

Application Note: High-Performance Soya Grinding Plant

Untoasted Soya DOC (De-Oiled Cake) is a high-protein, heat-sensitive material widely used in feed, food, and protein extraction industries. Due to its fibrous structure and sensitivity to thermal degradation, it requires a controlled grinding process that ensures uniform particle size without damaging proteins or altering functional properties.

The **Air Classifying Mill (ACM)** system offers a high-efficiency solution for micronizing untoasted Soya DOC into a consistent fine powder. Its integrated grinding and classification design minimizes heat generation, maintains protein functionality, ensures narrow particle size distribution, and delivers high throughput with excellent operational hygiene.

This application note outlines the process flow, technical performance, system advantages, and KPIs for an ACM plant specifically optimized for Untoasted Soya DOC.

1.0 Design & Working Principle

The Soya Grinding line operates on a continuous, automated principle comprising five critical stages:

Step 1: Material Feeding

Untoasted Soya DOC flakes/cakes are metered into the mill using a **controlled feeder**. Stable feeding ensures consistent grinding performance and prevents motor overload.

Step 2: Impact Grinding in ACM Rotor

Once inside, material encounters the **high-speed rotor** (4,000–8,000 RPM).

- Fibrous DOC is broken down by:
 - **Impact** of hammers/pins
 - **Shearing** against the liner
 - **Air turbulence** created by rotor movement

The airflow lifts the material and keeps it suspended, preventing localized heating — critical for heat-sensitive soya proteins.

Step 3: Air Classification

Ground material enters the **dynamic classifier** zone.

- **Classifier wheel** rotates at high speed.
- Fine particles pass through the wheel and exit with the air stream.

- Coarse particles are rejected by centrifugal force and **fall back into the rotor** for re-grinding.

This ensures:

- Narrow particle size distribution
- Minimal oversize
- Real-time fineness control (by adjusting classifier RPM)

Step 4: Pneumatic Conveying & Cooling

The blower creates a **pneumatic conveying loop** that:

- Transports product
- Maintains low grinding temperature
- Enhances classifier efficiency

For Untoasted Soya DOC, this is crucial to prevent:

- Protein denaturation
- Colour change
- Quality degradation

Step 5: Bag Filter & Product Collection

Fine product enters the bag filter, where centrifugal force separates powder from air.

- Heavier particles fall into collection bins.
- Captures <5% ultrafine particles.
- Ensures emissions remain below industry norms.
- Clean air is released back to atmosphere or recirculated.

Step 6: Product Discharge

Final soya DOC powder (150–250 microns) is collected for:

- Packing
- Blending
- Protein extraction processing

2.0 Key Components

Component	Function	Key Technical Feature
ACM Mill (Air Classifying Mill)	Performs grinding and classification of Untoasted Soya DOC	Integrated rotor + classifier, low-heat grinding, adjustable fineness (150–250 µm)
Bag Filter System	Captures fine powder and ensures dust-free air discharge	99% product recovery, pulse-jet cleaning, maintains hygiene
Centrifugal Fan (C-Fan / Blower)	Provides airflow for conveying, cooling, and classification	High-volume air delivery, maintains <15°C temperature rise
Control Panel (PLC/HMI)	Controls and monitors entire plant operation	VFD for classifier/mill, safety interlocks, real-time parameter monitoring
Vibro Shifter (Sieve)	Ensures final particle size consistency and removes oversize	Multi-deck vibration, uniform screening, stainless steel design

3.0 Model Variants

(Indicative values based on standard Soya DOC with <1.5% oil)

Variant	Model	Capacity (Approx.)	Target Fineness
SA-60-MS	ACM 60 MS	900-1000 Kg/hr	95% 150 – 180 Microns
SA-100-MS	ACM 100 MS	1450 – 1500 kg/hr	95% 150 – 180 Microns

4.0 Key Features & Benefits

- Low-Heat Operation**
All components work together to maintain a cool grinding environment, protecting protein integrity of Untoasted Soya DOC.
- Consistent Particle Size Output**
Integrated mill, classifier, airflow system, and shifter ensure uniform fine powder (150–250 µm).
- High Product Recovery (>99%)**
Efficient separation and dust control minimize material loss throughout the system.
- Dust-Free, Hygienic Operation**
Bag filter, sealed connections, and controlled airflow maintain clean processing conditions suitable for feed/food.

