Top 15 Industrial Uses of Cocoa Shells

2026 B2B Procurement Technical Specification & Operational Reference Guide

⚠️ **Industrial Buyer Notice:** This document serves as Enbri Nig. Ltd's technical datasheet and bulk procurement manual for plant managers, commercial boiler operators, agronomists, and industrial buyers evaluating Nigerian cocoa shell feedstock.

Executive Briefing: This technical guide provides comprehensive physical, chemical, thermochemical, and logistical parameters for evaluating Industrial-Grade Nigerian Cocoa Shells (*Theobroma cacao*). Designed for commercial boiler conversion, biochar production, organic fertilizer blending, and alkaloid/theobromine extraction, this document serves as an operational benchmark for high-volume bulk acquisition.

1. EXECUTIVE SUMMARY & CORE GRADE SPECIFICATIONS

Cocoa shells—the fibrous outer husk separated from the bean during thermal or mechanical de-husking—are a high-caloric, nitrogen-rich organic byproduct. Enbri Nig. Ltd supplies fully screened, destoned, and kiln-dried cocoa shells processed to strict European and Asian industrial tolerances.

PARAMETER	BIOMASS ENERGY GRADE	AGRONOMIC / SOIL GRADE	EXTRACTION GRADE	TESTING STANDARD
Moisture Content	≤ 8.5% - 10.0%	≤ 12.0%	≤ 8.0%	ISO 665 / ASTM D3173
Gross Calorific Value (GCV)	17.5 - 19.2 MJ/kg	N/A	N/A	ISO 1928 / ASTM D5865
Ash Content	≤ 6.5%	7.0% - 9.5%	≤ 5.5%	ISO 1171 / ASTM D3174
Organic Matter (Dry Basis)	N/A	≥ 82.0%	N/A	AOAC 967.05
C:N Ratio Range	N/A	18:1 - 22:1	N/A	Elemental Combustion Analyzer
Particle Size Distribution	2mm - 12mm (Sifted)	1mm - 20mm (Coarse)	< 4mm (Fine Shred)	ISO 3310-1 Sieve Standards
Foreign Matter / Impurities	≤ 0.5%	≤ 1.0%	≤ 0.1%	Visual / Gravimetric

2. COMPREHENSIVE THERMOCHEMICAL & CHEMICAL DATASHEET

A. Biomass Energy & Thermal Combustion Profile

For plant managers operating biomass co-firing units, fluidized bed boilers, or industrial furnaces, cocoa shell possesses combustion metrics comparable to high-grade wood pellets and low-rank brown coal (lignite).

- **Net Calorific Value (NCV):** ~16.2 - 17.8 MJ/kg (as received)
- **Volatile Matter (Dry):** 68.5% - 72.0% | **Fixed Carbon:** 18.5% - 21.0%
- **Ash Fusion Temperature:** Deformation: 1,180°C | Hemispherical: 1,240°C
- **Sulfur Content:** ≤ 0.18% (Low SOx emissions profile) | **Chlorine Content:** ≤ 0.05% (Reduced high-temp boiler corrosion)

B. Agronomic & Chemical Soil Amendment Profile

For commercial fertilizer formulators, compost manufacturers, and large-scale agricultural operations, cocoa shell functions as a slow-release soil conditioner rich in organic carbon and vital macronutrients.

- **Total Nitrogen (N):** 2.1% - 2.8% | **Phosphorus (P_2O_5):** 0.4% - 0.7% | **Potassium (K_2O):** 2.5% - 3.8%
- **Calcium (Ca):** 0.5% - 0.9% | **Magnesium (Mg):** 0.3% - 0.5% | **pH Range (1:5 H_2O):** 5.4 - 6.2
- **Biochar Yield:** Under slow pyrolysis (450°C - 550°C), yields ~32%-36% carbon-dense biochar with surface area > 220 m^2/g.

