f) *Crushing Value:* Decreasing with decreasing mortar attached.

2) G.murali, (2012) Uses water wash, Nitric acid, Sulphuric acid, and Hydrochloric acid to treat the RCA and gives the comparison between them on the basis of compressive strength, flexural strength, and split tensile strength test this research shows the most significant results of nitric acid compressive, split tensile, flexural strength increased by 11.8%,5.6%, and 8.77% respectively with respect to untreated so there are possibilities to make RCA is an alternative of natural aggregate.
3) Prof. A. Tiwari and P.Dwivedi (2014) Replace the recycle coarse aggregate from natural coarse aggregate by 0%, 30%, 40%, and 50% giving significant results in 28-day compressive strength as 33N/mm^2, 28N/mm^2, 26N/mm^2 and 27 N/mm^2 respectively.

IV. UTILISATION OF PLASTIC WASTE IN CONCRETE

Jain and Sharma (2021) In this study, plastic bag waste utilize in the concrete along with fly ash state that Sending plastic to squander in development items decreases natural contamination and additionally minimizes development and dumping fetched. This paper looks at the mechanical, strength, and affect traits of concrete arranged with non-metalized squander plastic pack strands (NMWPF) and fly fiery debris (FA). Ten blends were outlined and five blends were Standard Portland cement (OPC) based on counting NMWPF substances of 0, 0.50, 0.75, 1.00, and 1.25%. The remaining blends were FA mixed blends having the same rate of NMWPF substance as that of OPC-based blends, wherein 20% of cement was swapped with FA.

Amelshal and Tayd (2020) In this experimental study, did the partial replacement of the fine aggregate with plastic waste as 0%, 10%, 20%, 30%, 40%, and 50%, and observed workability is reduced due to interlocking between the concrete ingredients. Compressive Strength and flexural strength are tested for 7 days, 28 days, and 56 days. Strength results also in decreasing order but up to 10% of plastic waste cannot give a significant decrement in strength.

Hadithi and Hilal (2016) In this experimental study, they use plastic fibers to enhance the strength and durability properties of self-compacting concrete. In this research 0%, 0.25%, 0.50%, 0.75%, 1%, 1.25%, 1.50%, 1.75%, and 2% plastic fibers are used by volume of the concrete samples to achieve maximum strength. In this experiment, concrete gives maximum strength at 1.5% PET.

Carvo and Santori (2015) To determine the properties of the cement plastic bags and castor oil containers in the manufacturing of particle board, therefore properties of plastic cement bags, and the physical properties observed in this research work.

A. Sharma (2020) In this study plastic waste is used in concrete to enhance the property of the concrete, in this research plastic 1% waste was applied to increase the compressive strength of the samples

V. RESEARCH CHALLENGES

Following are the research challenges observed:-

1) Plastic waste obtained from the cement plastic bag is possessed very less density than with respect to conventional materials, therefore, it can be used for making lightweight concrete but is not suitable for gravity-based structures for mass concreting.
2) Interlocking properties of the plastic fibers are high which leads reduction in workability.
3) Interlocking of the concrete particles produces a big challenge for the self-compaction property.

VI. CONCLUSION

The conclusion drawn from the above study are as follows:-

1) Potential of the concrete generation is exceptionally tall hence plastic squander utilization can be tall within the concrete industry to arrange the plastic squander on location, plastic packs are made of polypropylene polymer hence it has stringy nature hence can be upgraded quality criteria. The objective of this work is to realize the ideal esteem of the plastic squander utilize in the generation of self-compacting concrete (SCC).
2) Replacement of the conventional fine aggregate contributes in three directions as resistance to natural resource depletion, reducing solid waste accumulation from ceramic waste, and good effect on the project economy.
3) Plastic waste at the construction site is generally in the form of empty cement bags which are made of polypropylene fibers that enough strong and ductile to give good tensile strength therefore they can be easily used as fine aggregate adulterants.

