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Experimental Study on Strength and Durability Parameters of Recycled Aggregate Concrete by Using Chemical and Mechanical Treatment

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Abstract: Up to 150 million tons of construction and demolition (C&D) waste are produced annually in developing nations like India, making up 35–40% of the world's total C&D waste. According to the Centre for Science and Environment, India recycles just 1% (6500 tonnes) of its construction and demolition waste (C&D) per day. Recycled concrete aggregate is conserved by thermal and mechanical treatment of recycled coarse aggregate, while natural aggregate lessens the impact on landfills. Demolished concrete derbies are used as recycled concrete aggregate. The physical and mechanical properties of natural and recycled aggregate are studied in these experimental works by replacing natural aggregate (by weight) with 10%, 20%, 30%, and 40% recycled aggregate with M30 and M40 grade concrete. The results of compression and tensile strength are compared after 28 days.
Keywords: Mechanical property, Chemical properties, construction and demolition waste , recycled coarse aggregate, compressive strength.

I. INTRODUCTION

Concrete, a man-made material used in construction, is a crucial part of society's infrastructure. As population increases, it consumes natural resources and energy, with the construction industry responsible for waste generation. Concrete consists of hydraulic cement, water, coarse and fine aggregates, with aggregates being the major component Recycled coarse aggregate is obtained from broken concrete structures or demolished buildings, used in construction. Large-scale demolition of concrete structures produces large amounts of waste, which can pollute air and water. Proper use of solid waste is crucial for reducing waste and promoting sustainable development.

II. NEED OF STUDY

To investigate the feasibility and effectiveness of using a combination of natural coarse aggregate and recycled aggregate on various treatments concrete, focusing on its workability, strength, and durability.

III. OBJECTIVE OF STUDY

1) To study the recycle aggregate in concrete mix.
2) To prepare aggregate for construction and demolition waste using various treatments.
3) To determine the chemical properties of recycled aggregate .
4) To determine the durability property of RCA

IV. TREATMENT METHOD ON RECYCLED AGGREGATE

A. *Mechanical Treatment Method*

The study utilized Los Angles abrasion machine and ball milling techniques to treat recycled coarse aggregate. The aggregate was treated using 12 steel spheres, capable of 300 revelations, and then sieved. The aggregate was cleaned with water to remove dust particles. The attached mortar was removed by rubbing the aggregate in the Los Angeles abrasion machine, which rotates steel spheres continuously for five minutes.

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Figure 1 Mechanical Treatment on recycled coarse aggregate

B. *Chemical Treatment Method*

Aggregate refers to the various treatments and assessments given to coarse recycled concrete aggregate after cleaning and a 24-hour drying process at 105 ± 5 C. The aggregate is pre-soaked in acetic acid for 24 hours, and then immersed in water to remove acidic solvents. It is then dried in an oven using hydrochloric acid to create acid solutions. The recovered aggregates are then used for an hour.

Figure 2 Chemical Treatment Method

V. PROPOSED MIX PROPORTION

The given value in Percentage (%)

Table 1 Vales of aggregate by%

Sr no	Natural coarse aggregate %	Recycled coarse aggregate	
		Mechanical treatment (%)	Chemical Treatment (%)
1.	100	0	0
2.	90	10	10
3.	80	20	20
4.	70	30	30
5.	60	40	40

