22PAFE302 POST-HARVEST ENGINEERING OF CEREALS, PULSES AND OIL SEEDS

Source : https://c1.staticflickr.com/1/162/399414627_ea29498bd1_b.jpg

Hours Per Week :

L	T	P	C
1	0	2	2

PREREQUISITE KNOWLEDGE: Basics of food processing operations in industry.

COURSE DESCRIPTION AND OBJECTIVES:

The goal of this course is to evaluate performance of cleaning, size reduction, mixing and milling operation in food processing industry. It also helps us to examine drying rate of agricultural produce and develop suitable drying model. It illustrates about different milling methods of cereals, pulses and oil seeds.

MODULE-1

UNIT-1 **4L+8T+8P=20 Hours**

CLEANING MIXING HANDLING:

Cleaning and grading, aspiration, scalping; size separators, screens. Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone, shape graders. Mixing: Theory of mixing of solids and pastes, Types of mixers for solids, liquid foods and pastes. Material handling equipment. Types of conveyors: Belt, roller, chain and screw. Elevators: bucket, Cranes & hoists. Trucks (refrigerated/ unrefrigerated), Pneumatic conveying. Drying: moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect.

UNIT-2 **4L+8T+8P=20 Hours**

DRYING & DRYERS :

Sieve analysis, capacity and effectiveness of screens. Mixing index, Mixing time. Determination of power requirement and capacity of conveying systems. EMC determination, Psychrometric chart and its use in drying. Drying principles and theory, Thin layer and deep bed drying analysis. Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, Mass and energy balance, Shedd's equation, Dryer performance, Different methods of drying, batch-continuous; mixing-non-mixing, Sun-mechanical, conduction, convection, radiation, superheated steam, tempering during drying, Different types of grain dryers: bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray.

PRACTICES:

- Performance evaluation of different types of cleaners and separators.
- Determination of separation efficiency.
- Determination of fineness modulus and uniformity index.
- Study of different types of conveying and elevating equipments.
- Study of different types of mixers.
- Measurement of moisture content: dry basis and wet basis.
- Study on drying characteristics of grains and determination of drying constant.
- Determination of EMC (Static and dynamic method).
- Study of various types of dryers.

SKILLS:

- ✓ *Compute effectiveness of screen and performance of mixers.*
- ✓ *Evaluate equilibrium moisture content and drying rate using the concept of psychrometric chart and sorption isotherm.*
- ✓ *Examine performance of size reduction and determine power requirement of various size reduction equipment.*
- ✓ *Investigate various operations involved in milling of cereals, pulses and oil seed.*
- ✓ *Evaluate performance of various extruders and design component of extruders.*

MODULE-2

UNIT-1 **4L+8T+8P=20 Hours**

SIZE REDUCTION & MILLING :

Size reduction: principle, procedure (crushing, impact, cutting and shearing). Milling of rice: Conditioning and parboiling, advantages and disadvantages. Milling of wheat, unit operations and equipment. Milling of corn and its products. Dry and wet milling. Extrusion cooking: principle, factors affecting. By-products utilization.

UNIT-2 **4L+8T+8P=20 Hours**

PERFORMANCE EVALUATION OF SIZE REDUCTION & MILLING:

Bond's law, Kick's law, Rittinger's law, Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill. Traditional methods, CFTRI and Jadavpur methods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. Milling of pulses: traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran. Extrusion cooking: single and twin screw extruders.

PRACTICES:

- Study of different size reduction machines and performance evaluation.
- Study of different equipments in rice mills and their performance evaluation.
- Study of different equipments in pulse mills and their performance evaluation.
- Study of different equipments in oil mills and their performance evaluation.
- Type of process flow charts with examples relating to processing of cereals pulses and oil seeds.
- Visit to grain processing industries.

COURSE OUTCOMES:

Upon successful completion of this course, students will have the ability to:

CO No.	Course Outcomes	Blooms Level	Module No.	Mapping with POs
1	Illustrate effect of screening, mixing and material handling and optimize performance.	Apply	1	1, 2, 7
2	Analyze knowledge of sorption isotherm to develop different types dryers and drying types.	Analyze	1	1, 2, 3, 4, 6, 9
3	Examine different factors affecting size reduction process and compute their performance.	Evaluate	2	1, 2, 6, 7, 9
4	Design small cereal milling pilot plant.	Create	2	1, 2, 3, 4, 6, 7, 9, 11
5	Design small pulses milling pilot plant.	Create	2	1, 2, 3, 4, 6, 7, 9, 11

TEXT BOOKS:

1. Chakraverty, A. Post Harvest Technology of cereals, pulses and oilseeds. Oxford & IBH publishing Co. Ltd., New Delhi, 2003.
2. Sahay, K.M. and Singh, K.K. "Unit operations of Agricultural Processing" Vikas Publishing house Pvt. Ltd. New Delhi, 1994.

REFERENCES :

1. Dash, S.K., Bebartta, J.P. and Kar, A. "Rice Processing and Allied Operations" Kalyani Publishers, New Delhi, 2015.