



Closing the Loop: Plastic-Enhanced Cementitious Materials for Diverse Concrete Application

SP Singapore
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Technology Licensing Opportunity

Technology Overview

The building and construction industry contributes approximately 1% of global carbon dioxide emissions through concrete production. Similarly, materials like plastics are non-biodegradable, difficult to recycle and release toxic fumes when incinerated. Disposal by landfills are unsustainable and impractical in the long run, creating an urgent need for innovative waste management solutions.

Plastics such as polypropylene (PP) and acrylonitrile butadiene styrene (ABS) do not degrade easily in landfills, with PP being highly resistant to chemical breakdown and ABS having a complex structure that makes it particularly hard to decompose. Both materials face significant barriers to effective mechanical recycling due to contamination and mixed material designs.

This technology transforms plastic waste disposal challenges into construction opportunities by taking components like cooler blades and fan blades from used air-conditioners. The process involves pre-treatment including segregation, removal of non-plastic parts, shredding, grinding and sieving, followed by a systematic three-step approach providing detailed assessment of plastic waste use in concrete with various aggregate replacement content.

All design mixes are evaluated for compressive strength, water absorption and thermal conductivity. The optimised design mix achieves high aggregate replacement while providing improved thermal insulation, creating functional yet sustainable non-structural concrete that reduces landfill waste and enhancing sustainability.

Potential Applications

This technology is adaptable and can be applied across various construction and manufacturing sectors such as:

- Precast construction industry
- Thermal insulation panels
- Suppliers of air-conditioning plastic waste
- Aggregate industry
- Concrete industry

Commercialization / R&D Opportunities

- ✓ Ready for commercialization
- ✓ Looking collaborators for further development / to develop new applications
- ✓ Available for licensing
- ✓ Accepting business plans from interested parties

Intellectual Property -

- Know-How

Technology Features & Specifications

- **Cost savings:** Significantly reduces production costs and minimises landfill waste disposal, creating dual economic and environmental benefits for manufacturers.
- **Promote circular economy:** Creates sustainable end-of-life applications for PP and ABS plastic waste through efficient low-cost pre-treatment processes, transforming disposal challenges into valuable construction resources.
- **Reduced thermal conductivity:** Achieves substantially lower thermal conductivity than conventional concrete, providing superior insulation properties that lower heating and cooling costs.
- **Lightweight concrete:** Produces notably lighter concrete that reduces dead load in load-bearing structures, improving structural efficiency and design flexibility while maintaining strength for non-structural applications.
- **Enhanced durability:** Improves flexibility and crack resistance compared to traditional formulations, resulting in better longevity and structural performance under various loading conditions.
- **High replacement content:** Enables significant aggregate replacement content while maintaining optimal performance, surpassing existing plastic-concrete solutions through optimised design mix.

Unique Value Proposition

- With increasing demand for greener technologies to mitigate climate change and emphasis on Corporate Social Responsibility (CSR), there is a need to develop technologies that reduce environmental impact. By incorporating plastic waste in concrete, less waste requires disposal, incineration or landfill management, whilst any percentage of aggregate replacement brings substantial carbon footprint and cost savings.
- Every household today has at least one air-conditioner unit, creating abundant local plastic waste that can reduce dependency on imported construction materials. This approach uses readily available waste streams to create valuable construction resources locally.
- This technology has undergone rigorous testing and meets stringent regulatory requirements, with accredited laboratory tests completed for compressive strength compliance (BS EN 12390-3:2019) and chemical leaching safety assessments (US EPA 1311). These certifications demonstrate environmental safety and structural reliability for commercial adoption.
- There is a possibility of incorporating other types of materials into the mix to further refine it and boost the concrete's sustainability and material performances while adhering to the required standards according to the grade of concrete.

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