



FOOD SAFETY AND CONTROL in FLOUR MILLING INDUSTRY



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GRAIN PRODUCTION IN INDIA



- ❖ Indian food grains production is increasing steadily:
 - Advancement in cultivation technologies
 - Development of new grain varieties
 - Use of fertilizers
- ❖ Annually India produces more than 250 million tonnes of all major food grains
- ❖ India is second largest producer of wheat (97 million tonnes) and rice (111 million tonnes) in the world
- ❖ The production of pulses is about 23 million tonnes and coarse cereals are about 45 million tonnes
- ❖ Total Oilseeds production in the country during 2017-18 is estimated at 29.88 million tonnes



WHEAT PROCESSING IN INDIA

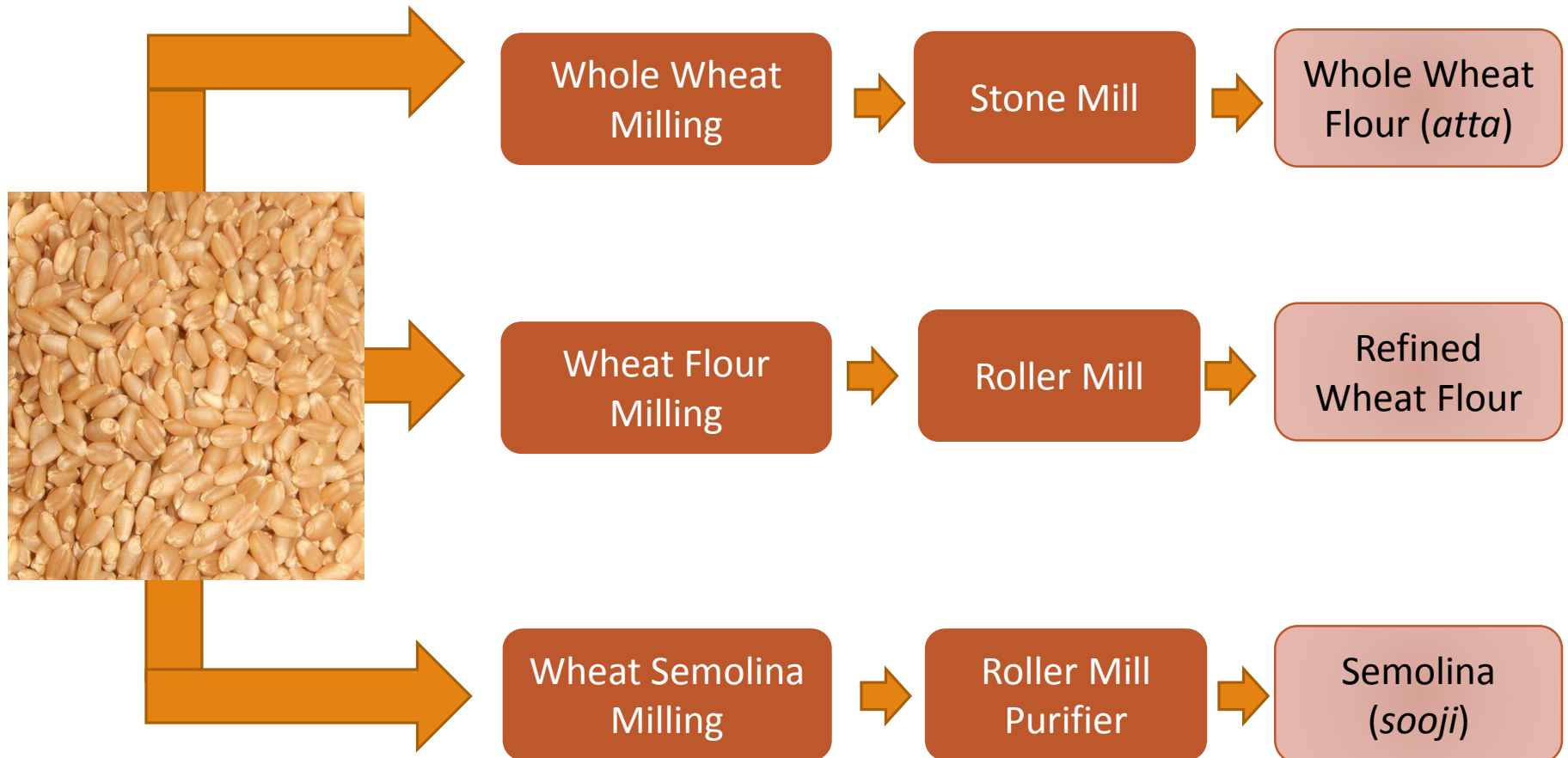


- ❖ India is having about 2000 roller milling companies grinding from 18 to 20 million tones of wheat per year into refined wheat flour
- ❖ About 50 to 55 million tonnes of wheat is processed into whole wheat flour (*atta*) in traditional *chakki* mill



