iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** V **Month of publication:** May 2024

DOI: https://doi.org/10.22214/ijraset.2024.61744

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue V May 2024- Available at www.ijraset.com

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

Falguni Patel[1], Prof. Kishan Vekariya[2]
[1]*Department of Civil Engineering, Noble Group of Institution, Junagadh*
[2]*Head of Department of civil Engineering Noble Group of Institution, Junagadh*

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.

©IJRASET: All Rights are Reserved



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

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

VI. TEST RESULTS AND GRAPH

1) Workability Test by Mechanical treatment

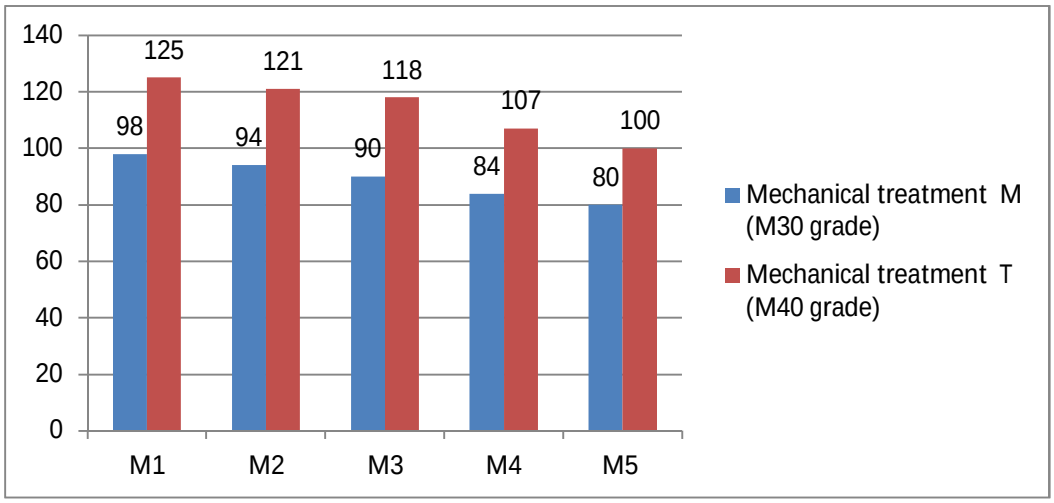


