PROC-X MANUFACTURING GROUP

BIOCHAR & BIOMASS PELLETIZING SYSTEMS

Engineering the right path from low-density feedstock to a durable, saleable product.

EXTRUSION / DIE PELLETIZING
ROTARY TABLET PRESS COMPACTION

TECHNOLOGY GUIDE • PROCESS DESIGN • COMPLETE LINE INTEGRATION

THE PELLET IS THE PRODUCT

DENSIFICATION TURNS VARIABLE POWDER INTO CONTROLLED PERFORMANCE.

Biochar and biomass begin as difficult bulk solids: low bulk density, inconsistent flow, entrained air, dust, variable moisture and a wide particle-size distribution. The business case is created when densification improves logistics and produces a repeatable form that survives handling and performs in the customer's application.

01
BULK DENSITY
More mass per bag, pallet, truck and silo.

02
DURABILITY
Less breakage through conveying and shipping.

03
FINES CONTROL
Cleaner plants, cleaner packages, higher yield.

04
USE PERFORMANCE
Predictable burn, dosing, dissolution or soil release.

THE PELLETIZER CANNOT CORRECT INCONSISTENT FEED.

Feed preparation and control are part of the pelletizing system—not optional accessories.

PELLET ENGINEERING

Six variables determine whether a pellet is merely formed—or engineered to perform.

01 PARTICLE ARCHITECTURE

Top size, distribution, aspect ratio and surface area govern packing, binding and die flow.

02 MOISTURE + TEMPERATURE

Water plasticizes fibers and binder systems; excess moisture weakens compacts and drives drying load.

03 BINDER CHEMISTRY

Lignin, starch, molasses, oils, polymers or mineral binders change strength, water resistance and emissions.

04 CARBON / FIBER STRUCTURE

Porosity, ash, volatile content and fibrousness affect compressibility, friction and spring-back.

05 PRESSURE + DIE GEOMETRY

Compression ratio, land length, clearance and dwell time set density, heat and wear.

06 POST-TREATMENT

Cooling, drying, curing, screening and fines recycle determine saleable yield—not just machine output.

MEASURE THE PRODUCT—NOT ONLY THE MOTOR.

BULK DENSITY	DURABILITY	FINES	CRUSH STRENGTH	SPECIFIC ENERGY
kg/m³	% retained	% by mass	N / unit	kWh / tonne

A successful design window balances quality, capacity and wear. There is no universal recipe: every feedstock needs a defined operating envelope.

ROUTE 01 / EXTRUSION

How it works

01	02	03	04	05
METERED FEED	CONDITION + MIX	COMPRESS THROUGH	CUT TO LENGTH	COOL + SCREEN

Why extrusion wins

- **High continuous output**
  Well suited to fuel pellets, soil-amendment pellets and bulk industrial products.
- **Feedstock flexibility**
  Fibrous biomass can develop natural binding; formulated biochar blends can accept liquid or dry binders.
- **Geometry flexibility**
  Diameter, die land and knife speed control the cylindrical product envelope.
- **Thermal conditioning**
  Moisture, steam or controlled heat can activate lignin and reduce forming resistance.

BEST FIT: TONNES PER HOUR + CONTINUOUS CYLINDRICAL PRODUCT

Available as ring/flat-die pelleting or screw-extrusion architecture, selected by feed behavior and product target.

ROUTE 02 / TABLET PRESS

How it works

01	02	03	04	05
METER + FILL	PRE-COMPRESS	MAIN COMPRESSION	EJECT + DEDUST	INSPECT + PACK

Why tablet pressing wins

- **Exceptional unit control**
  Fill depth and compression force can deliver tight weight, thickness and density distributions.
- **High local pressure**
  Creates dense compacts from properly milled, flowable formulations.
- **Designed geometry**
  Round, shaped, scored or branded tooling enables a premium, differentiated product format.
- **Inline quality signals**
  Compression and ejection force reveal fill, lubrication, wear and formulation changes in real time.

BEST FIT: PRECISE DOSE + HIGH-VALUE CONTROLLED GEOMETRY

Feed flow, granulation, lubrication and abrasive wear must be engineered as carefully as compression force.

