ENGRO
BUILDING SUSTAINABILITY

P197A and P197B

High performance Eco-Friendly Cement – *Complying with SS EN 197-1: 2014*

As part of our continuous efforts to help our customers meet the growing requirements of the still-nascent green building era, **EnGro** developed the high performance eco-friendly cement **P197A** and **P197B**, which are approved by Singapore Environment Council (SEC) as eco-friendly building material that qualifies under the Singapore Green Labelling Scheme. P197A and P197B are the blends of CEM I (Portland Cement) and our Green Label certified "VCEM" brand Ground Granulated Blastfurnace Slag (GGBS), complying with SS EN 197-1: 2014.

EnGro's Green Label "VCEM" GGBS has been widely used, as a supplementary cementitious material, for its superiority in improving concrete durability and extending concrete service life. With the addition of GGBS, P197A and P197B improve the physical and chemical properties of the concrete.

SPECIFICATIONS

Product	Typical GGBS Content	Specification (SS EN 197-1: 2014)
P197A	15-20 %	Portland-Slag Cement CEM II/A-S 42.5N
P197B	30-35 %	Portland-Slag Cement CEM II/B-S 42.5N

Lower CO2 Emission

To produce 1 ton of CEM I (Portland cement), approximately 900 kg of CO2 is emitted during production. In contrast, the CO2 emission for producing 1 ton of GGBS is less than 60 kg. Thus, using P197A and P197B result in a reduction of CO2 emission up to 32% compared to CEM I (Portland Cement), helping our customers to create a sustainable future.

Higher Fineness

GGBS is normally ground finer than Portland cement. The specific surface area is increased to enhance the early-age reaction rate and improve the cohesiveness of the cement paste. With addition of GGBS, P197A and P197B offer better workability with less bleeding and segregation than CEM I, facilitating the pumping, placing and compacting of concrete.

Lower Chromate Content

European Scientific Committee of Toxicity, Ecotoxicity and the Environment (CSTEE) has concluded that presence of chromate in cement causes serious allergic reaction in construction workers, especially water-soluble Cr(VI), which can even penetrate wet leather grove and induce dermatitis. Typical Cr(VI) content of Portland cement ranges from 5.8 to 8.4 pmm. Whereas, P197A and P197B have Cr(VI) contents less than 2 pmm, thus reducing the hazard substantially.

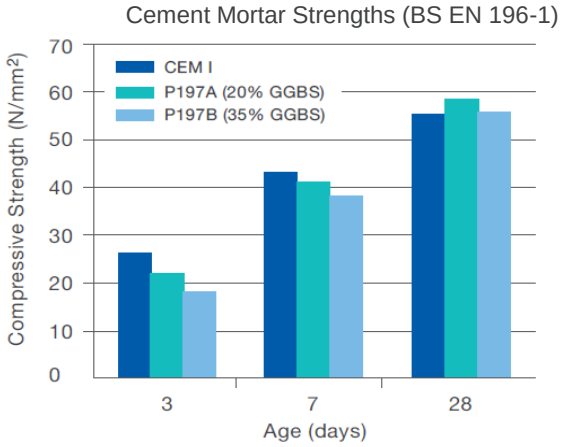
Better Setting Time

There is no significant delay in setting observed for P197A, with 20% GGBS. P197B shows a slight prolongation in setting, which can be an advantage in concreting under local tropical climate.

TECHNICAL PROPERTIES COMPARISON

	CEM I	P197A	P197B
GGBS content	0%	20%	35%
Fineness (cm^2/g)	3400-3800	3600-3900	3800-4100
Initial Setting (min)	120-140	130-150	140-170
Water-soluble Cr(VI) content (ppm)	5.8	<2	<2
CO2 Emission (kg/tonne)	866	707	587

STRENGTH COMPARISON



P197A and P197B provide superior long-term strengths without compromising too much on their early strengths.