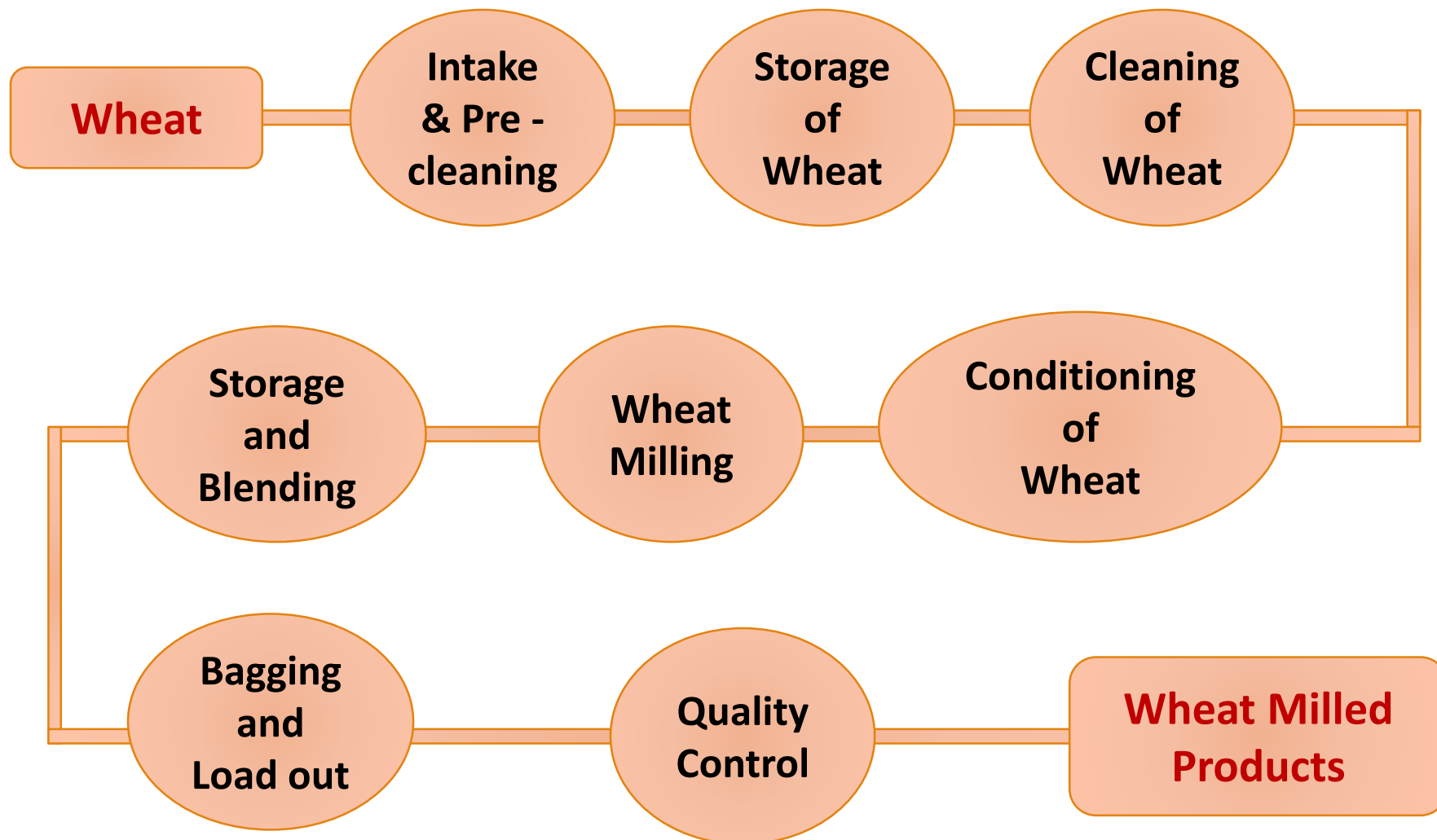


WHEAT PROCESSING IN INDIA





TYPICAL FLOWCHART OF WHEAT PROCESSING





OBJECTIVES OF WHEAT MILLER



- ❖ High extraction flour (yield) by keeping lower ash content
- ❖ Consistent and high quality of wheat milled products
- ❖ Reduction in operation cost
- ❖ Increase in capacity of plant

