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Experimental Study on Self Compacting & Self-Curing Concrete using Recycled Aggregates with Silica Fume and Sap Agent

Nagomiya Rajan Deepika[1]; Kavitha N[2]

[1]PG Student – Structural Engineering, M.E.T. Engineering College, Chenbagaramanputhur – 629304
[2]Assistant Professor, Department of Civil Engineering, M.E.T. Engineering College, Chenbagaramanputhur – 629304

[1] Reg. No: 961323413004

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Abstract: This study investigates the performance of self-compacting and self-curing concrete (SCC & SCCu) using waste recycled coarse aggregates, silica fume, and sodium polyacrylate (SAP) as additives. SCC offers high workability and durability, while self-curing technology addresses the challenge of proper hydration, especially in inaccessible areas or water-scarce regions. Experimental investigations were carried out on M30 grade concrete, with varying percentages of silica fume (0.1–0.25%) and SAP (0.4– 1%). Recycled aggregates replaced conventional coarse aggregates in selected mixes. Key properties such as compressive, tensile, and flexural strengths, as well as fresh concrete characteristics (slump flow, L-box, Vfunnel, and J-ring tests), were evaluated. Results confirmed that optimal performance was achieved with 0.2% silica fume and 0.8% SAP, particularly in recycled aggregate concrete, enhancing mechanical performance and sustainability.

Keywords: *Self-Compacting Concrete, Self-Curing Concrete, Recycled Aggregates, Silica Fume, SAP Agent, Sustainable Construction.*

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I. INTRODUCTION

Concrete is the most widely used construction material globally, yet traditional concrete suffers from limitations in terms of flowability and the need for external curing. With rapid urbanization and a growing emphasis on sustainable building practices, there's an urgent demand for materials that are both durable and environmentally friendly. This research focuses on combining three critical innovations in concrete technology—self-compacting concrete (SCC), self-curing concrete, and the utilization o...

II. OBJECTIVES AND METHODOLOGY

The overall methodology includes selecting materials conforming to IS standards, designing mixes using the Nan Su method, and performing tests in accordance with EFNARC guidelines. Experiments were conducted under controlled conditions. Eight different concrete mixes were prepared by varying the dosage of silica fume (0.1% to 0.25%) and SAP agent (0.4% to 1.0%) for both natural and recycled aggregates.

- *Methodology:*

The Nan Su method was used to design M30 grade concrete. Eight mixes were prepared using different combinations of normal and recycled aggregates with silica fume (0.1%– 0.25%) and SAP agent (0.4%–1%). Standard procedures (IS codes) were followed for testing mechanical and workability properties.

III. MATERIALS

In this investigation, each material was tested for its compliance with Indian Standards. Fly ash was used as a supplementary cementitious material to improve durability and reduce the heat of hydration. The SAP agent used in this research is a cross-linked polyacrylate polymer capable of

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absorbing several hundred times its own weight in water. Silica fume, a byproduct of silicon metal production, enhances strength and reduces permeability.