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VI. TEST RESULTS AND GRAPH

1) Workability Test by Mechanical treatment

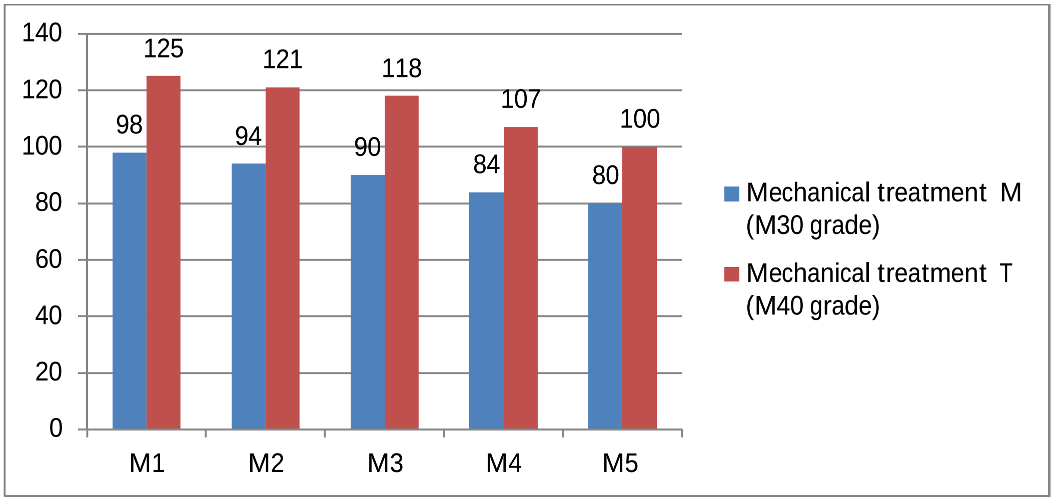

Figure 3 Workability test Mechanical Treatments

2) Workability test Chemical Treatments

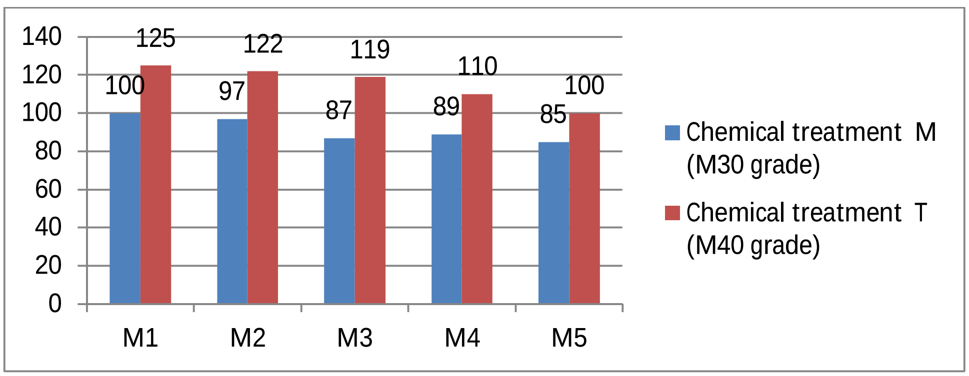