**To provide the high quality milled products that are safe and healthy to the consumer:
Food Safety Regulation**

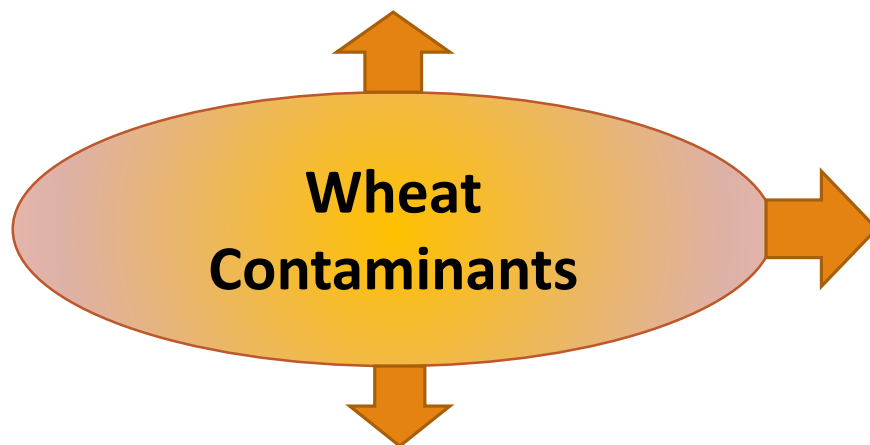


COMMON WHEAT CONTAMINANTS



Non – Wheat Contaminants

Metals, Wood, Glass, Sand, Stones, Dust, Steaks, Straws, Weed Seeds and other Grains



Surface Contaminants

Microbial, Dust, Sand, Chemicals etc.

Wheat Contaminants (Damaged Wheat)

Diseased Kernels. Insect Damage, Rain Damage, Frost Damage etc.



PLACES OF CONTAMINATION IN CHAIN



FARM LEVEL

- Soil
- Pesticides
- Herbicides
- Rain Damage
- Frost Damage
- Bird
- Diseases

Harvesting

- Metals
- Stones
- Sand
- Wood
- Minerals
- Weed Seeds
- Foreign Cereals

Storage & Transport

- Insect
- Rodents
- Birds
- Fumigants
- Minerals
- Coal

Processing

- Metals
- Chemicals
- Biological



FOOD SAFETY HAZARD TYPES



Physical

- Metals
- Stones
- Sand
- Wood
- Minerals
- Wood
- Plastic

Chemical

- Pesticides
- Herbicides
- Fumigant
- Mycotoxins
- Lubricants
- Oil and Grease

Biological

- Insects
- Rodents
- Fungi
- Mold
- Birds



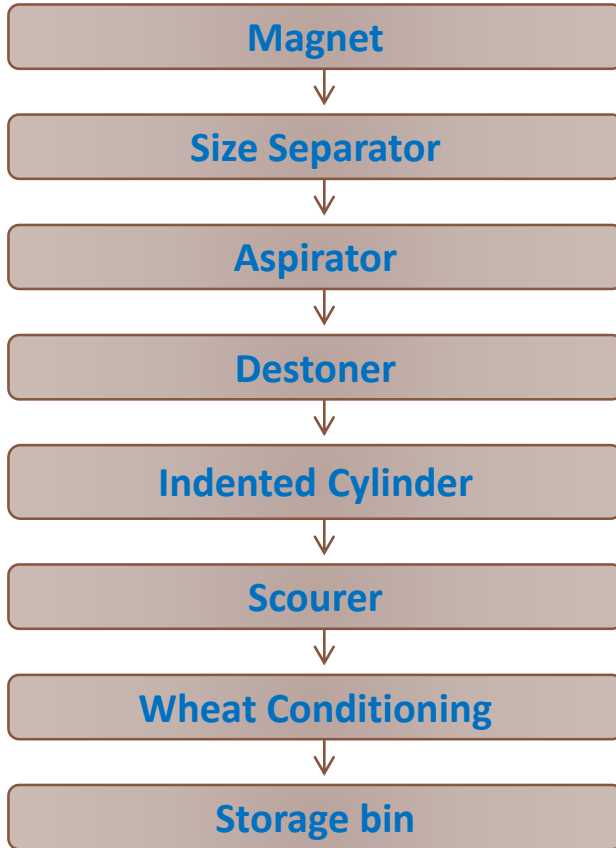
CONTROL OF HAZARDS



- **Purchase of defined quality of raw grains**
- **Microbiological specification**
- **Insecticide and pesticide**
- **Diseased kernels**
- **Mycotoxins etc.**