3. TOP 15 INDUSTRIAL APPLICATIONS BREAKDOWN

01 Biomass Co-Firing — ENERGY
Direct replacement up to 20–25% blend ratio in coal-fired power boilers.

02 Pelletization Feedstock — ENERGY
High lignin binder capability for producing high-density industrial fuel pellets.

03 Fluidized Bed Boiler Fuel — ENERGY
Stable combustion bed behavior under high air velocity conditions.

04 Pyrolytic Gasification — ENERGY
Conversion into bio-syngas for localized industrial thermal energy applications.

05 Organic NPK Balancer — AGRICULTURE
Direct application source for natural Potash (K2O) and organic Nitrogen.

06 Soil Biochar Production — AGRICULTURE
Pyrolyzed matrix creation for long-term carbon sequestration and soil water retention.

07 Commercial Mulching — AGRICULTURE
Weed suppression and root temperature regulation for high-value horticulture.

08 Composting Accelerator — AGRICULTURE
High carbon-to-nitrogen balance component for industrial aerobic composting.

09 Theobromine Extraction — EXTRACTION
Pharmaceutical/food grade alkaloid isolation (1.0%-1.3% assay content).

10 Polyphenol Recovery — EXTRACTION
Flavan-3-ol and active antioxidant extraction for nutraceutical formulations.

11 Dietary Fiber Component — EXTRACTION
Non-starch polysaccharide extraction for livestock and animal feed processing.

12 Natural Pectin Source — EXTRACTION
Structural polysaccharide recovery for commercial food gelling applications.

13 Bio-Sorbent Filtration — MATERIALS
Industrial wastewater treatment substrate for heavy metal entrapment.

14 Composite Fillers — MATERIALS
Natural fiber reinforcement for bioplastics and eco-friendly packaging materials.

15 Activated Carbon Precursor — MATERIALS
High-fixed carbon feedstock for physical or chemical vapor activation circuits.

4. BULK HANDLING, STORAGE & CONTAINERIZATION METRICS

HANDLING PARAMETER	METRIC VALUE
Bulk Density (Loose)	320 kg/m³ - 380 kg/m³
Bulk Density (Compacted / Baled)	450 kg/m³ - 520 kg/m³
Angle of Repose	36° - 40° (Free-flowing through standard hoppers)
Standard Packaging Options	• 50 kg Woven PP bags with PE inner liner • 1,000 kg Jumbo / FIBC Big Bags • Loose Bulk Containerization
20ft FCL Loading Capacity	~10.5 Metric Tons (Bagged) / ~12.0 Metric Tons (Loose)
40ft HC Loading Capacity	~24.0 Metric Tons (Jumbo Bags / Palletized)

5. QUALITY CONTROL, COMPLIANCE & EXPORT CERTIFICATION

Enbri Nig. Ltd subjects every shipment batch to pre-shipment inspections carried out by independent third-party laboratories such as SGS or Intertek.

- **Phytosanitary Certification:** Fumigated via Aluminium Phosphide or Methyl Bromide under NAQS supervision.
- **Heavy Metal Limits:** Lead (Pb ≤ 1.0 mg/kg), Cadmium (Cd ≤ 0.5 mg/kg), Arsenic (As ≤ 0.2 mg/kg).
- **Mycotoxins:** Aflatoxin B1+B2+G1+G2 < 10 ppb; Ochratoxin A (OTA) < 5 ppb.
- **EUDR Compliance:** 100% compliant with EU Deforestation Regulation featuring verifiable GPS farm polygon data.

6. COMMERCIAL TERMS & PROCUREMENT CONTACTS

- **Incoterms 2020:** FOB Lagos (Apapa/Tin Can), CFR, CIF (Rotterdam, Hamburg, Qingdao, Houston, etc.).
- **Minimum Order Quantity (MOQ):** 1 x 40ft HC Container (~24 Metric Tons).
- **Monthly Supply Capacity:** 1,500 MT / Month (Peak Season) | 800 MT / Month (Off-Peak).
- **Payment Terms:** 100% L/C at Sight OR 30% Advance T/T, 70% Balance against presentation of Shipping Documents.

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