Figure 4 Workability test Chemical Treatments

3) Compressive strength

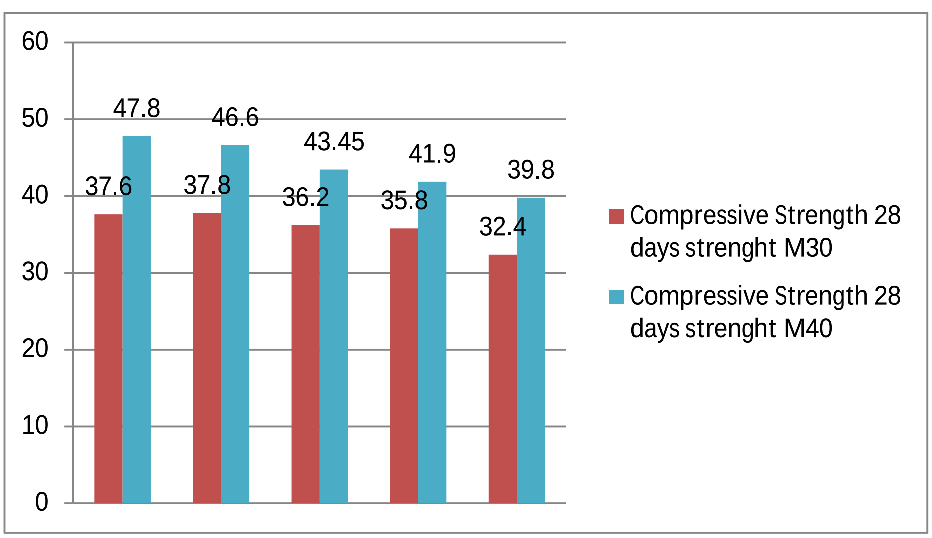

Figure 5 Compressive strength of mechanical treatments

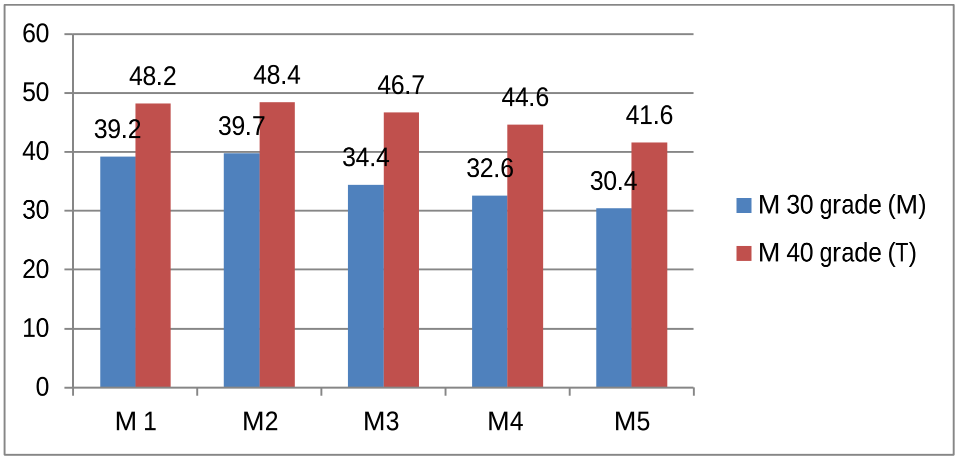

Figure 6 compressive strength of concrete by chemical treatments

4) Split tensile strength