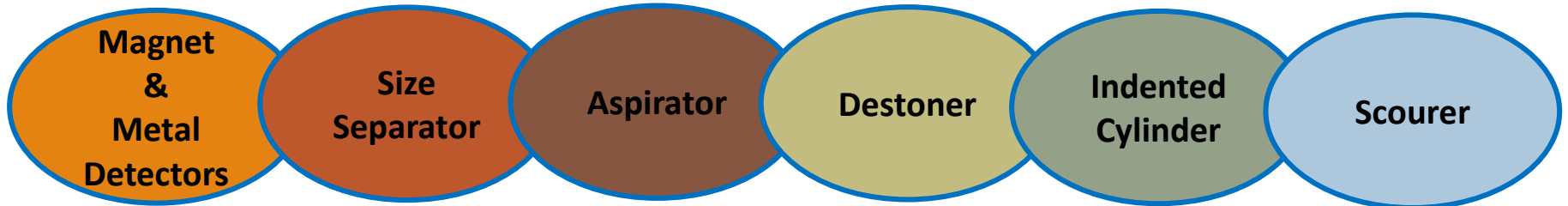


CONTROL OF HAZARDS



WHEAT PREPARATION

- Removal of contaminants from wheat
- Proper conditioning of wheat





Separation of Contaminants



Magnets and Metal Detectors



- Separation of ferrous and non-ferrous impurities
- At the beginning of the cleaning section
- Before any fast moving machine
- Before packing of the finished products



Separation of Contaminants



Size Separation and Air Resistance



- Separation of bigger and smaller contaminants than wheat
- Separation of lighter contaminants than wheat
- Part of pre and main cleaning



Separation of Contaminants



Specific Gravity



- Removal of heavier contaminants from wheat
- Separation of stones, mud, bricks etc.
- Air medium: Stones settle down on the screen and conveyed to upward towards stone outlet



Separation of Contaminants



Shape



- Longer-than-wheat contaminants separation
- Shorter-than-wheat contaminants separation



Separation of Contaminants



Surface friction



- Surface cleaning by friction
- Attached aspirator to remove the contaminants



MICROBIOLOGY OF WHEAT MILLED PRODUCTS



- **Microbiological specification**
- **Testing of its raw material and finished products**



EFFECT OF MILLING ON MICROBIOLOGY OF WHEAT MILLED PRODUCTS



- ❖ Wheat microbiological quality have direct influence
- ❖ Water use during processing can encourage the growth of microbes
- ❖ Milling of wheat into wheat flour / semolina results into reduction into microbial count
- ❖ More reduction on break passages Vs small reduction on reduction passages

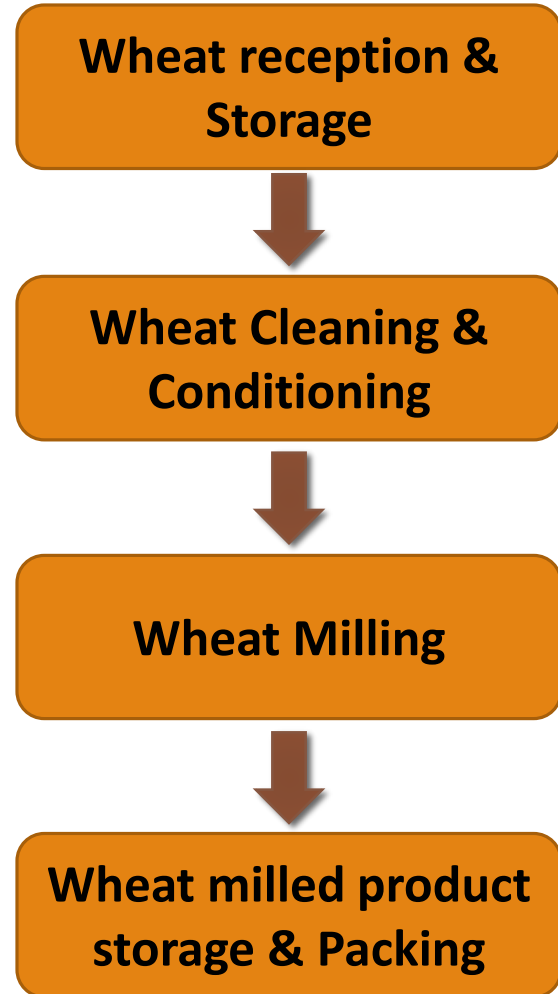




EFFECT OF MILLING ON MICROBIOLOGY OF WHEAT MILLED PRODUCTS



- ❖ Surface adhering contaminants concentrated in the bran, germ and pollard
- ❖ Source of microbial contamination:
 - ✓ Storage
 - ✓ Handling
 - ✓ Machineries
 - ✓ Plant Design and maintenance

