Application Note: Agrochemical Grinding

The production of Agrochemicals—specifically Pesticides, Insecticides, Herbicides, and Fungicides—requires precision engineering to handle materials that are often toxic, explosive, and expensive.

The objective is to produce Wettable Powders (WP) or Water Dispersible Granules (WDG) with ultra-fine particle sizes (typically D97 < 45 microns or 325 Mesh) to ensure high "Suspensibility" and efficacy in the field.

RIECO Industries offers a comprehensive **Agrochemical Formulation Plant** that integrates Pre-Blending, Ultra-Fine Grinding (via **ACM** or **Jet Mill**), and Post-Blending. Our designs prioritize safety (ATEX compliance), hygiene (Cross-contamination prevention), and operational efficiency.

1.0 Design & Working Principle

The process is designed as a continuous, automated line to minimize operator exposure to hazardous chemicals.

- **Stage 1: Pre-Blending:** Active Ingredients (Technical grade) and fillers (Clay, Silica, etc.) are weighed and mixed in a Ribbon Blender to create a homogeneous pre-mix. This ensures the active ingredient is evenly distributed before grinding.
- **Stage 2: Ultra-Fine Grinding:** The pre-mix is fed into the grinding system.
    - **For Standard WP (D97 = 45 microns):** We employ the **Air Classifying Mill (ACM)**. It grinds and classifies in a single step, offering high throughput and precise top-cut control.
    - **For High-Value/Heat-Sensitive WDG (D97 < 10 microns):** We use a **Air Jet Mill**. It uses compressed air to create particle-on-particle collision, ensuring no heat generation and ultra-fine micronization.
- **Stage 3: Post-Blending (Homogenization):** The ground powder is conveyed to a post-Blender (typically a ribbon blender) to smooth out any batch variations and ensure consistent active ingredient percentage (A.I. %) across the final lot.
- **Stage 4: Safety & Collection:** The entire system operates under negative pressure. For explosive materials (like Mancozeb or Sulphur), the system is designed as a Closed Loop with Nitrogen (N2) Inerting to keep oxygen levels below the Limiting Oxygen Concentration (LOC).

2.0 Key Components

Component	Function	Technical Feature
Ribbon Blender	Pre/Post Mixing	Double-helix design for fast, homogeneous mixing of active ingredient and carriers.
Air Classifying Mill (ACM)	Fine Grinding	Integrated dynamic classifier; suitable for 90% of pesticide formulations. Built-in classifier avoids over-grinding and maintains product consistency.
Jet Mill (Spiral/Fluid Bed)	Micronization	No moving parts; ideal for heat-sensitive or high-abrasion chemicals (< 10 microns).
Pulse Jet Bag Filter	Product Recovery	**Anti-Static (Conductive)** filter bags to prevent static discharge explosions. Achieves outlet dust concentration typically **<10 mg/Nm³** (as per pollution norms).
N2 Inerting System	Explosion Prevention	Maintains O2 < 8% (typical) using nitrogen purging for hazardous dusts.
Double Flap Valve	Air Sealing	Used instead of Rotary Valves for abrasive materials to reduce wear and leakage.

3.0 System Characteristics

Capacity Range	80 - 1500 Kg/hr
Output Finess	Min. 99% passing 45
Grade	TC, TK, WDP, WP, SP, Uria

4.0 Model Variants

RIECO provides scalable solutions from pilot to large-scale production.

Varient	Model	Application	Typical Capacity*	Target Fineness
AG-15-MS	**ACM 15**	**Low Vol**	**80 – 150 kg/hr**	**325 Mesh (45 µm)**
AG-15-SS	**ACM 15**	**Low Vol**	**80 – 150 kg/hr**	**325 Mesh (45 µm)**
AG-30-MS	**ACM 30**	**Production**	**250 – 500 kg/hr**	**325 Mesh (45 µm)**
AG-30-SS	**ACM 30**	**Production**	**250 – 500 kg/hr**	**325 Mesh (45 µm)**