Figure 3 Workability test Mechanical Treatments

2) Workability test Chemical Treatments

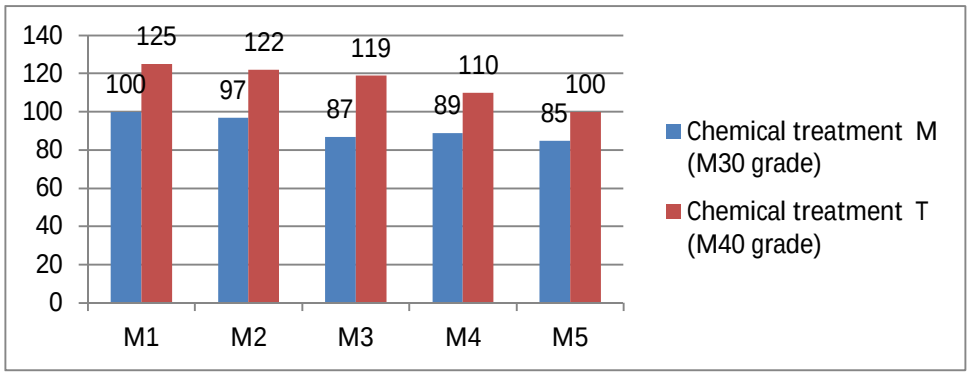


Figure 4 Workability test Chemical Treatments

3) Compressive strength

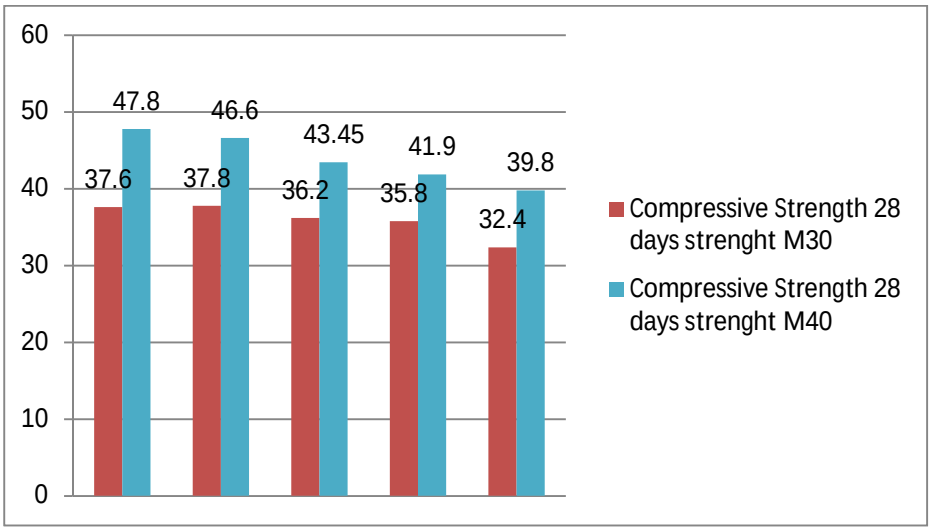


Figure 5 Compressive strength of mechanical treatments

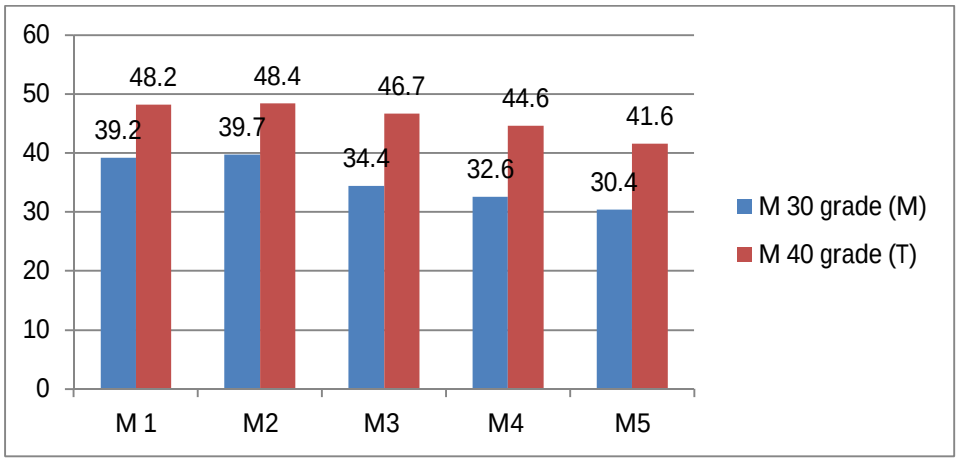


Figure 6 compressive strength of concrete by chemical treatments

4) Split tensile strength

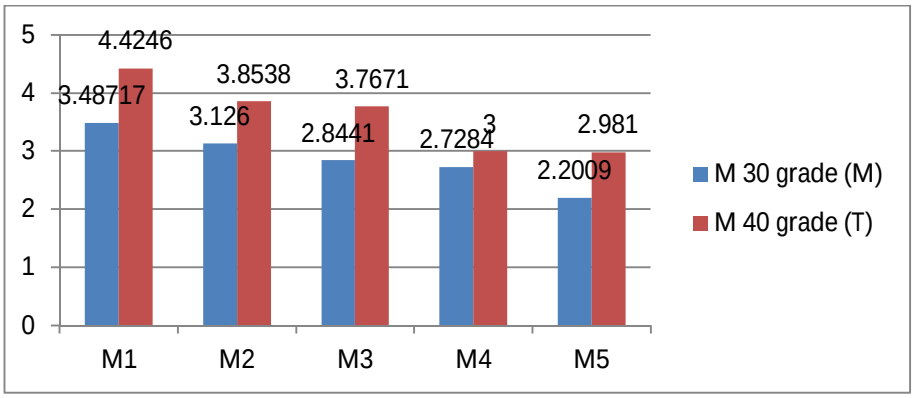


Figure 7 Split tensile strength mechanical treatment

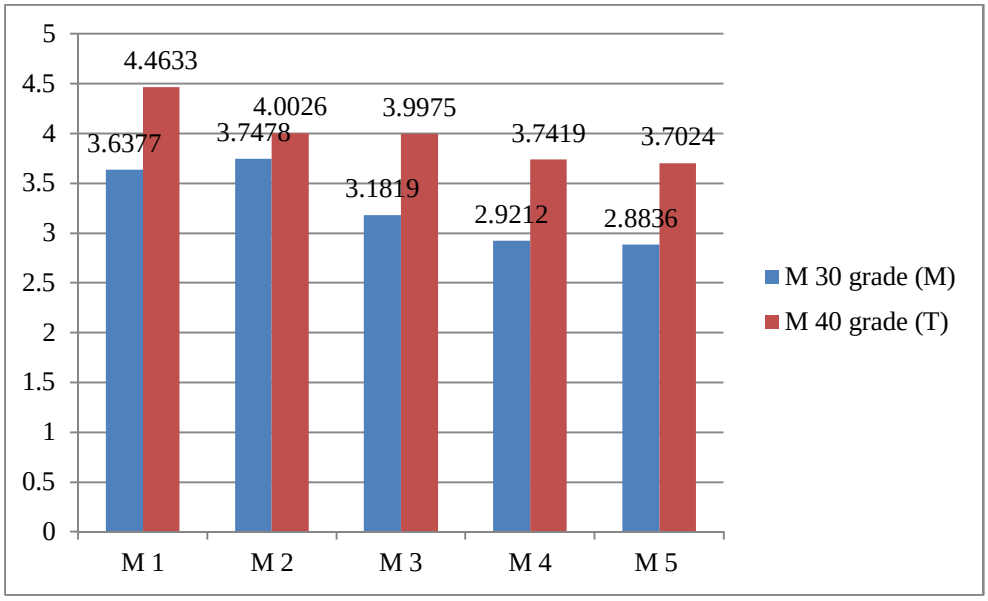


Figure 8 Split tensile strength Chemical treatment

5) Flexural strength test

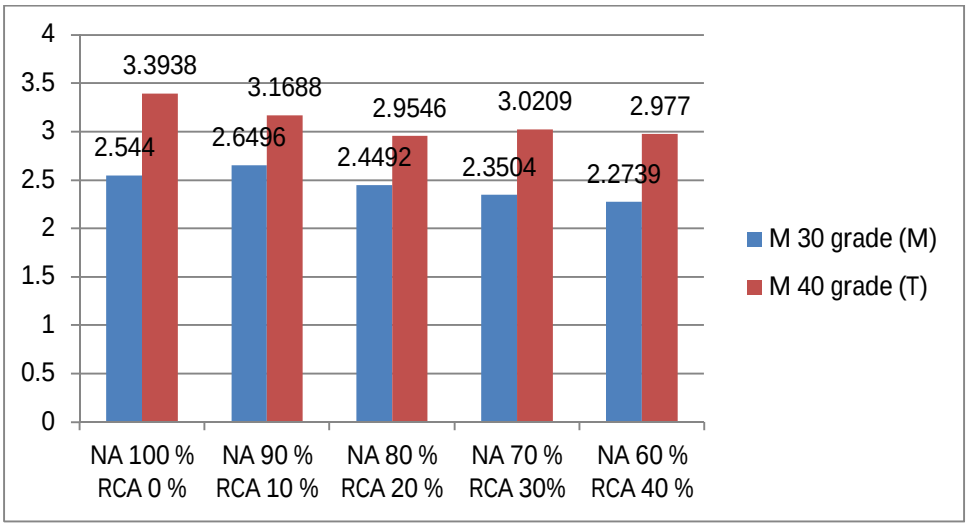


Figure 9 Flexural strength by Mechanical treatments

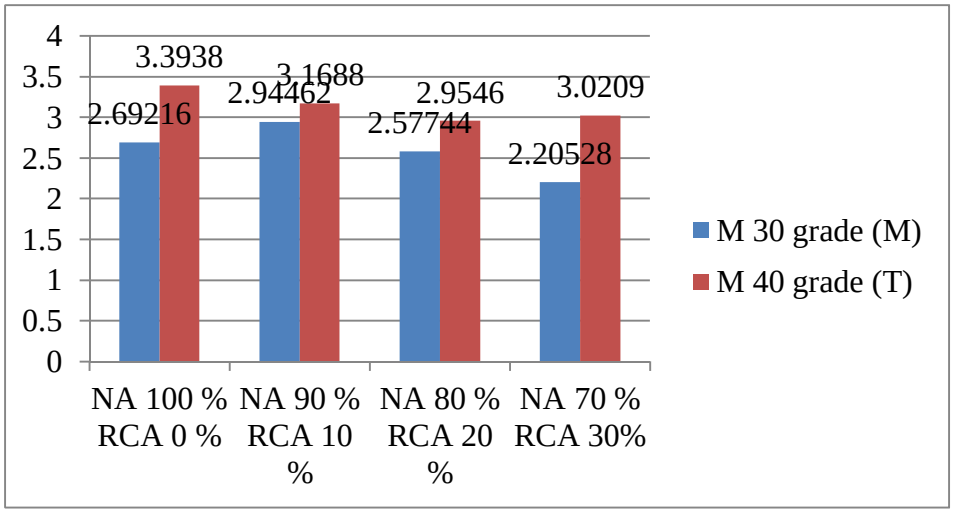


