ROHINI

COLLEGE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF AGRICULTURAL ENGINEERING

AI3601 POST- HARVEST TECHNOLOGY

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UNIT III: CLEANING AND GRADING

CO3: To recognize the working principle of grain cleaning and grading devices and able to select suitable equipment for cereal grains, oilseeds and pulses.

Fundamentals of Cleaning and Grading

Cleaning and grading are essential post-harvest operations that enhance the marketability, storability, and processing quality of agricultural produce.

a) Principle of Cleaning:

Cleaning involves the removal of undesirable materials from the harvested crop, such as:

- Foreign matter (soil, stones, chaff, weed seeds)
- Broken, immature, or damaged grains
- Dust, stems, leaves, and other impurities

The principle is based on separation using differences in physical and aerodynamic properties between the good produce and the impurities.

b) Principle of Grading:

Grading involves sorting the cleaned produce into uniform groups based on:

- Quality parameters (colour, maturity, damage)
- Size and shape uniformity
- Specific weight or density
- Nutritional or compositional standards

The principle is based on classification into categories that meet market, regulatory, or processing standards.

Physical and Mechanical Properties Used in Cleaning and Grading

Separation and classification rely on measurable differences in the following properties:

a) Size

- **Property:** Length, width, thickness, or diameter of seeds/grains.
- **Application:**
    - **Screens/sieves** with different apertures separate particles based on size.
    - **Example:** A scalper removes larger impurities; a grader separates grains by thickness or width.
    - **Machine:** Screen cleaners, cylinder separators, indented disc separators.

b) Shape

- **Property:** Round, flat, elongated, or irregular geometry.
- **Application:**
    - **Spiral separators** use rolling behavior—round seeds roll faster than flat ones.
    - **Cylinder separators** use length-based separation (indented pockets).
    - **Example:** Separating round peas from flat broken grains.

c) Density and Specific Gravity

- **Property:** Mass per unit volume; weight in air vs. in liquid.
- **Application:**
    - **Air aspiration** separates lighter chaff/straw from heavier grains.
    - **Gravity separators** use vibration and airflow to stratify materials by density.
    - **Liquid flotation** separates damaged/hollow grains from sound ones.
    - **Example:** Removing light weed seeds from wheat.

d) Surface Texture and Friction

- **Property:** Roughness, smoothness, or frictional coefficient.
- **Application:**

- **Friction-based separators** (e.g., inclined belts) allow smooth seeds to slide while rough ones are carried upward.
- Used in cottonseed cleaning or separating hairy vs. smooth seeds.

e) Aerodynamic Property (Terminal Velocity)

- **Property:** Behavior of particles in an airstream based on weight, size, and shape.
- **Application:**
  - **Air-screen cleaners** combine aspiration (for light material) and screening (for size).
  - **Example:** Removing dust and husk from grains using an aspirator.

f) Colour and Optical Properties

- **Property:** Reflectance, absorption, or transmission of light.
- **Application:**
  - **Electronic colour sorters** use sensors to detect and eject off-coloured, damaged, or moldy grains.
  - **Example:** Removing discoloured grains in rice or coffee processing.

g) Electrical and Magnetic Properties

- **Property:** Conductivity, dielectric constant, or magnetic susceptibility.
- **Application:**
  - **Electrostatic separators** separate materials based on charge differences.
  - **Magnetic separators** remove metal impurities.

h) Elasticity and Resilience

- **Property:** Bounce or rebound behavior.
- **Application:**
  - **Bounce separators** separate tough grains from brittle impurities based on impact response.

3. Integrated Cleaning-Grading Systems

Modern seed and grain processing plants often use multi-stage systems where:

1. **Pre-cleaning** removes coarse impurities (straw, stones).
2. **Basic cleaning** uses air-screen machines for size and weight separation.
3. **Precise grading** uses indented cylinders, spirals, or colour sorters for final quality sorting.
4. **Final inspection** ensures compliance with grade standards (e.g., FAO, AGMARK, USDA).

4. Importance in Post-Harvest Technology

- Reduces post-harvest losses by removing spoilage-prone materials.
- Adds value by improving appearance, uniformity, and safety.
- Meets regulatory and export standards.
- Enhances efficiency in further processing (milling, packaging, storage).
- Improves seed viability in planting material.