IV. MIX PROPORTIONS

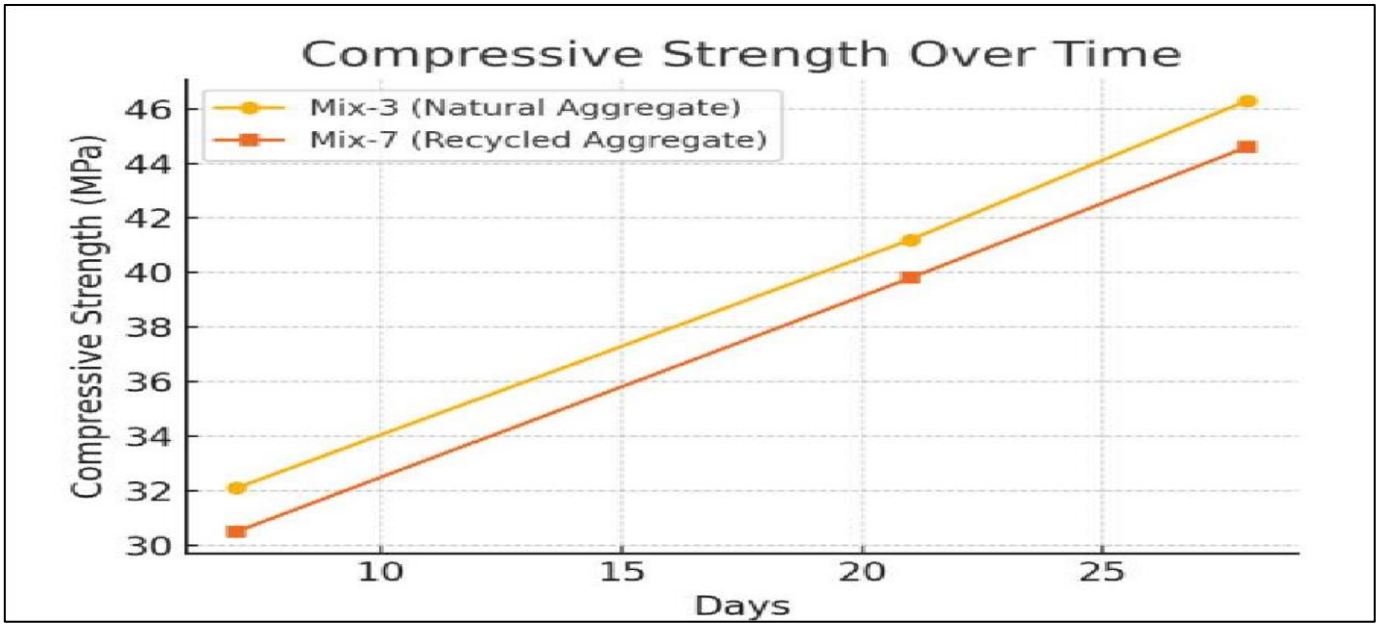
The Nan Su mix design method was chosen for its suitability in optimizing the powder-toaggregate ratio and ensuring proper filling and passing abilities. Watercement ratio was kept constant, and dosage of admixtures was varied. Batching and mixing were done in a pan mixer, ensuring homogeneity before casting specimens.

V. RESULTS AND DISCUSSION

A detailed examination of mechanical and workability results showed that Mix-3 (natural aggregate with 0.2% silica fume and 0.8% SAP) provided the best compressive strength (46.3 MPa at 28 days). Recycled aggregates performed slightly lower but within acceptable limits. Workability tests like slump flow, Lbox, and J-ring confirmed that all mixes complied with EFNARC limits, though higher SAP content slightly reduced flow due to water absorption.

Table 1 Compressive Strength Mix design vs Days

Mix ID	7 Days (MPa)	21 Days (MPa)	28 Days (MPa)
Mix-1	28.4	35.6	40.1
Mix-3	32.1	41.2	46.3
Mix-5	26.7	33.0	38.5
Mix-7	30.5	39.8	44.6



VI. CONCLUSION

This study confirms the potential of using recycled aggregates in self-compacting and self curing concrete without compromising mechanical performance. Silica fume and SAP synergistically improve concrete durability, reduce permeability, and contribute to sustainable development goals by recycling construction waste and reducing water usage during curing.

REFERENCES

[1]. Okamura, H., & Ouchi, M. (2003). Selfcompacting concrete. Journal of Advanced Concrete Technology, 1(1), 5–15.

[2]. EFNARC. (2005). The European Guidelines for Self-Compacting Concrete.

[3]. Ganesan, K., Rajagopal, K., & Thangavel, K. (2008). Rice husk ash blended cement: Construction and Building Materials, 22(8), 1675–1683.

[4]. Bentz, D. P., & Weiss, W. J. (2011). Internal curing: A 2010 state-of-theart review. NISTIR 7765.

[5]. Rao, A., Jha, K. N., & Misra, S. (2007). Use of aggregates from recycled C&D waste in concrete. Resources, Conservation and Recycling, 50(1), 71–81.