Figure 10 Flexural strength by chemical treatments

6) Durability tests

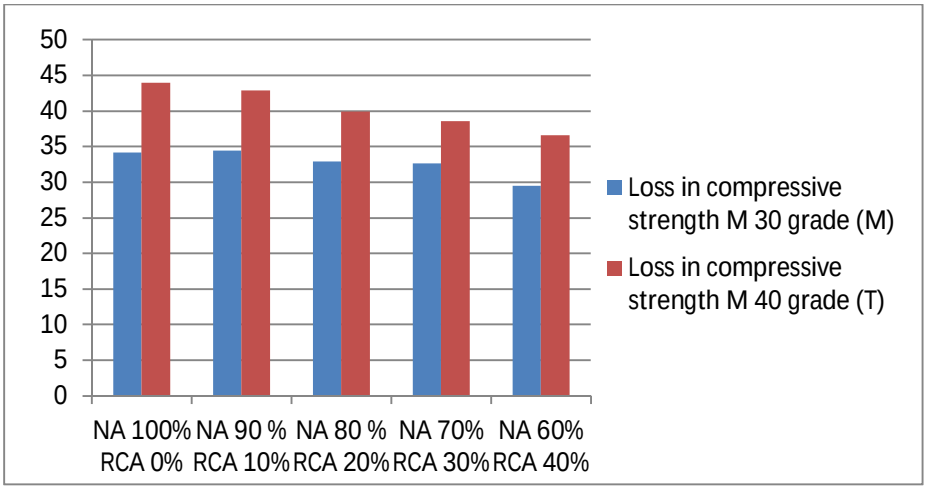


Figure 11 Acid attack test by mechanical treatments

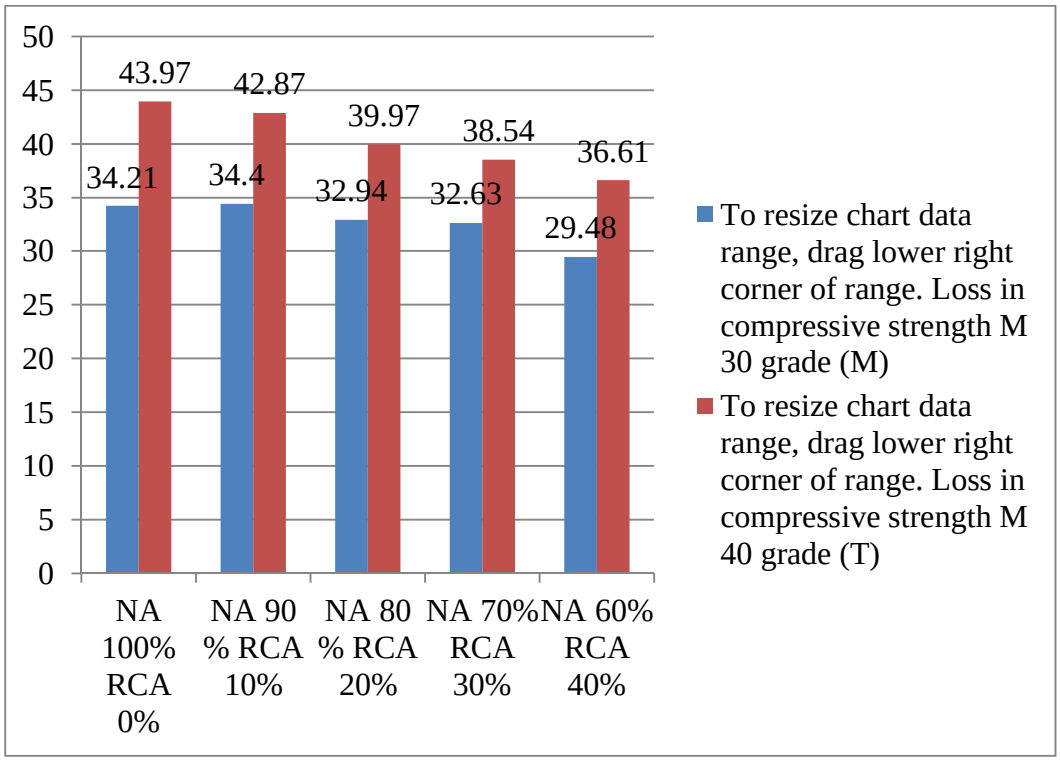


Figure 12 Acid attack test By chemical Treatments

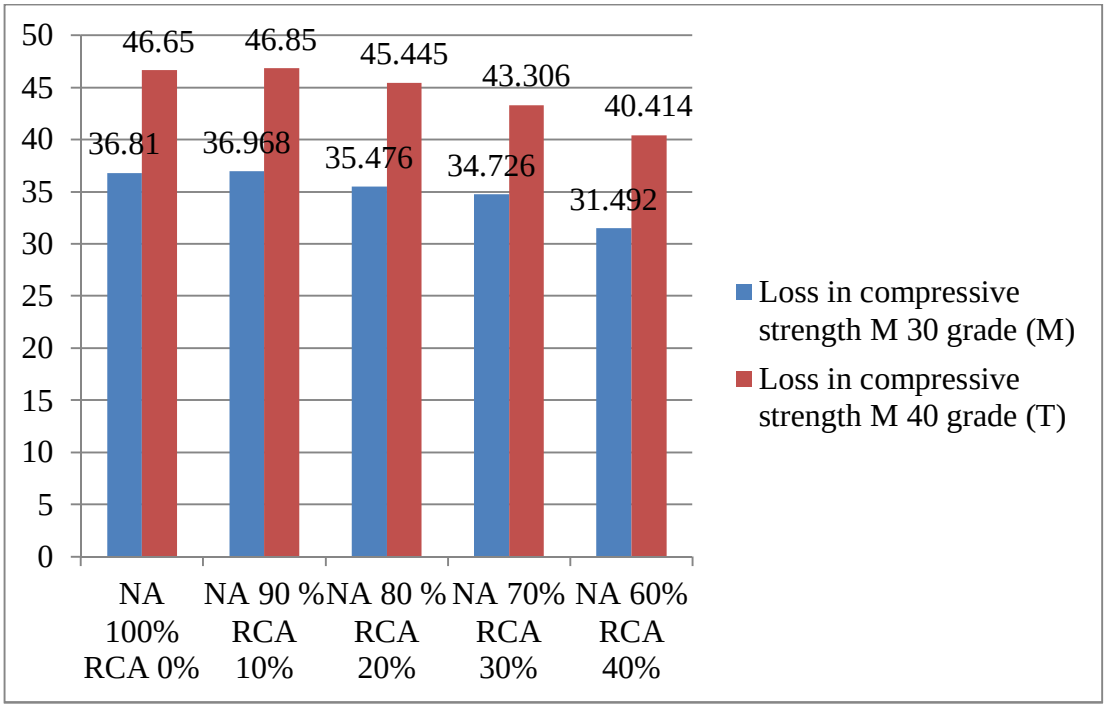


Figure 13 salt attack by mechanical treatments

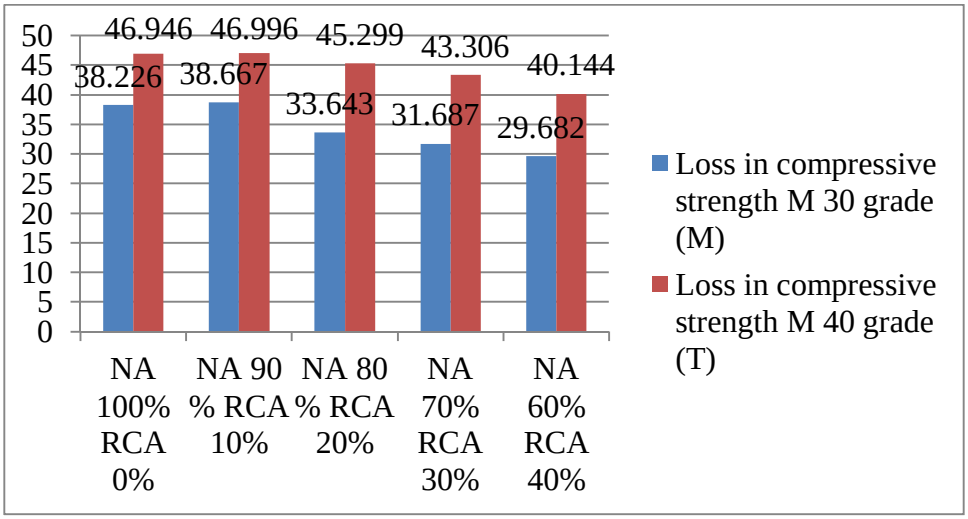


Figure 14 salt attack by chemical treatment

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

REFERENCES

[1] IS 456 (2000) Plain and reinforced concrete code of practice [CED : 2 Cement and concrete]
[2] IS 10262(2009) Guidelines for concrete mix design proportioning [CED: 2 Cement and concrete]
[3] MS Shetty concrete technology theory and practice 2008