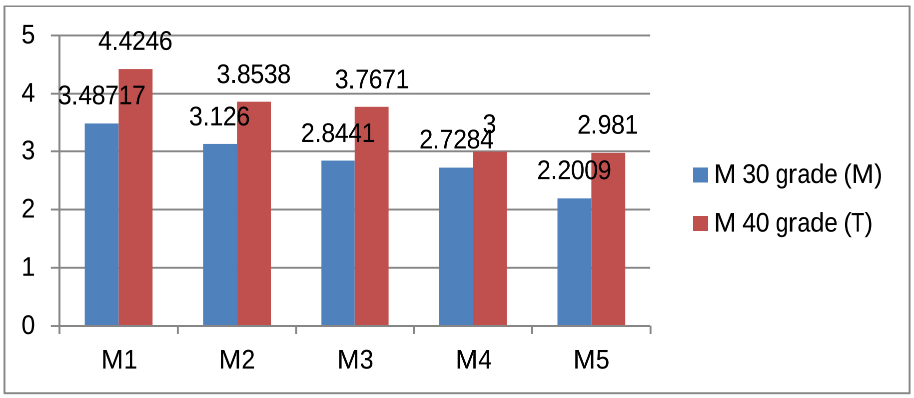

Figure 7 Split tensile strength mechanical treatment

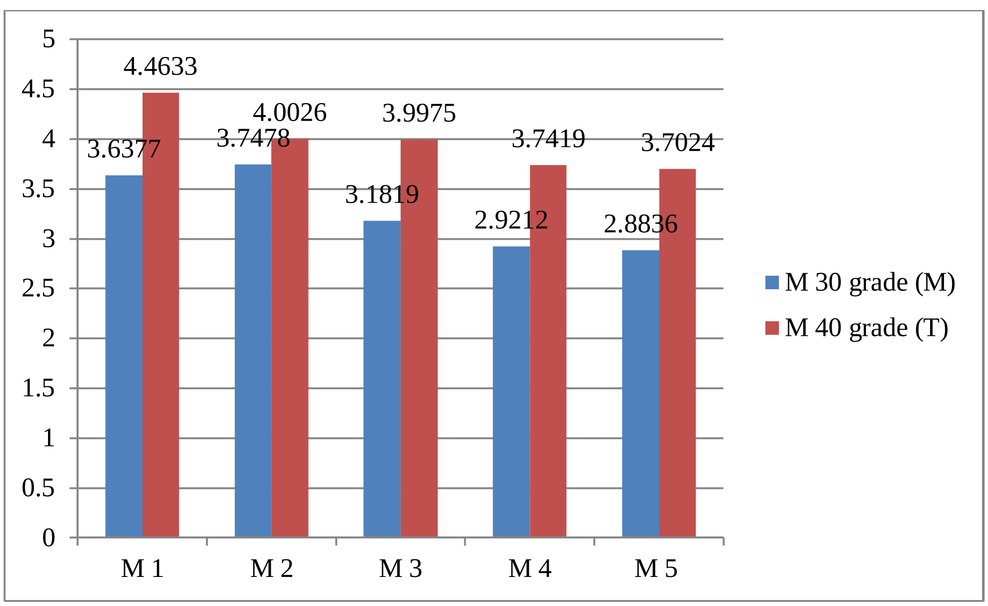

Figure 8 Split tensile strength Chemical treatment

5) Flexural strength test

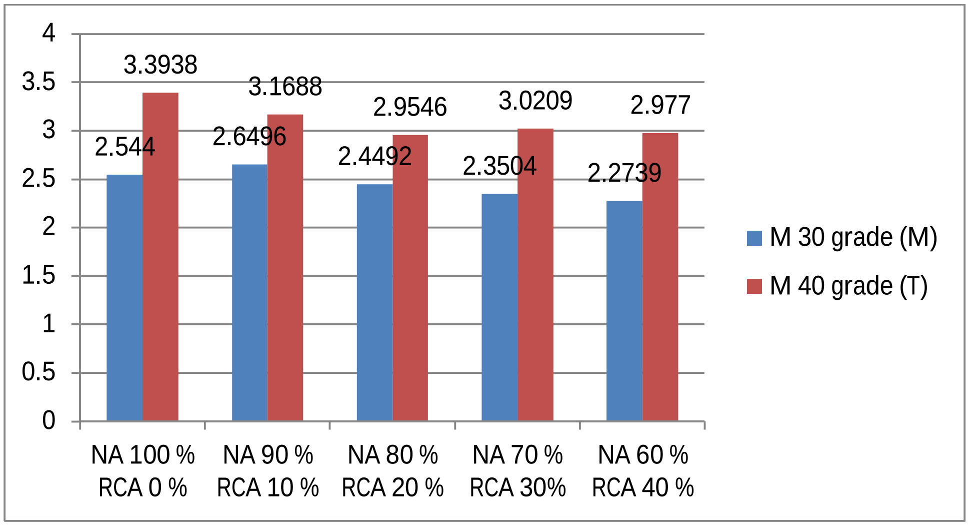

Figure 9 Flexural strength by Mechanical treatments