- **Energy Efficient System**
Optimized mill design, high-efficiency fan, and precision automation reduce overall power consumption per ton.
- **Reliable Continuous Operation**
All major components (mill, blower, filters, control panel) are designed for 24/7 industrial duty.
- **Automation & Easy Control**
PLC/HMI panel integrates all equipment, providing real-time monitoring, alarms, and simple operation.
- **Low Maintenance Requirements**
Wear-resistant mill internals, self-cleaning bag filter, and vibration-balanced equipment reduce downtime.
- **High Throughput Capacity**
System configuration allows consistent processing of 100–2,500 kg/hr depending on model.
- **Improved Final Product Quality**
Combined grinding, classification, filtration, and sieving enhance powder flowability, purity, and application performance.

5.0 Applications

- **Animal Feed Formulations**
(Poultry, cattle, aqua, pet food)
- **Protein Extraction Processes**
(SPC – Soy Protein Concentrate, SPI – Soy Protein Isolate)
- **Food & Nutrition Blends**
(Soya flour, bakery mixes, protein fortification)
- **Extrusion-Based Products**
(Texturized vegetable protein – TVP/TSP)
- **Industrial Bio-Processing Applications**
(Fermentation substrate, organic fertilizer base)

6.0 Performance Parameters

- **Input Material:** Soya Flakes, Soya Grits, or Whole Beans.
- **Fineness Range: D90 : 150–250 microns** Adjustable through classifier speed (VFD)
- **Raw material input moisture :** 6-8%
- **Yield:** > 98.5% product recovery.
- **Sound Level:** < 85 dBA (with acoustic insulation).

7.0 Automation & Integration

The system supports:

- **HMI/PLC Control:** One-touch recipe selection for different grades (e.g., "Fine Flour" vs. "Grits").
- **Load Balancing:** Automatic feed rate adjustment based on mill motor amp load.
- **Safety Interlocks:** Prevents operation if air pressure is low or doors are open.

8.0 Frequently Asked Questions (FAQ)

Q1: Soya protein is very heat sensitive. How does your system prevent burning or denaturation?

A: Our Air Classifying Mill (ACM) utilizes a high volume of airflow (cool air) that passes through the grinding chamber. This air acts as a transport medium and simultaneously cools the material during impact. Typically, the temperature rise is limited to 10–15°C above ambient, ensuring the Protein Dispersibility Index (PDI) remains unaffected⁴⁴⁴⁴.

Q2: Can this same machine produce both Soya Grits and Soya Flour?

A: Yes. The fineness is controlled by the speed of the dynamic classifier wheel, which is driven by a Variable Frequency Drive (VFD). You can switch from producing coarse grits (e.g., 60 mesh) to fine flour (e.g., 200 mesh) just by changing the classifier speed on the control panel, without mechanical changes.

Q3: High-fat soya tends to clog screens. How do you handle this?

A: The RIECO ACM is a screen-less machine. It uses air classification rather than physical screens to separate particles. This eliminates the risk of screen blinding or clogging that is common with traditional hammer mills when processing oily or sticky materials⁵.

Q4: Is the system safe for handling Soya dust, which can be explosive?

A: Absolutely. Soya dust is classified as combustible (St1). We offer ATEX-certified systems equipped with explosion relief vents, flameless venting (for indoor installation), and explosion isolation valves to ensure full compliance with safety standards.

Q5: What is the maximum moisture content the grinder can handle?

A: For efficient grinding and flowability, we recommend a feed moisture content of < 10–12%⁶. Higher moisture levels can reduce capacity and cause material build-up. If your material is wetter, we can integrate a flash dryer or conditioner upstream.

Q6: How do you ensure the final product is free from metal contamination?

A: The system includes multiple checkpoints. We install high-power magnetic separators at the feed inlet to catch tramp iron. Additionally, the final powder is passed through a vibro-sifter and can be integrated with a metal detector before packing to ensure food safety⁷.

Q7: Can the system run 24/7? What is the maintenance schedule?

A: The system is designed for continuous industrial operation. Routine maintenance involves checking the rotor and liner wear (which are easily accessible via the mill door) and cleaning the bag filter elements. The "Pulse Jet" cleaning system automatically cleans the filters during operation to maintain suction.

Q8: Do you offer a trial facility to test my specific Soya material?

A: Yes, RIECO has a state-of-the-art Test Centre where we can run trials with your specific soya flakes or beans. This allows us to validate the capacity, fineness, and temperature parameters before you invest in the full plant.