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ENGINEERING PROPERTIES OF WASTE CEMENT-BASED GROUTS FOR GEOTECHNICAL APPLICATIONS

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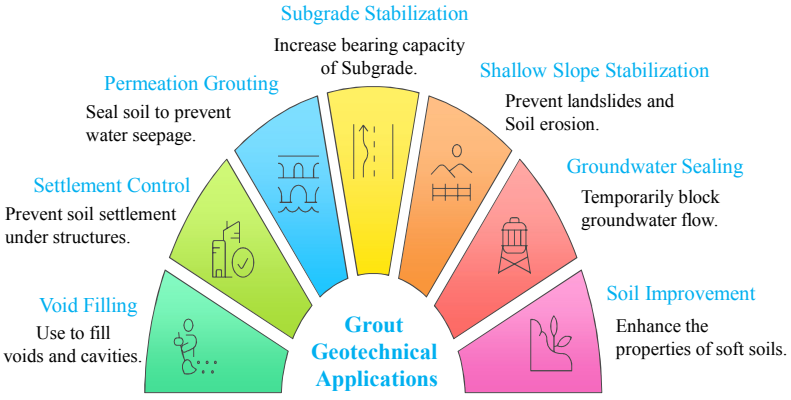
INTRODUCTION & AIM

Waste cement, particularly shelf-life-expired (SLE) cement, presents a sustainable alternative binder for geotechnical grouting, reducing environmental impact and minimizing the excessive consumption of manufactured cement. Grout materials are widely used in geotechnical applications for:

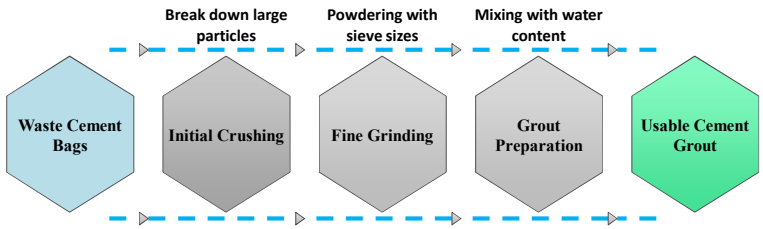


This study aims to evaluate the mechanical and fresh properties of SLE-cement-based grouts for geotechnical applications requiring moderate structural intensity.

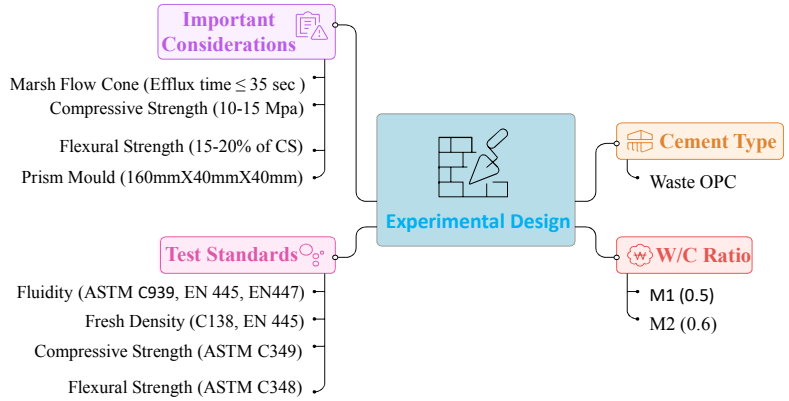
MATERIALS COLLECTION & RESEARCH DESIGN

Hardened Waste Cement Bag | Waste Cement Extracted | Ground to Smaller Particles | Mechanical Sieving retained on 0.075 mm Sieve | Powdered Waste Cement Collection

Recycling Waste Cement into Grout



Expired cement in lab — Two mixes with varying content



RESULTS & DISCUSSION

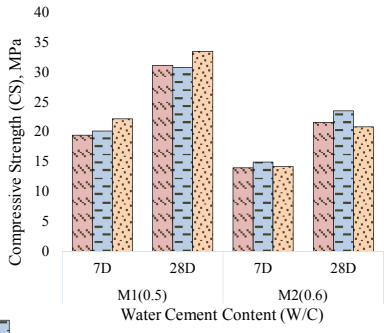
Flowability | Bulk Weight | Compressive Strength | Flexural Strength

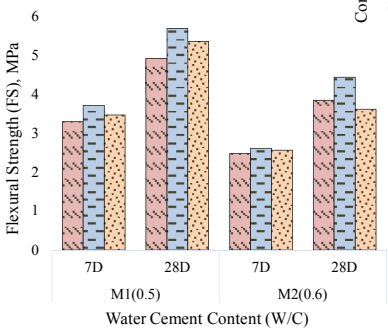
Fresh Property Test

Mix type	Water-cement ratio (W/C)	Flowability time (sec)	Fresh density (g/cm^3)
M1	0.5	37.73	1.88
M2	0.6	18.67	1.72

Mechanical Property Test

M1 Grout, CS = 30.85 to 33.51 Mpa
M2 Grout, CS = 20.84 to 23.54 Mpa





M1 Grout, FS = 4.91 to 5.68 Mpa
M2 Grout, FS = 3.61 to 4.43 Mpa

CONCLUSION

- SLE cement is viable in cementitious grout for moderate-strength geotechnical applications
- M1 (0.5) mixes achieved better CS & FS results than M2 (0.6). However, M2 (0.6) are comparatively more Suitable and Cost-Effective.
- Fresh Properties results are satisfactory for Injectable Grout in Soil Improvement.
- Reduction in raw cement demand and waste generation, which supports SDG 11 (Sustainable Cities & Communities) and SDG 12 (Responsible Consumption & Production).

FUTURE WORK / REFERENCES

Future Plan

- Long-Term Durability Studies
- Field Trials in Low Permeability Silty Sands through Grout Injection.

References

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