[4] " Use of Demolished Concrete Waste in Partial Replacement of Coarse Aggregate in Concrete" Rakesh B J , C R Shivakumar, Prashanth D N , Amithgowda4 , Akashkumar V K, Shashikumar N V, Padmashree C N.International Journal of Research in Engineering and Science (IJRES) ISSN (Online): 2320-9364, ISSN (Print): 2320-9356 www.ijres.org Volume 11 Issue 5 ǁ May 2023 ǁ PP. 886-890
[5] "A Comprehensive Review on Recycled Aggregate and Recycled Aggregate Concrete"Bo Wang 1, Libo Yan 1,2,*, Qiuni Fu 1, Bohumil Kasal 1,2 Resources, Conservation & Recycling journal homepage: www.elsevier.com/locate/resconrec.
[6] "Acid resistance of quaternary blended recycled aggregate concrete"K Jagannadha Raoa, K. Keerthia, Srinivas Vasamb .Contents lists available at ScienceDirectCase Studies in Construction Materialsjournal homepage: www.elsevier.com/locate/cscm
[7] "Durability and Structural Performance of Recycled Aggregate Concrete: A review Articlein International Review of CivilEngineeringhttps://www.researchgate.net/publication/335023730 (IRECE) · May 2019
[8] "Durability Aspects of Recycled Aggregate Concrete: An Experimental Study" Smitha Yadav, Snehal Pathak World Academy of Science, Engineering and Technology International Journal of Civil and Environmental Engineering Vol:12, No:3, 2018
[9] "Characterization of recycled aggregate by the combined method: Acid soaking and mechanical grinding technique" Abhishek Verma , V.S. Babu, S. ArunachalamJaypee University of Engineering and Technology, A.B Road, Raghogarh, Guna 473226, India Article inMaterials Today Proceedings · March 2021DOI: 10.1016/j.matpr.2021.01.842 profiles for this publication at: https://www.researchgate.net/publication/349872488.