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Eco Friendly Building Material

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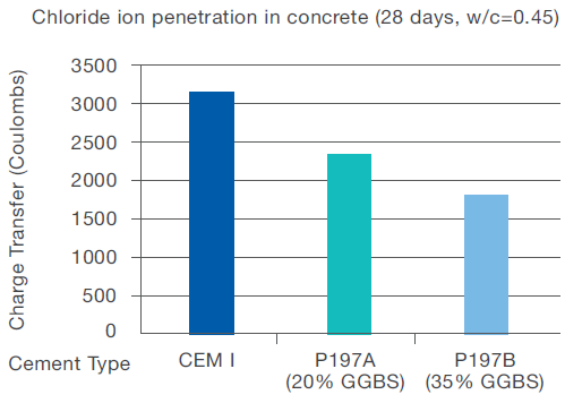
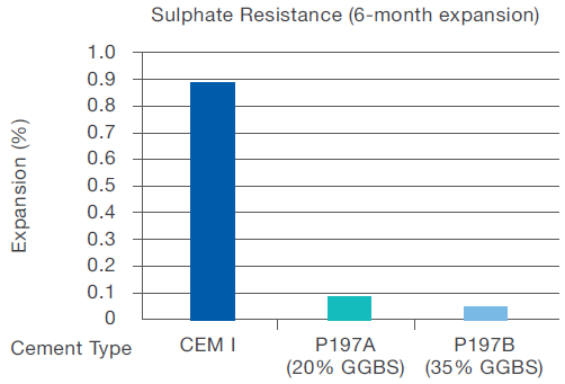
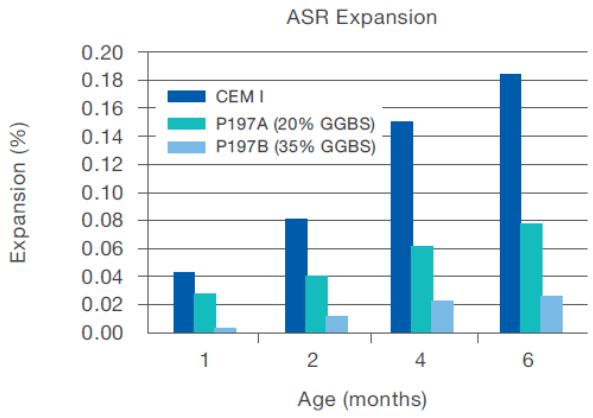
Chloride Penetration - (ASTM C1202)



Sulphate Resistance – (ASTM C1012)



ASR Expansion – (ASTM C277)



The presence of GGBS effectively reduces the concrete permeability and the Alkali content in the cement. Hence, the chemical resistance of concrete is improved. With GGBS content up to 35% P197A and P197B provide moderate resistance against chloride penetration, sulphate attack and Alkali-Silica Reaction (ASR). For concrete under aggressive chemical environments, higher GGBS content is required.

BENEFITS OF CONCRETE

- Lower carbon footprint
- Improved workability, pumpability and compaction properties with less bleeding and segregation
- Higher long-term strength
- Lower permeability
- Improved chemical resistance
- Reduced risk of skin allergy due to low chromate content, Cr(VI) < 2ppm
- Less prone to thermal cracking

APPLICATIONS

Product	Typical Applications Recommended
P197A	For all general construction purposes, especially where green product or low Cr(VI) content cement is required.
P197B	For all general construction purposes, especially where green product, low Cr(VI) content cement or moderate resistance to ASR, Chloride penetration and Sulphate Attack is required

PACKAGING

Both P197A and P197B are available in bag (50-kg) and bulk forms.

GREEN MARK BENEFITS

- As a Greenlabel product, using P197A and P197B helps to gain green mark points.

STORAGE

P197A & P197B are sensitive to moisture and should be stored in a dry place. The products may be stored for up to 12 months with proper storage and protected from moisture.

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