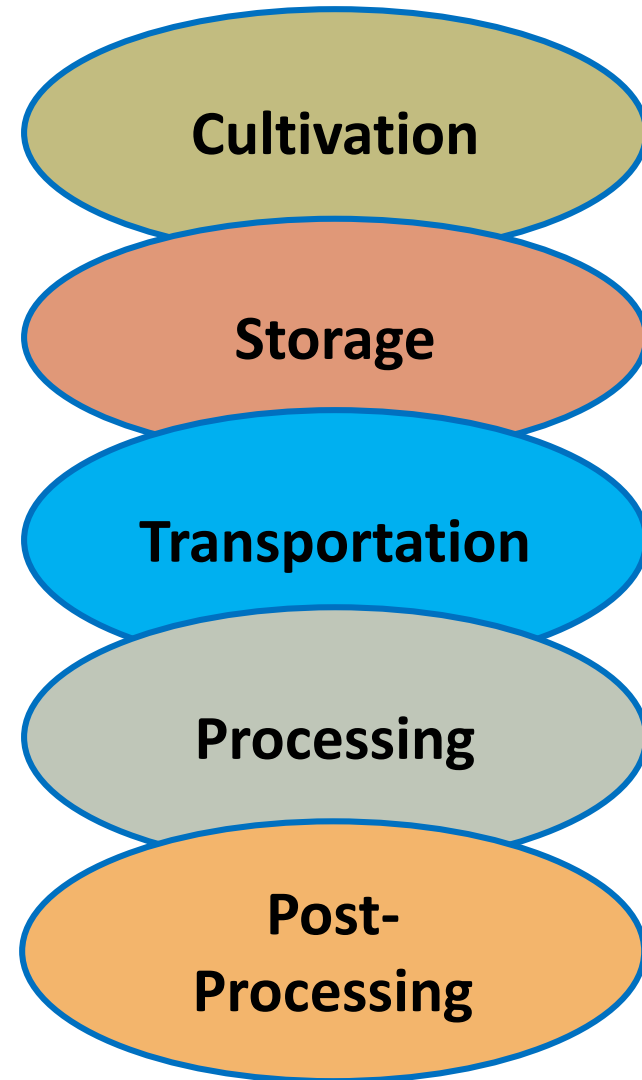




MYCOTOXIN IN WHEAT



- ❖ **Mycotoxins are fungal secondary toxic metabolites and are major food safety concern**
- ❖ **Mycotoxins can cause the serious health impact on human and animal**
- ❖ **Mycotoxins are produced by various fungi species:**
 - ✓ **Aspergillus**
 - ✓ **Penicillium**
 - ✓ **Fusarium genera**





MYCOTOXIN IN WHEAT



Most common mycotoxin contamination found in wheat and wheat milled products are:

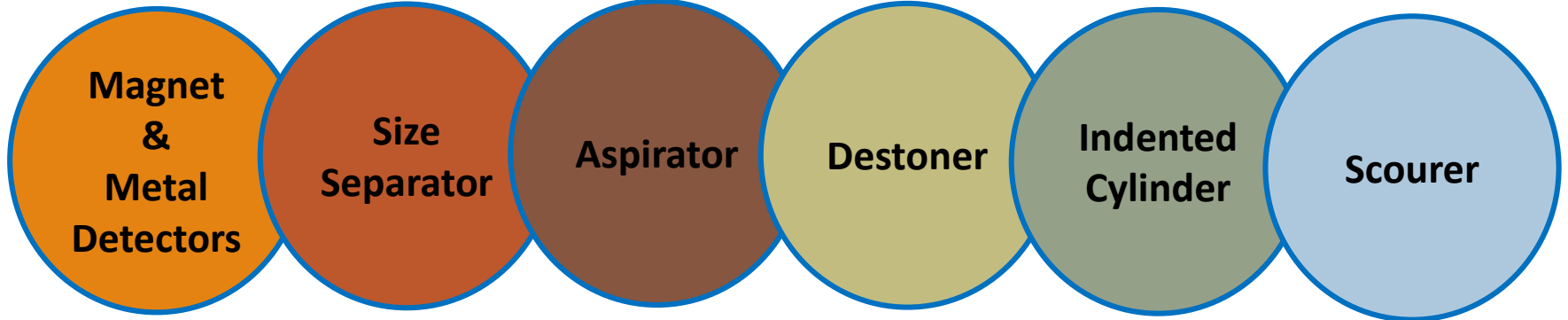
- **Deoxynivalenol (DON)**
- **Nivalenol (NIV),**
- **Zearalenone (ZEA),**
- **T-2 and HT-2 toxin**



EFFECT OF CLEANING ON MYCOTOXIN



- ❖ **Cleaning and sorting of the wheat may reduce the mycotoxin concentration in grains**
- ❖ **Removal of contaminants:**
 - ✓ **Mold damaged grains**
 - ✓ **Broken kernels**
 - ✓ **fine and dust impurities**