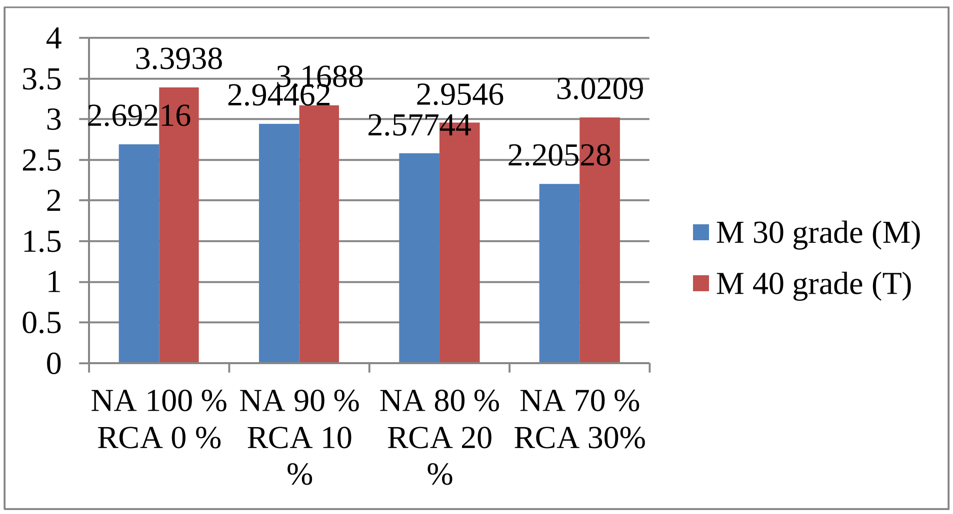

Figure 10 Flexural strength by chemical treatments

6) Durability tests

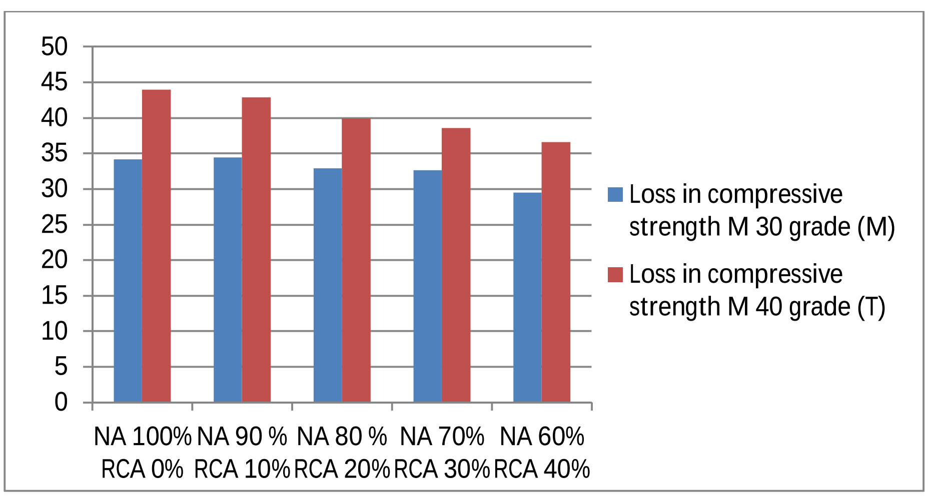

Figure 11 Acid attack test by mechanical treatments

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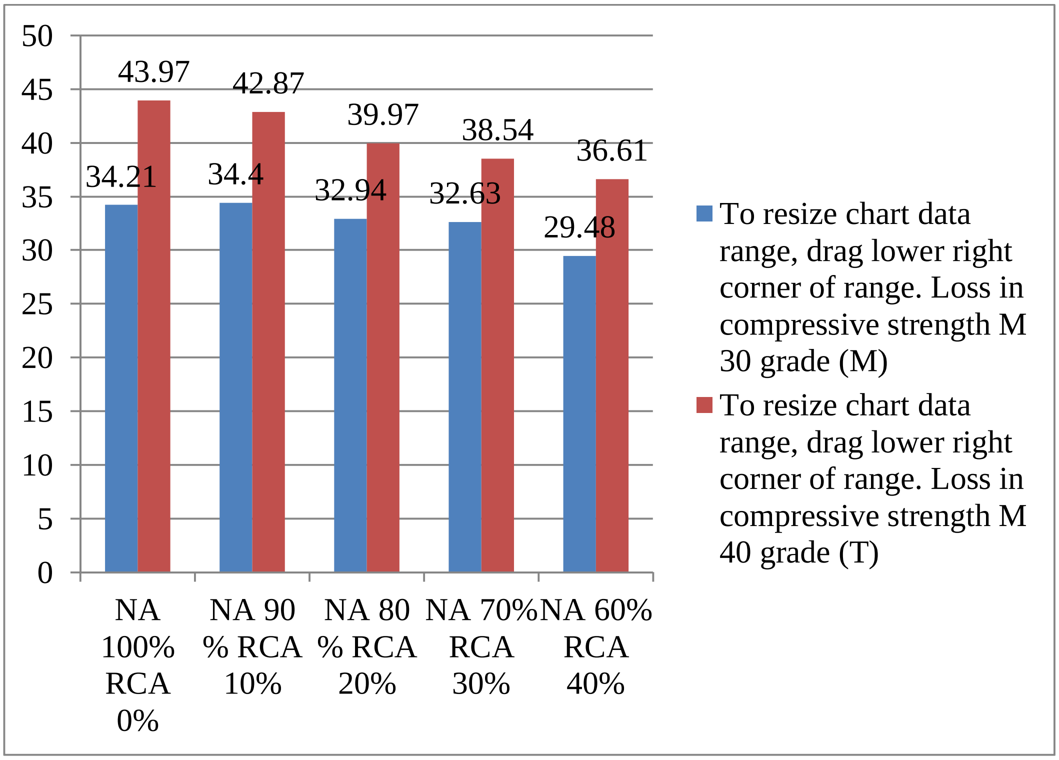