[10] "The effects of surface treatment methods on properties of recycled concrete aggregates" Ankush Tanta , Abhishek Kanoungo , Swati Singh , Shristi Kanoungo profiles for this publication at: https://www.researchgate.net/publication/354993220
[11] "Improvement of the Quality of Recycled Concrete Aggregate Subjected to Chemical Treatments: A Review" Javier A. Forero , Jorge de Brito , Luís Evangelista , and Cláudio Pereira MDPI stays neutralwith regard to jurisdictional claims inpublished maps and institutional affiliations. 8 April 2022
[12] "The effects of surface treatment methods on properties of recycled concrete aggregates" Ankush Tanta a, Abhishek Kanoungo , Swati Singh , Shristi Kanoungo Article inMaterials Today Proceedings · September 2021 this publication at:https://www.researchgate.net/publication/354993220
[13] "A novel approach to utilize recycled concrete aggregates as landfill liner"T. Anstey Vathani , J. LogeshwariWaste Management Bulletinjournal homepage: www.elsevier.com/locate/wmbWaste Management Bulletin 1 (2023) 39–48

[14] "Compressive strength of concrete with recycled aggregate; a machine learning-based evaluation" Hamed Dabiri , Mahdi Kioumarsi , Ali Kheyroddin , Amirreza Kandiri , Farid Sartipi Contents lists available at ScienceDirect journal homepage: www.elsevier.com/locate/clema.

[15] "Methods for improving the durability of recycled aggregate concrete: A review" Yuanxun Zheng, Yahui Zhang, Peng Zhangjournal homepage:www.elsevier.com/locate/jmrt