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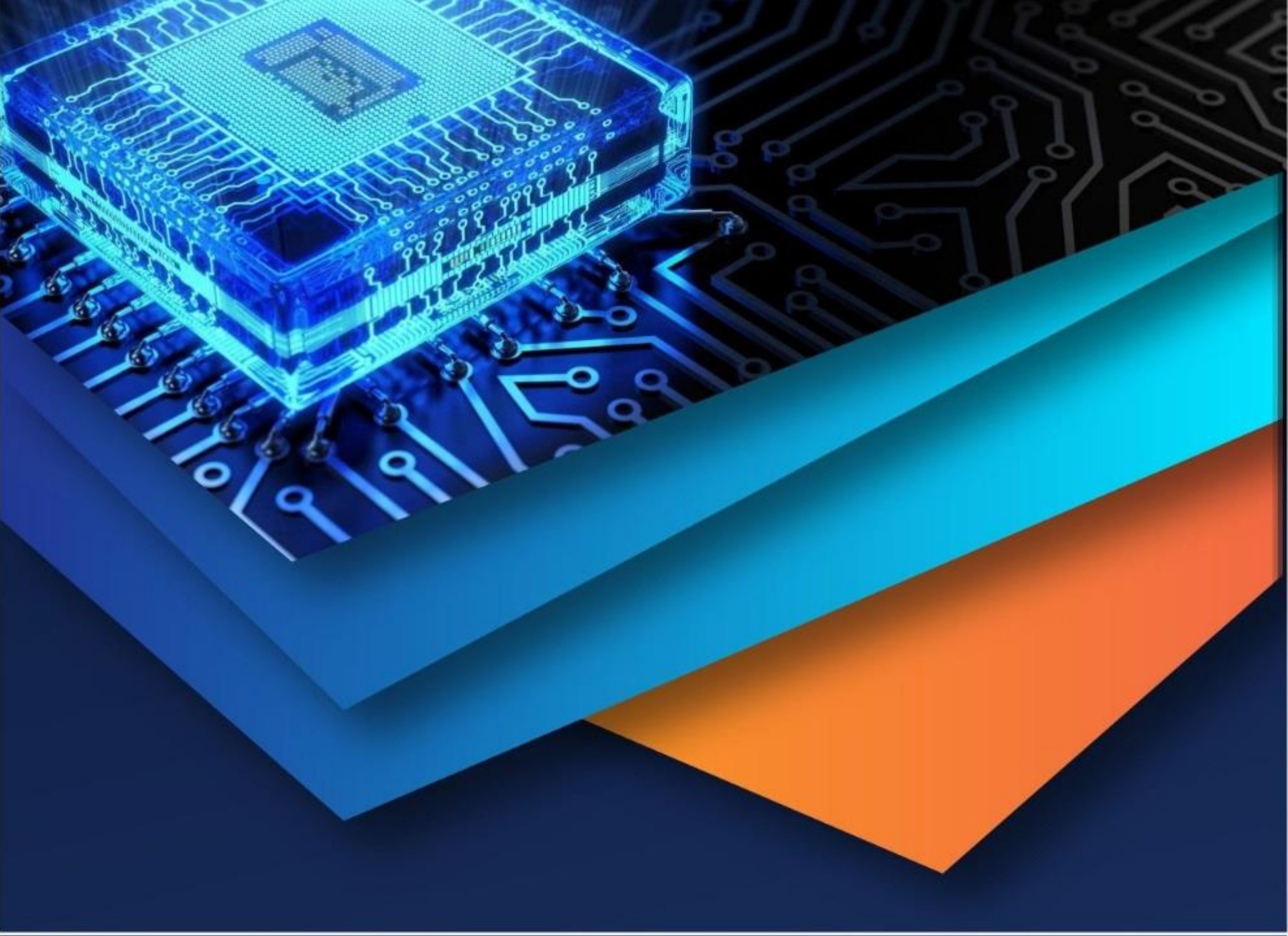

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