



ROHINI

COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF AGRICULTURAL ENGINEERING

AI3601 POST- HARVEST TECHNOLOGY

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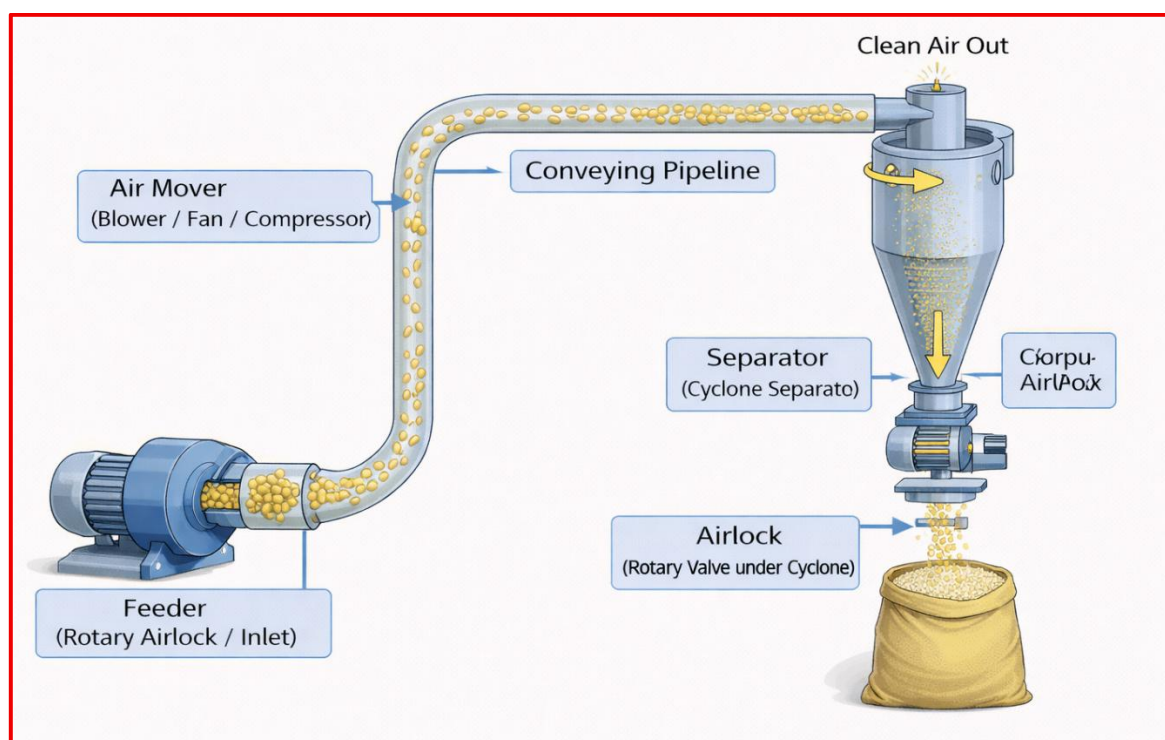
UNIT IV: SHELLING AND HANDLING

CO4: To understand the operation of post-harvest equipment like shellers and conveyors.

Pneumatic conveying

Pneumatic conveying is a method of transporting bulk materials such as grains, powders, and granules through a pipeline using a moving stream of air. In post-harvest systems, it is widely used to move grains from trucks, dryers, or storage bins to processing areas. It offers flexibility, cleanliness, and efficiency compared to mechanical conveyors.

Major components and their functions:



Component	Function
Air Mover (Blower / Fan / Compressor)	The heart of the system; creates the air flow and pressure difference required to move the material through the pipeline.
Feeder (Rotary Airlock / Inlet)	Introduces material into the pipeline while minimizing air leakage; ensures a steady, controlled feed rate.
Conveying Pipeline	The tube through which the air-material mixture travels; can be routed horizontally, vertically, or around obstacles.

Separator (Cyclone Separator)	Located at the discharge end; uses centrifugal force to separate grains from the air stream.
Airlock (Rotary Valve under Cyclone)	Discharges grain from the cyclone while preventing air from entering, maintaining system pressure.

Working principle:

- ❖ The working principle of a pneumatic conveying system is based on creating a pressure difference across a pipeline, which causes air to flow at high velocity.
- ❖ Solid particles (grains) are picked up and suspended in the air stream, and the air-solid mixture flows through the pipeline to the destination.
- ❖ At the discharge point, a separator slows the air, allowing the grain to fall out by gravity.

Types of pneumatic conveying systems:

Type	Principle	Application
Vacuum System	Operates below atmospheric pressure; material is pulled through the pipeline.	Truck unloading, dust-sensitive materials.
Pressure System	Operates above atmospheric pressure; material is pushed through the pipeline.	Distributing grain to multiple silos.
Combined Vacuum-Pressure System	Vacuum picks up material; pressure conveys to discharge points.	Long-distance conveying with multiple pick-up points.

Advantages of pneumatic conveying over mechanical conveyors:

- Flexibility in routing - Pipes can go around obstacles, up/down, horizontally – no straight-line limitations like belt or screw conveyors.
- Dust-free operation - Totally enclosed system prevents dust emission, excellent for hygiene and preventing product losses.
- Low maintenance - Few moving parts (only fan and airlocks) compared to belt/screw/chain conveyors with multiple bearings and drives.
- Multiple pick-up and discharge points - One system can serve many locations using diverter valves and multiple inlets.
- Safety - Can convey hazardous materials (toxic dusts, explosive materials) safely in an enclosed pipe with proper grounding.

- Space saving - Pipes occupy less space than inclined belt conveyors or screw conveyors.

Limitations of pneumatic conveying over mechanical conveyors:

- High power consumption - Moving air is energy-intensive, especially for long distances or high capacities.
- Product damage - High-velocity impacts (especially at bends) can crack or abrade grains, reducing quality.
- Pipe wear - Abrasive materials like sand or shelled corn can wear out pipes, especially at bends.
- Material limitations - Not suitable for sticky, very wet, or fibrous materials as they tend to clog the pipeline.
- Noise - Air movers (blowers) and high-velocity flow generate significant noise, requiring noise control measures.
- Dust explosion risk - Static electricity buildup and dust clouds inside pipes pose explosion hazards; requires grounding and proper design.

Applications of pneumatic conveying in post-harvest systems:

- Truck unloading - Vacuum systems suck grain directly from trucks into storage bins.
- Distributing grain to multiple silos - Pressure systems with diverter valves route grain to different bins.
- Transferring grain between processing units - Moving paddy from dryers to shellers, or rice to polishers.
- Handling milled products - Conveying flour, bran, and husk (dusty materials) in rice and flour mills.
- Seed treatment plants - Gentle conveying of chemically treated seeds in an enclosed system for safety.