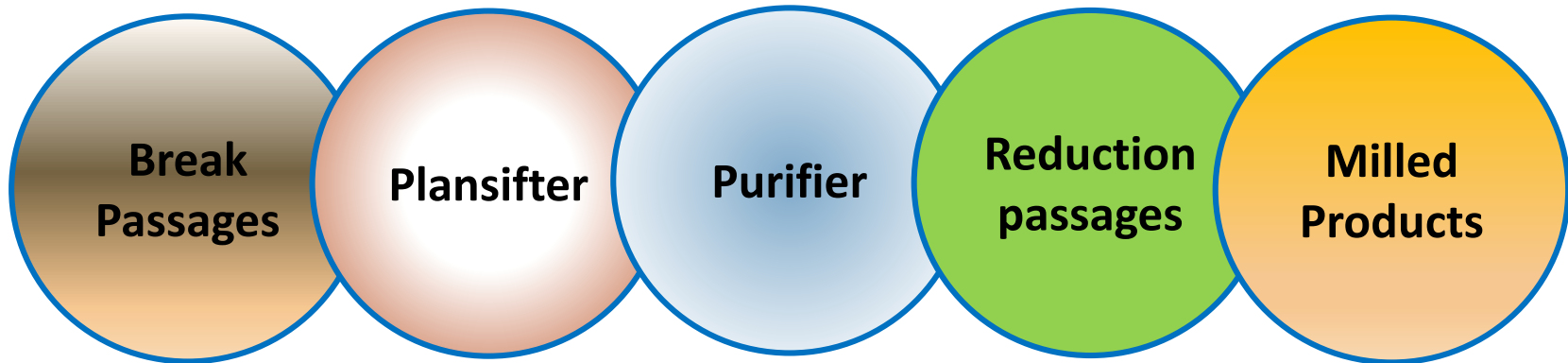




EFFECT OF MILLING ON MYCOTOXIN



- ❖ Higher contaminated fractions: Bran and Shorts
- ❖ Lowest contaminated fractions: Flour and Semolina
- ❖ Hence the toxins are mostly concentration on the outer part of the wheat kernel





PROCESSING PARAMETERS AND MYCOTOXIN



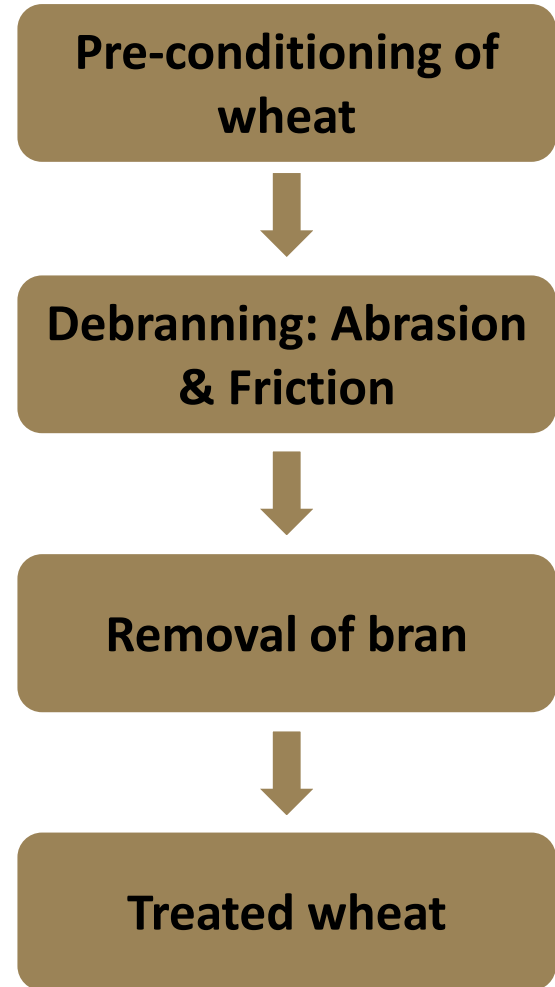
- ❖ **Cleaning and sorting machineries**
- ❖ **Flowsheet of cleaning section**
- ❖ **Milling flowsheet**
- ❖ **Extraction of different milled products**
- ❖ **Other milling Parameters**



HAZARD CONTROL: GRAIN SURFACE CLEANING



- ❖ Objective of bran layer to protect the endosperm and germ component of grain
- ❖ The debranning is the process by which the outer bran layer of the wheat kernel is removed
- ❖ Degree of debranning adjustment (upto 7-8%)
- ❖ Debranning Principle:
 - ✓ Abrasion
 - ✓ Friction





HAZARD CONTROL: GRAIN SURFACE CLEANING



- ❖ Outer layers of wheat grain is subjected to more natural contamination
 - Micro- organisms
 - Deoxynivalenol
 - Pesticides and fumigant
 - Heavy metals (cadmium and lead)

- ❖ Reduction of concentration of mycotoxin content in the debranned wheat

- ❖ Debranning efficiently reduces the heavy metals



HAZARD CONTROL: GRAIN SURFACE CLEANING



- ❖ **Removal of harmful surface element**
 - **Microbial contamination**
 - **Insecticide and pesticide residue**
 - **Sand and dust**
 - **Fumigant**
 - **Heavy metals**



