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Experimental Study of PCB and Tyre Chips Waste on Strength of Concrete

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Abstract: *The generation of waste materials, including Printed Circuit Boards (PCBs) and discarded tyres, has reached alarming levels, presenting significant environmental and waste management challenges. This paper presents an experimental study aimed at investigating the effects of incorporating PCB and tyre chips waste as partial replacements for coarse aggregates in concrete. The primary objective is to assess the impact of these waste materials on the strength properties of concrete, with a focus on compressive strength and workability. The experimental program involves the preparation of concrete specimens with varying percentages of PCB and tyre chips waste, with detailed characterization of the waste materials. The results of this study will provide valuable insights into the viability of utilizing PCB and tyre chips waste as sustainable alternatives in concrete production, contributing to waste reduction and promoting environmental sustainability in the construction industry.*

Keywords: PCB waste, Tyre Chips, concrete, compressive strength, workability

I. INTRODUCTION

The ever-increasing production of waste materials, particularly Printed Circuit Boards (PCBs) and discarded tyres, poses significant environmental and waste management challenges worldwide. Proper management and utilization of these waste materials are imperative to mitigate their adverse impacts. In recent years, there has been a growing interest in incorporating waste materials into concrete as a sustainable alternative. This paper presents an experimental study aimed at investigating the effects of incorporating PCB and tyre chips waste as partial replacements for coarse aggregates in concrete.

The utilization of waste materials in concrete offers several potential benefits. Firstly, it helps in reducing the demand for natural resources, as waste materials can be used as substitutes for conventional aggregates. Secondly, it provides an opportunity to divert waste materials from landfills, mitigating environmental pollution and promoting a circular economy approach. Lastly, incorporating waste materials into concrete has the potential to enhance the mechanical properties of the resulting concrete, leading to more sustainable and durable structures.

The primary objective of this study is to assess the impact of PCB and tyre chips waste on the strength properties of concrete. Compressive strengthtestconducted to evaluate the mechanical performance of concrete specimens with varying percentages of waste material replacements.

By investigating the effects of incorporating PCB and tyre chips waste in concrete, this study aims to contribute to the body of knowledge on sustainable waste management practices in the construction industry. The findings will provide valuable insights into the viability of utilizing these waste materials as partial replacements for aggregates in concrete production. Moreover, the study aims to address any concerns related to the performance and durability of concrete containing waste materials, ensuring the safety and reliability of structures constructed using these sustainable alternatives.

The outcomes of this study have the potential to promote the adoption of waste materials in concrete production, not only in terms of environmental sustainability but also in terms of enhancing the structural performance of concrete. The findings can serve as a basis for further research and development in the field of waste utilization in construction materials, facilitating the transition towards a more sustainable and circular economy.

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II. EXPERIMENTAL PROGRAM

1. Materials:

Cement: Portland cement of 53 grades

Fine Aggregate: Natural sand conforming to relevant standards

Coarse Aggregate: Conventional crushed stone aggregates conforming to relevant standards

Figure PCB Waste and Tyre chips

Mix Proportions:

Control Mix: Conventional concrete mix without any waste materials

PCB Mixes: Concrete mixes with varying percentages (7.5%, 10%, 12.5%) of PCB waste replacingfine aggregates

Tyre Chips Mixes: Concrete mixes with varying percentages (7.5%, 10%, 12.5%) of tyre chips wastereplacing coarse aggregates

Specimen Preparation:

Mixing: Thoroughly mix the cement, aggregates, waste materials, and water according to themix proportions.

Molding: Cast concrete specimens (cubes) of standard dimensions forcompressive strength,

Curing: Cure the specimens in a controlled environmentfor a 7 days and 28 days.

III. RESULTS

Table: Compressive Strength Of Concrete

Sr. no.	Proportion of waste added in concrete	Compressive strength in N/mm^2	
		7 days	28 days
1	0 %	13.21	21.85
2	15 %	11.72	18.32
3	20 %	12.94	20.95
4	25 %	10.85	17.52

Table: WORKABILITY OF CONCRETE

Sr. no.	Proportion of waste added in concrete	SLUMP (mm)	Workability
1	0 %	92	Medium
2	15 %	95	Medium
3	20 %	98	Medium
4	25 %	100	Medium

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IV. CONCLUSION

The percentage of waste mix 20% increase the compressive strength of concrete. After the 20% mix the compressive strength decreases. So the optimum proportion of waste mix is 20%. However, excessive amounts of waste negatively affected concrete strength. Utilizing waste materials in concrete production can promote sustainability and the circular economy in construction

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