Figure 12 Acid attack test By chemical Treatments

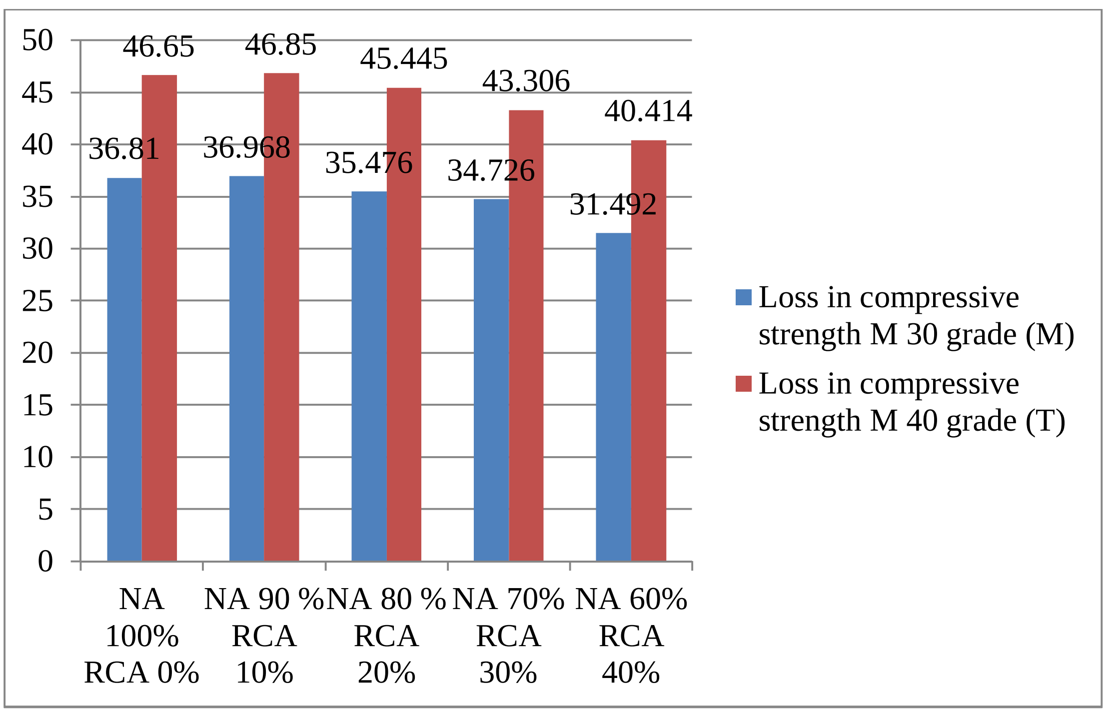

Figure 13 salt attack by mechanical treatments

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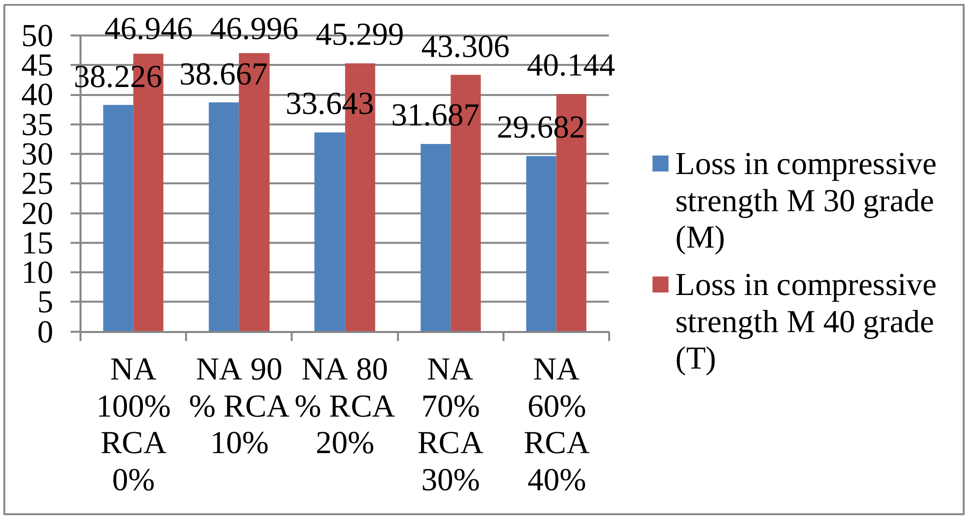

Figure 14 salt attack by chemical treatment

VII. CONCLUSION

In summary, the use the chemical and mechanical activated with neutral water effectively regulates setting times in slag-based concrete, while in corpora ting and with sodium silicate enhances workability. Higher s percentages decrease setting time and workability but increase compressive strength. concrete typically shows higher density than OPC, with formulations high in fly ash content capable of curing in ambient conditions. Regarding comparisons with OPC, GPC exhibits lower modulus of elasticity but higher deformation capacity and ductility at equivalent strengths. Optimizing GPC performance involves specific ratios of NaOH, Na2SiO3, and total alkali activator to fly ash technology offers a sustainable alternative to OPC, utilizing reduce CO2 emissions. Recent advancements highlight the potential for enhancing compressive strength, especiallyin cast-in-situ applications. Further research is needed to explore long-term durability and structural applications ,but experimental studies demonstrate promising mechanical properties and offer insights into mix design optimization for sustainable concrete