**Capacities vary based on formulation density and active ingredient hardness.*

5.0 Key Features & Benefits

- **High Suspensibility:** The precise cut-point of the ACM/Jet Mill ensures a narrow particle size distribution (Steep PSD), which allows the powder to remain suspended in water for longer periods (a critical quality metric for pesticides).
- **Cross-Contamination Control:** "Easy-Clean" designs with access doors and polished interiors allow for rapid changeovers between different products (e.g., Herbicide to Insecticide) without contamination risks.
- **Uniform Quality for Formulations**
  Ensures proper suspension, dispersibility, and active ingredient performance.
- **Dust-Free Operation**
  Closed-loop grinding reduces emissions and operator exposure.
- **Explosion Safety:** Explosion-proof design & Systems for handling available for hazardous Agro-chemicals. **Mancozeb, Sulphur, and Carbon-based powders** are equipped with **Explosion Suppression Systems** or **N2 Inserting loops** monitored by Oxygen Analysers.
- **Handling Sticky Materials:** Specialized "Liner" and "Rotor" designs are available for hygroscopic or sticky materials (like Urea-based formulations) to prevent internal build-up.
- **Low Temperature:** High air volume in ACM and the cooling effect of expansion in Jet Mills ensure the active ingredients do not degrade due to heat.

6.0 Applications

- **Insecticides:** Cypermethrin, Deltamethrin formulations.
- **Fungicides:** Mancozeb, Sulphur (WP/WDG).
- **Herbicides:** Glyphosate, Atrazine.
- **Fertilizers:** Water-soluble NPK blending and grinding.

7.0 Performance Parameters

- **Input Material:** Pre-mixed cake or coarse powder.
- **Output Fineness:**
  - **Standard:** 98% passing 325 Mesh (45 microns).
  - **Premium:** D50 = 2–5 microns (for SC/WDG grades).
- **Yield:** > 99.0% material recovery.
- **OEL Compliance:** Designed for OEB 3/4 containment levels if required.

8.0 Automation & Integration

- **Recipe Management:** PLC stores parameters (Rotor Speed, Classifier Speed, Airflow) for each product code.
- **Control Philosophy / Control Strategies**: Closed-loop control of airflow/pressure and classifier speed for stable PSD
- **Safety Interlocks:** System will not start if N2 pressure is low or if grounding (earthing) is not detected. All system is consist of Interlock to avoid production loss & Safety.
- **Data Logging:** Records batch data (Amps, Temp, Pressure) for quality traceability.

9.0 Frequently Asked Questions (FAQ)

Q1: How do you handle explosive materials like Sulphur or Mancozeb?

A: We treat these as high-risk St2/St3 dusts. The standard solution is a Closed Loop System using Nitrogen (N2) to displace oxygen. We continuously monitor O2 levels; if they rise above a safe limit, the system automatically shuts down or purges more N2.

Q2: What is the difference between ACM and Jet Mill for pesticides?

A: ACM is mechanical (impact) and is more energy-efficient for standard fineness (325 Mesh). Jet Mill uses compressed air (no moving parts) and is used when you need ultra-fine particles (< 10 microns) or for extremely heat-sensitive/abrasive materials.

Q3: Cross-contamination is a huge issue for us. How easy is cleaning?

A: We use a "Clamshell" design for the mill housing, allowing it to open fully for washing. The bag filter housing has side access for easy bag replacement. For critical lines, we recommend dedicated filter bags for incompatible product families (e.g., Herbicides vs. Insecticides).

Q4: Can this plant handle hygroscopic materials like Urea?

A: Yes. We can integrate a Dehumidifier to supply dry air (Dew point -20°C) to the grinding chamber. We also use special non-stick liners (e.g., PTFE or polished SS) to prevent caking inside the mill.

Q5: What is "Suspensibility" and how does your machine improve it?

A: Suspensibility is how well the powder stays mixed in water. Our classifiers remove the "oversize" particles that sink quickly, ensuring a steep Particle Size Distribution (PSD) that stays suspended longer, improving field efficacy.

Q6: Do you provide the mixing system as well?

A: Yes, we provide the complete turnkey line: Pre-Blender + Grinding System + Post-Blender. This ensures the entire line is balanced in capacity and integrated into a single control panel.

Q7: Can we grind abrasive carriers like Silica or Clay?

A: Yes. For abrasive fillers, we use Tungsten Carbide tipped hammers and Ceramic or Hardened Alloy liners to maximize wear life.

Q8: What safety certifications do you have?

A: Our systems can be designed to meet ATEX (Europe), NFPA (USA), or Indian factory safety standards. We use certified explosion vents, isolation valves, and flame-proof motors.