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Corrosion Of Steel Bars In Concrete With Recycled Aggregate Treated With Diammonium Phosphate

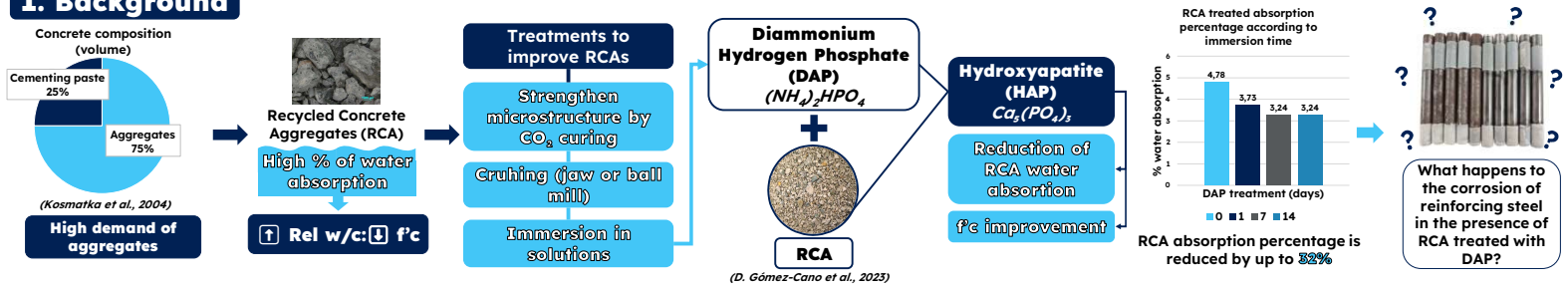
Juan Diego Bolaños[1], Rossana Villa-Serna[2], Esteban Camilo Correa-Gómez[2], Diana Gómez-Cano[2], Daniela González-Betancur[2], Yhan Paul Arias-Jaramillo[2], Luz Marina Ocampo[1]

[1] Department of Materials and Minerals, School of Mines, Universidad Nacional de Colombia, (Medellín, Colombia)
[2] Department of Construction, School of Architecture, Universidad Nacional de Colombia, (Medellín, Colombia)
Proyecto Corrosión – Semillero de Investigación en Ingeniería Circular para la Construcción

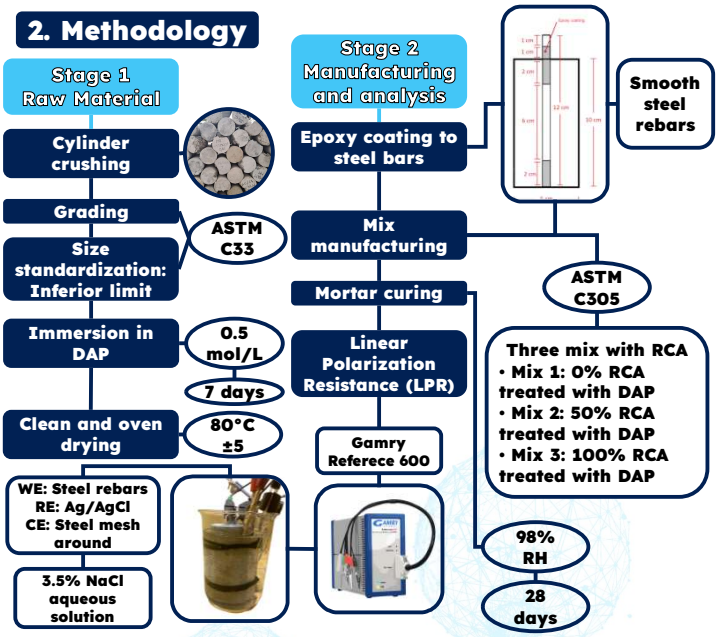
Abstrasct

This study focuses on a comparison of the corrosion kinetics of reinforcing steel in three types of concrete: conventional with natural aggregates, concrete with recycled aggregates (RCA) from crushed concrete, and concrete with recycled aggregates from crushed concrete treated with diammonium phosphate (DAP). The literature shows that DAP improves the characteristics of RCA and therefore the mechanical performance of concrete mixes is better, however, there is no clarity about the kinetics of corrosion in embedded steel. Three series of mixtures of cylindrical specimens with a water-binder ratio of 0.46 were prepared. Test specimens for each mixture were exposed to 3.5% NaCl aqueous solution, and the corrosion current density was measured using the resistance to polarization (Rp) technique. The corrosion kinetics results allowed establishing the minimum DAP concentration conditions to enhance the quality of the treated RCA and prevent the deterioration of the reinforcement steel.

1. Background



2. Methodology



3. Results

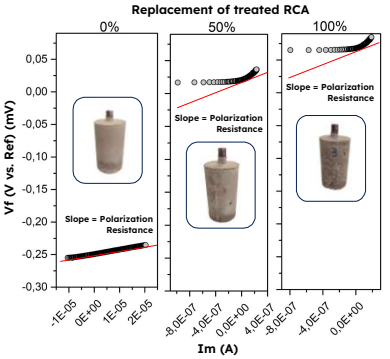


Figure 1. LPR measurements

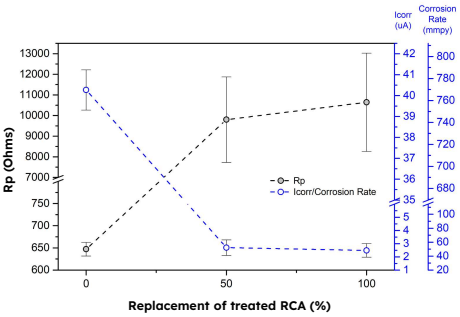


Figure 2. Comparison between the results of Rp, Icorr, and corrosion rate

Replacement of treated RCA	Rp	Rp Change	Icorr	Icorr Change	Corrosion rate	CR Change
%	Ohms	-	uA	%	mmpy	%
0	647.07	1.00	40.27	100%	769.93	100%
50	9801.67	15.15	2.67	6.70%	51.61	6.70%
100	10640.00	16.44	2.49	6.18%	47.55	6.18%

Table 1. Percentage changes in LPR measurements

4. Conclusions

- Mortars with a higher substitution of treated aggregates with DAP exhibited an Rp around 15 times higher compared to the case of mortars with untreated RCA. This suggests that the DAP treatment enhances the durability of the reinforcing steel in the mortars.
- The Icorr values for substitutions of 50% and 100% of RCA treated with DAP are very close, indicating that the quantity of treated RCA does not significantly influence the corrosion kinetics.
- The remarkably high Rp values of the samples with treated RCA (close to 10k Ohms) indicate that the treatment influenced the increase in their LPR.

5. References

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Contact information

Juan Diego Bolaños: jdbolanoso@unal.edu.co
Rossana Villa-Serna: rvillas@unal.edu.co
Esteban Camilo Correa-Gómez: escorreag@unal.edu.co
Diana Gómez-Cano: digomezca@unal.edu.co
Daniela González-Betancur: dgonzalezbe@unal.edu.co
Yhan Paul Arias-Jaramillo: ypariasj@unal.edu.co
Luz Marina Ocampo: lmocampo@unal.edu.co

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