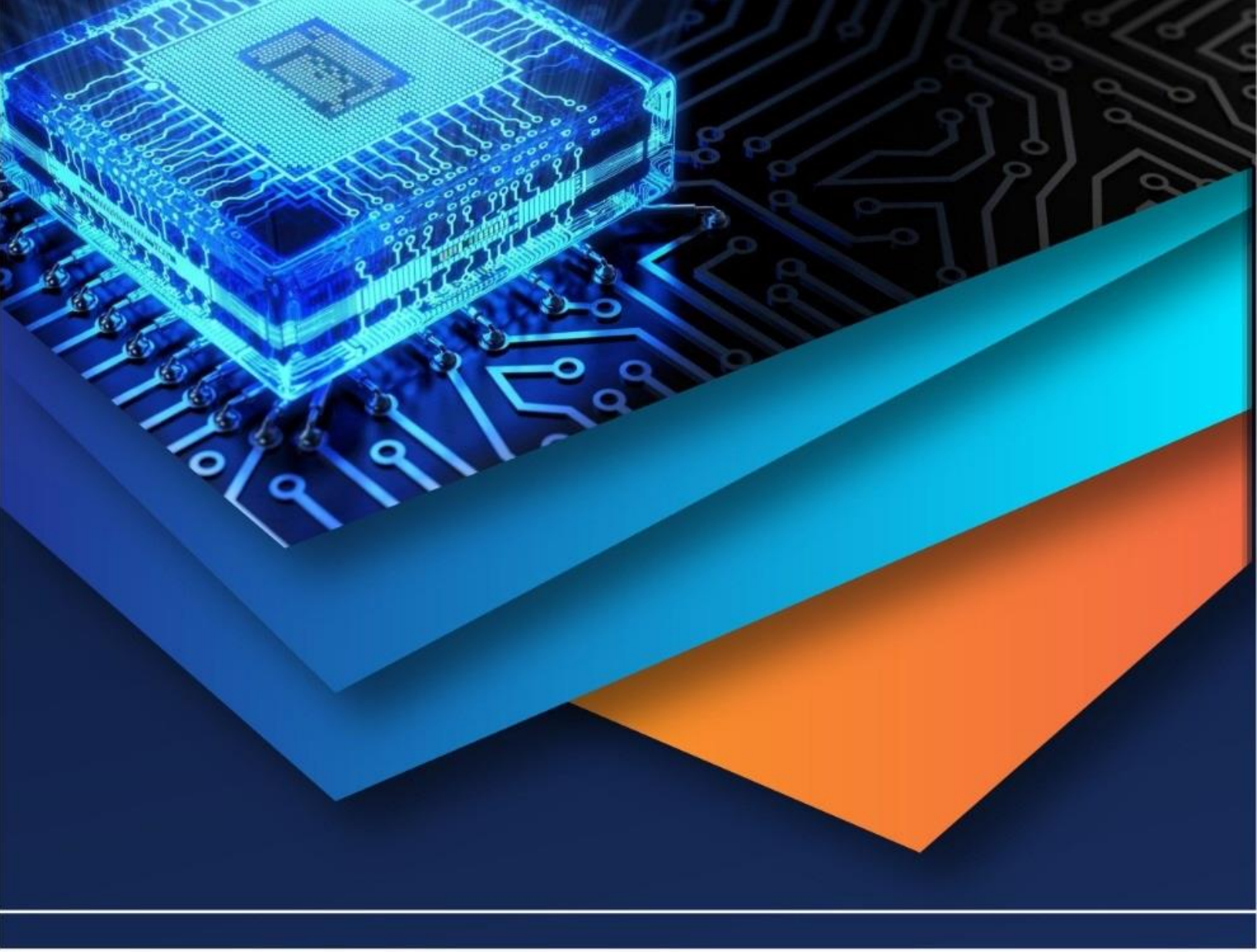
[16] Mechanical and durability properties of recycled aggregate concrete with ternary binder system and optimized mix proportion O.E. Babalolaa, P.O. Awoyerab,∗, M.T. Trana, D.-H. Lea, O.B. Olalusic, A. Viloria d,e, D. Ovallos-Gazabonf www.jmrt.com.br j m a t e r r e s t e c h n o l . 2 0 2 0;**9(3)**:6521–6532

[17] An experimental study on the mechanical properties of underground mining backfill materials obtained from recycling of construction and demolition waste Faeze Sadat Khandani, Hadi Atapour *, Mostafa Yousefi Rad, Behzad Khosh www.elsevier.com/locate/cscm

[18] " Experimental Study on Recycled Concrete Aggregates" Zidan Ahmed, Syed Khaja Yaser Ali, Mohammed Ahmed uddin, Mr. Ahmed Abdul AhadInternational Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

[19] "An Experimental Study on Partially Processed Recycled Coarse Aggregate in Concrete" Monu Chauhan1, Prof. Rajeev Parihar ISSN: 2581-3404 (Online) International Journal of Innovative Research in Technology and Management, Vol-4, Issue-5, 2020.

[20] "An Experimental Study On the Strength Properties of Graphene Oxide Concrete with Partial Replacement of Coarse Aggregate by Recycled Coarse Aggregate" G. S. Sudhi Kumar*, K. A. Abhilash Kumar International Journal of Research in Engineering, Science and Management Volume 4, Issue 4, April 2021 https://www.ijresm.com | ISSN (Online): 2581-5792



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)