SIDE-BY-SIDE DECISION MATRIX

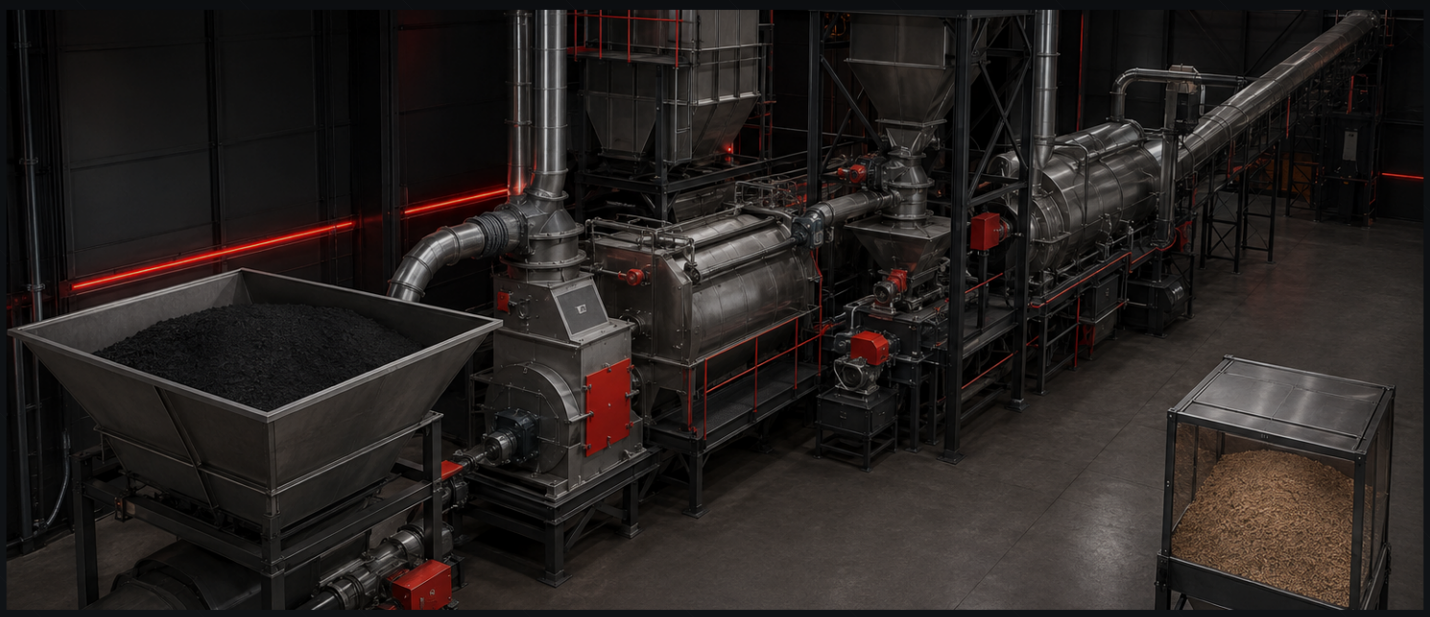
Choose the product architecture first. Then choose the machine that can make it repeatedly.

DECISION CRITERION	EXTRUSION / DIE PELLETIZING	ROTARY TABLET PRESS
Production mode	Continuous strands, cut to length	Discrete compacts, station by station
Preferred feed	Conditioned; tolerant of fibrous structure	Milled, flowable and consistently metered
Shape control	Cylindrical; diameter + cut length	Precise diameter, thickness and custom shape
Throughput profile	High bulk throughput per line	Moderate to high unit count; mass rate depends on size
Compaction behavior	Die friction + compression ratio dominate	Peak force + dwell + ejection dominate
Density consistency	Good with stable moisture and feed rate	Excellent per-unit control
Binder strategy	Dry/liquid binders; lignin activation possible	Controlled binder/granulation; lubrication critical
Changeover	Die, roller/screw and knife settings	Punch-and-die tooling, feeder and force recipe
Wear focus	Die lands, rolls, screws, knives	Punch tips, dies, cams and feeder components
Best-value market	Fuel, bulk soil amendment, industrial feedstock	Premium carbon products, dosing, controlled-release units

THE DECISION IN ONE LINE

Use extrusion when continuous mass flow and cylindrical pellets drive the economics. Use tablet pressing when unit geometry, dose consistency and product value justify precision tooling.

FEED PREPARATION IS THE FOUNDATION



Stable pellet quality begins before the press. Proc-X engineers the upstream system around the feedstock's variability, not around an isolated nameplate capacity.

01 RECEIVE + SCREEN

02 METAL REMOVAL

03 SIZE REDUCTION

04 WEIGH + BLEND

05 BINDER ADDITION

06 CONDITION + FEED

Critical feed specifications

- Particle-size distribution
  Not only top size
- Moisture uniformity
  Average + variation
- Binder distribution
  No wet pockets
- Bulk density
  Stable feeder behavior
- Temperature
  Repeatable plasticization
- Dust + air content
  Controlled filling

INTEGRATED EXTRUSION LINE

A complete line is a controlled mass-and-energy system—not a chain of independent machines.