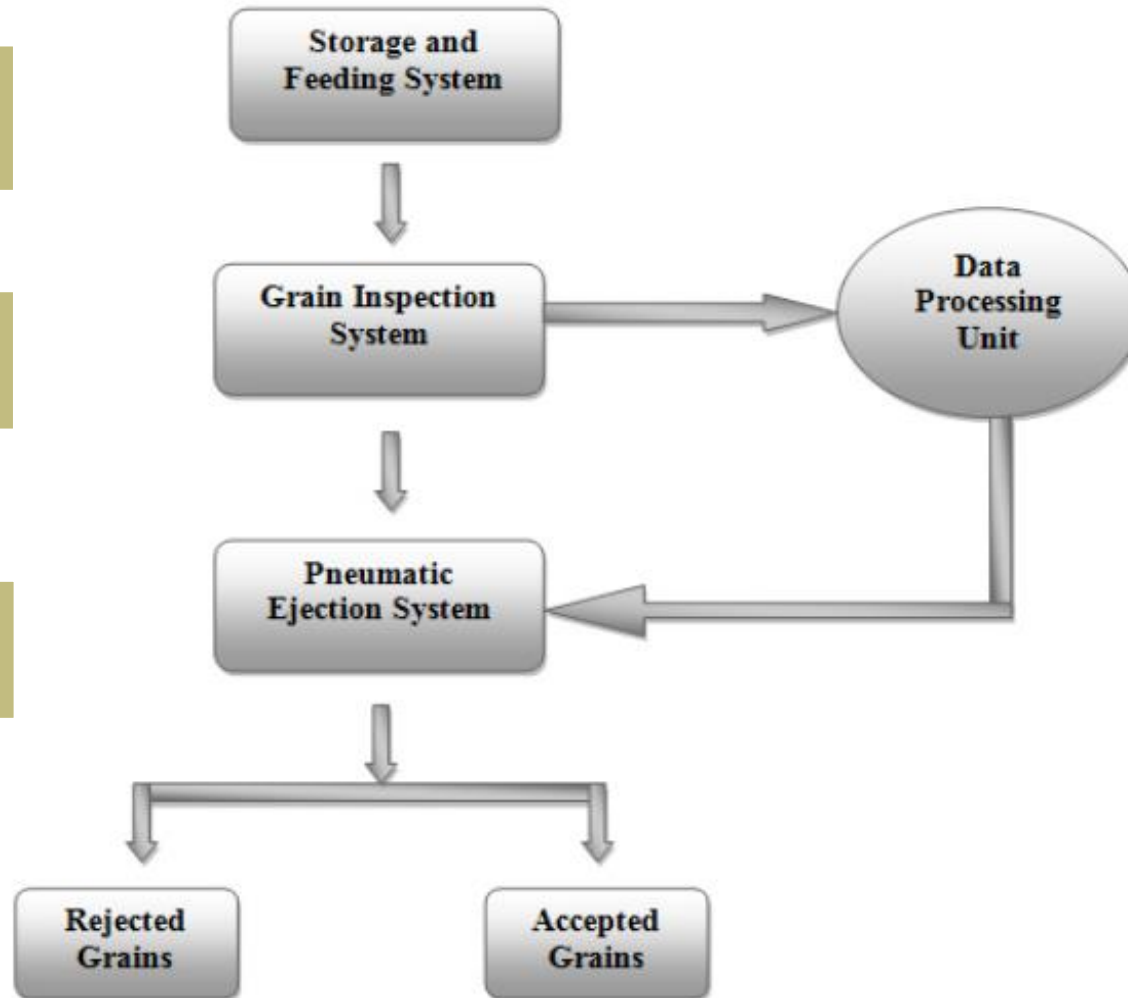
HAZARD CONTROL: COLOUR SORTING



Grain Feeding

Inspection Mechanism

Defect Ejection

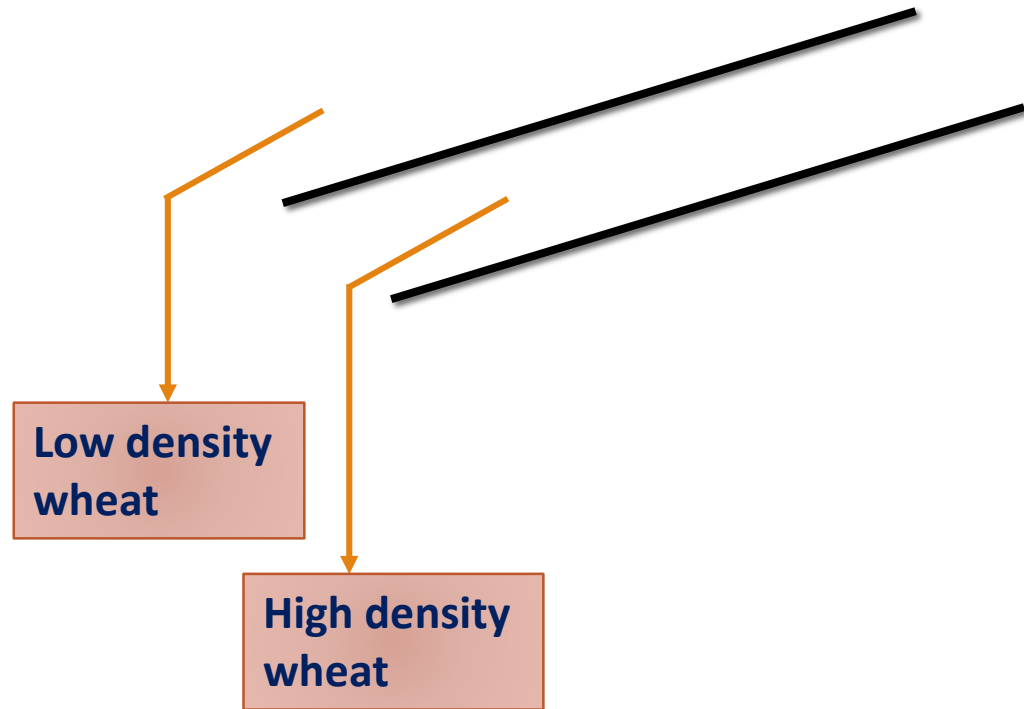




HAZARD CONTROL: DENSITY SEPARATOR



- ❖ **Diseased kernels**
results in reduction in
density of grains
- ❖ **These damaged grains**
can be removed using
the density separator





WHOLE GRAIN PROCESSING CHALLENGES



- ❖ All whole grain definition state that they must contain bran, germ and endosperm in the same proportion as in the original grain
- ❖ Surface cleaning should be part of wheat preparation for milling
- ❖ Colour sorting of grains is growing for whole-grain products to remove the discolored or partially discolored kernels
- ❖ Grains organic in origin and destined for whole grain products



HACCP in FLOUR MILLING



To conduct the hazard analysis of manufacturing process

Identification of critical control point (CCP)

Establish the critical control limits for each CCP

Establish the monitoring system for each critical control points

