

PRODUCT BROCHURE



ENGINEERED BIOCHAR CONCRETE MIX BUILD GREEN, BUILD STRONG, BUILD DURABLE

General description

Our innovation involves valorization of biochar, prepared from waste biomass, as admixture in cement mortar and structural concrete. Biochar-concrete is a low carbon material technology with lower demand of cement and sand and provides a means of sequestering carbon in future construction.

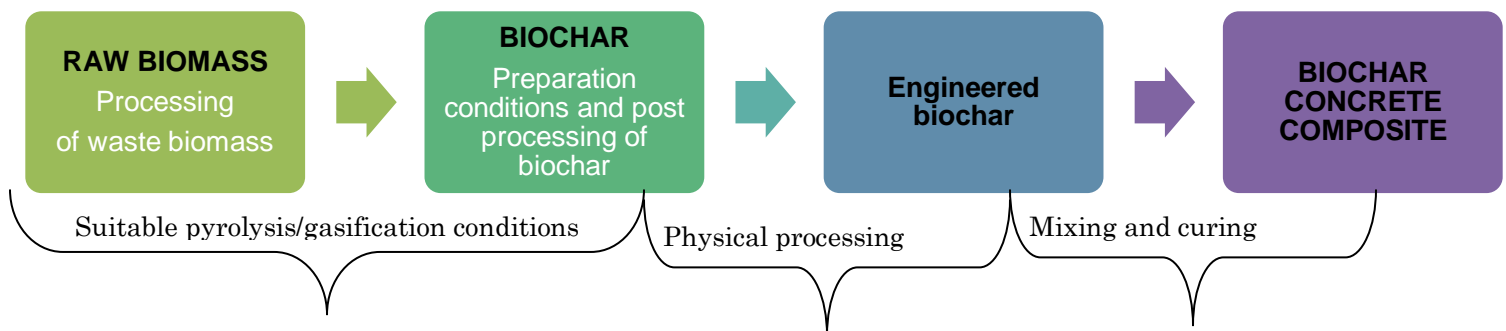
IP: WO2018203829A1: Sustainable construction material and method of preparation and use thereof.

Status: National phase. Approved for filing in Singapore, China, Indonesia, USA and Saudi Arabia

Unique features

Our preparation method and processing (patent filed) lead to several benefits in fresh and hardened concrete

- **SUPERIOR PERFORMANCE:**
 - Higher cohesiveness with reduced risk of segregation during pumping.
 - 15% higher early age and matured strength of concrete.
 - 40% lower permeability, which means lower risk of water seepage in buildings
 - Carbon capturing and sequestering ability
- **REDUCED COST:** Higher strength-density ratio and early strength gain, leading to potentially lower investment on foundation, higher construction speed and lighter construction
- **SUSTAINABILITY:** Reduction in sand and cement demand in concrete constructions, and sequester waste bio-carbon in future constructions



Properties of engineered biochar

- Carbon rich (60-90% elemental carbon)
- High surface area (630 – 200,000 m²/kg)
- Meso-porous with customizable pore volume
- Skeletal density of 1.50-1.70 g/cc
- pH in the range of 8 to 11. Cement pore solution pH > 12.50
- Micro-particles with customizable particle size distribution

CONTACT US:

Dr. Souradeep Gupta, Co-founder and Director

Email: souradeep.gupta@biochar-innovations.com / souradeepnus@gmail.com

Dr. Kua Harn Wei, Co-founder and Technical Advisor

Email: bdgkuahw@nus.edu.sg

Technical specifications

Biochar-concrete (Structural applications)

Properties	Biochar-concrete composite	Control concrete
7-day compressive strength (MPa) (ASTM C39)	61	51.50
28-day compressive strength (MPa) (ASTM C39)	68	60
Elastic modulus (GPa) (ASTM C469)	30	29.24
Flexural strength (MPa) (ASTM C293)	7.80	8.12
Strength-density ratio ($\times 10^{-3}$ MPa.m ³ /kg)	27	24
Water sorptivity (mm ³ /mm ²) (ASTM C1585)	0.72	1.20
Depth of water penetration (mm) (BS EN 12390-8)	8.50	15

Biochar-Mortar (Structural and non-structural applications) ('_' means data not available)

Properties	Biochar-mortar	Blended Biochar Mortar	Control mortar
Hardened density (SSD) (kg/m ³)	2330 - 2350	2220 - 2240	2292 - 2310
1-day compressive strength (MPa) (ASTM C 109)	35	27	27.50
28-day compressive strength (MPa) (ASTM C109)	61	70	57.00
2-year compressive strength (MPa) (ASTM C109)	72	–	65.00
Compressive strength retention after exposure to 500 °C (%)	75	–	67
Elastic modulus (GPa) (ASTM C469)	29	30.20	28
Flexural strength (MPa) (ASTM C293)	10.50	11.33	9.80
Strength-density ratio ($\times 10^{-3}$ MPa.m ³ /kg)	26	31.50	25
Total shrinkage (56-day) (micro-strain)	700 - 800	800 - 1000	700 - 850
Water sorptivity (mm ³ /mm ²) (ASTM C1585)	0.55 – 0.65	0.35 – 0.45	0.80 – 0.85
Water absorption (%) (28-day) (ASTM C1403)	2.44	0.75	3.45
Water absorption (g/cm ²) (ASTM C1403)	0.30	0.15	0.40
Depth of water penetration (mm) (BS EN 12390-8)	8.67	7.00	16

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Email: bdgkuahw@nus.edu.sg