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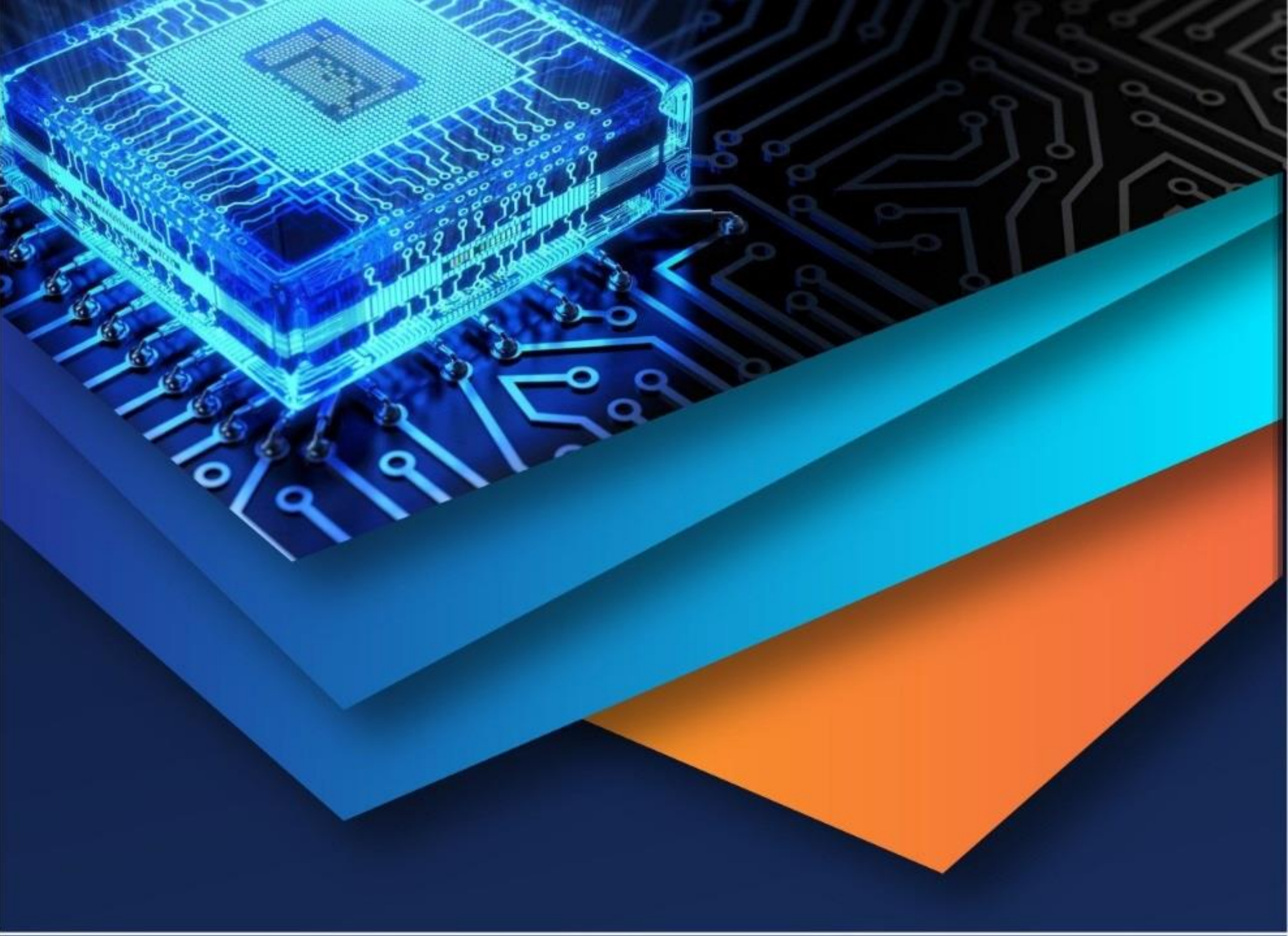

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