Establish the corrective action plan when monitoring indicates deviation from the HACCP program

To establish procedures for verification to confirm that the HACCP system is working effectively

Establish documentation and record-keeping procedures



HACCP : PROPOSED GENERIC CCP



Wheat and other raw material selection & reception

Wheat storage and fumigation

Fumigant application

Cleaning of wheat: Magnet, Size Separator, Aspirator, Destoner, etc.

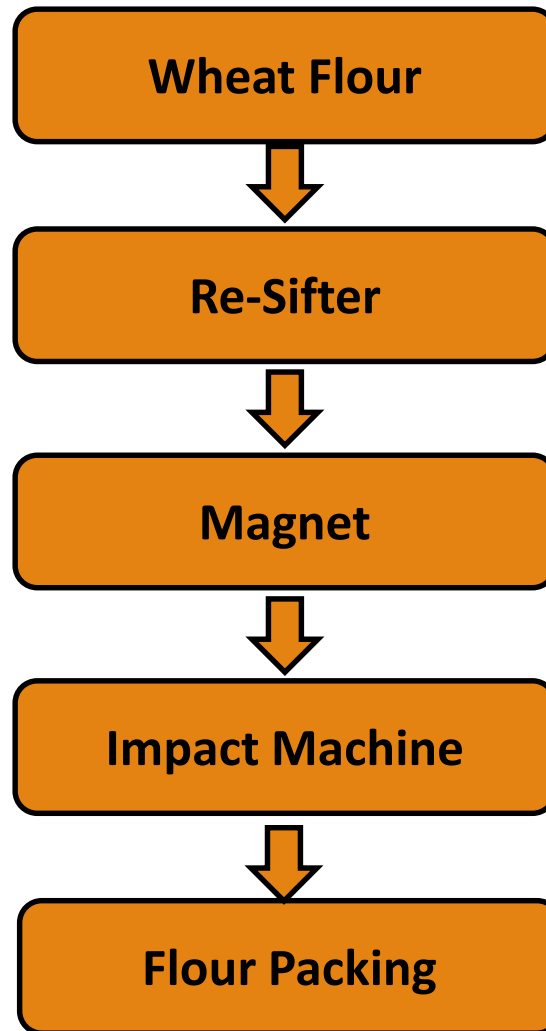
Screening

Conditioning of wheat

Water addition



HACCP : FLOUR HANDLING AND PACKING





CONCLUSIONS



- ✓ Regulations on food quality and safety are becoming more stringent in grain processing industries.
- ✓ To produce safe milled products, it is essential to have control on raw grains purchasing, storage, cleaning, conditioning, milling and finished product packaging
- ✓ The technique such as surface cleaning, colour sorting, density separator, etc. of grains before milling have shown potential to reduce contaminants



**Thank you all for your attention
and
Hearty Welcome
to
IAOM**