01 RAW FEED
Hopper + screen

02 PREPARE
Dry / mill / classify

03 FORMULATE
Weigh + mix + binder

04 PELLETIZE
Condition + extrude

05 STABILIZE
Cool / dry / cure

06 FINISH
Screen + recycle + pack

CONTROL LOOPS THAT PROTECT OUTPUT

- **Mass flow**
  Loss-in-weight feed stabilizes die loading.
- **Moisture**
  Inline or at-line measurement trims liquid addition.
- **Torque / amperage**
  Motor load reveals restriction, slip and feed shifts.
- **Die temperature**
  Protects binder behavior and reduces thermal excursions.
- **Cooling air**
  Controls final moisture, temperature and storage stability.
- **Fines recycle**
  Closes the yield loop without destabilizing the fresh feed.

OPTIMIZE FOR SALEABLE TONNES—NOT WET MACHINE OUTPUT.
Capacity is confirmed at final moisture, final fines level and required durability.

INTEGRATED TABLET PRESS LINE

Precision compaction begins with precision feeding—and ends with unit-by-unit quality control.

01 MILL + CLASSIFY

Create a controlled, flowable particle system

02 FORMULATE + GRANULATE

Distribute binder, lubricant and functional additives

03 DEAERATE + HOLD

Prevent fill variation and preserve blend uniformity

04 ROTARY COMPRESSION

Control fill depth, pre-load and main force

05 DEDUST + DETECT

Remove loose fines and verify product integrity

06 CURE / COAT / PACK

Complete the designed application performance

The press becomes a process sensor

Compression force
Tracks fill and compactability

Ejection force
Warns of friction, sticking and wear

Tablet weight
Confirms feeder and fill-depth stability

Thickness
Correlates with density and spring-back

Reject trend
Exposes drift before a full batch is lost

Tool position
Supports traceability and maintenance

DESIGN NOTE

A rotary press rewards consistency and exposes variability. Granulation, lubrication, feeder design and dust extraction are part of the compression package.

SAFETY, WEAR & CLEANABILITY

Biochar and biomass can combine combustible dust, abrasive ash, hot particles and electrostatic charging. Final safeguards must be based on the site dust-hazard analysis, material test data and governing jurisdiction.

DUST RISK

- Enclosed transfer and local extraction
- Grounding and bonding
- Deflagration venting or suppression
- Explosion isolation where required

THERMAL RISK

- Bearing and die temperature monitoring
- Spark / hot-particle detection
- Controlled shutdown logic
- Cooler and storage temperature limits

WEAR CONTROL

- Replaceable liners and wear zones
- Hardened or coated dies / tooling
- Rotor, screw and feeder protection
- Inspection based on mass throughput

Material-of-construction strategy

Industrial fuel / utility	Carbon steel structure with selected stainless or wear-resistant product-contact zones
Soil amendment / fertilizer	304 or 316 stainless contact parts as formulation and corrosion dictate
Activated / specialty carbon	Contamination-controlled surfaces, abrasion package and tool-material study
Frequent changeover	Tool-less access, cleanout ports, removable feeders and validated cleaning method

SAFETY IS ENGINEERED FROM MATERIAL DATA—NOT ADDED AFTER MACHINE SELECTION.

OPTIMIZE $ / SALEABLE TONNE

TOTAL CONVERSION COST

POWER + LABOR + BINDER + WEAR + MAINTENANCE + RECYCLE

SALEABLE PRODUCT TONNES

Where each route creates value

EXTRUSION VALUE CASE

- **Fuel pellets**
  High continuous mass rate
- **Bulk soil amendments**
  Handling + distribution efficiency
- **Pyrolysis feed**
  Controlled size and flow
- **Industrial absorbent pellets**
  Porosity balanced with durability
- **Blended biomass fuels**
  Formulation flexibility

TABLET PRESS VALUE CASE

- **Controlled-release soil tabs**
  Precise mass and geometry
- **Specialty carbon compacts**
  Premium presentation + density
- **Dosing units**
  Repeatable unit addition
- **Water-treatment media units**
  Designed residence and dissolution
- **Branded / shaped briquettes**
  Product differentiation

Economic questions Proc-X resolves

YIELD	What is the sellable yield after cooling and screening?
WEAR	How quickly does abrasive feed consume tooling?
LOGISTICS	Does higher density reduce freight and packaging cost?
MARKET	Does premium geometry earn a premium selling price?
UTILITIES	How much binder and drying energy are truly required?
RECYCLE	Can fines recycle without destabilizing the fresh feed?

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TEST.
MEASURE.
SCALE.

Proc-X develops the operating window before locking the production design—reducing scale-up risk and creating an acceptance test built around the finished product.

- Throughput at final moisture
- Fines after handling
- Dimensional consistency
- Water stability / dissolution
- Bulk density + durability
- Crush strength / hardness
- Specific energy
- Tooling wear trend

BRING US THE FEEDSTOCK.
WE'LL ENGINEER THE PRODUCT.

GLOBAL ENGINEERING • PILOT TESTING • COMPLETE LINE INTEGRATION

PROC-X MANUFACTURING GROUP INC.

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