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TECHNOLOGICAL ADVANCEMENT IN PULSE INDUSTRY

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Abstract: The conventional desalination processes require significant amount of energy to convert brackish water into potable water for human consumption and industry. Solar still is an innovative device that utilizes solar energy to produce distilled water from brackish water. Numerous experimental research works have been reported in literature to analyze the performance of various types of solar stills under local climatic conditions. The aim of this study is that it provides energy researcher's insight into solar still design for clean water production and thus, it promotes commercialization of this product in rural development.

Keywords: Solar still, multi-effect, multistage, desalination, evacuated tube collector,

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INTRODUCTION

The size of pulses economy of the world is 61.3 MMT. India is the largest pulse producing country with (22-25) % i.e. (13.50-15.32) MMT of the world production is concentrated in India. But as India has a large vegetarian population, which largely dependent upon pulses, wheat and milk as its major source of protein, the size of consumption of pulses in India is around (16-18) MMT, in order to meet such demand, India depends upon import of pulses to the extent of (3-4) MMT.

Splitting of pulses is done in pulse processing. Dal mill industry is one of the major agro processing industries in India. Out of the total production of 13.50 MMT of pulse in the country, 75% is processed by these Dal mills.

This has put India in an advantageous position, by developing its niche in its processing. As a result, Indian processors have been able to enhance their output efficiency, reduce wastage with good quality of output.

1.1 Problems associated with existing pulse processing Industry

There are many challenges in the industry, right from establishment of the industry to efficient running, by using the optimal resources of men machine money and method. The units are mostly traditional ones, largely capital /labor intensive and energy sapping in nature.[i] The yield of dehusked and split pulses is around (75-80) percent in comparison to (88-89) per cent. Thus, there is loss of pulse cotyledons and embryos in the form of broken and powdered grains to the extent of (5-15) per cent.

1.2 Objectives of the study:

Present is under taken for the pulse industry with the following objectives.

1. To emphasize the need technological advancement in the pulse processes industry

1.3 MATERIAL AND METHODS

The chapter deals with the research methodology, data collected from the various sources, case study which is done in one of pulse processing industry and the hypothesis are formulated.

1.4 Data Collection

Table No -1: Data collected from pulse industries of Akola (Sample Design)

Sr. No	State	Farmer	Processing Units	Traders /Commission agents	Total
1	Maharashtra Akola Dist.	20	20	20	60

Analysis: Total twenty pulse processing units are studied, out of which are
Tur -8, Chana -8 Urad- 2, Mung-2 pulse processing units.

Table No -2: Processing data collected from industry[ii]

Sr. No	Industry	Capacity (tons)Daily	Actual Prod (tons)	Recovery Dal %	Broken %	Husk %	Un split Dal %	Process improve-ment
1	Tur	40	36	74	6	15	5	Grading and Polishing
2	Chana	40	38	78	5	15	2	Scratching
3	Urad	40	32	78	5	15	2	Splitting
4	Mung	40	30	74	8	16	2	Cleaning
5	Sortex	60	59	98	-	2	-	Cleaning

Data in the table suggests that overall recovery in pulse processing industry is 76 % and process like grading; polishing and splitting operations are needed to studied and improved.

Table No-3: Data collected regarding challenges and issues of pulse industry[iii]

Sr. No	Improvement Industry	Technology Advance-ment
1	Tur mill	8
2	Chana Mill	8
3	Urad Mill	2
4	Mung Mill	2

5	Sortex Unit	2

(Figures in tables are no. of industries)

Analysis:

Data reveal that more 92 % of the pulses processing units are having problems in technological advancement.

1.5 Present scenario of processing unit:

- Small capacity mill (20-40) tons/per day adding to cost of overheads, resources, infrastructure, and cost of operation–leads to higher cost of Production /ton.
- Market demands are met by procuring readymade Dal from processing centers
- Quality standards are getting more and more stringent market demands for ISO 22000.

1.6 Observation in the Industry:

Present status of processing unit.[iv]

1 Comparatively low yield, inconsistent quality and more consumables.

2 Many machines found running idle without product- wasting valuable energy.

3 Lot of leakages due to poor quality of machines and improper engineering.

4 Creates dust mixes products with by- products.

5 As it is a (30-40) ton per day local non-automated Dal mill having individual starters, without any additional monitoring facilities.

6 The industry requires 15 people to run the complete system (including unloading, bagging and loading labour)

2.0 DATA ANALYSIS AND INTERPRETATION

2.1 Need of Technological Advancement in Pulse Industry

Since pulses are consumed in dehusked and split form, the processing of pulses assumes lot of importance. The processing units help in transforming the raw grains, legumes into edible form. The objective deals with technological advancement in pulse processing industry.

2.1.1 Status of pulses processing industry in India

Dal milling industry is one of the major agro processing industries in India. Out of the total production of 13.19 MMT of pulse in the country, 75% is processed by these mills. The units are mostly traditional ones, capital intensive and energy sapping in nature. The dehusking efficiency in traditional mills is quite low. Moreover, the yield of dehusked and spitted pulses in traditional mills is about (65-70) % in comparison to (88-90) % maximum potential recovery of splits. Thus there is excessive loss of pulse cotyledons and embryos in the form of broken and powdered grains (5-15) %.

2.1.2 The Pulse Milling Process:

In India most of the pulses are consumed in dehusked and split form. Thus processing of pulses assumes a lot of importance. Pulse processing industry helps in processing the raw grain legumes/ pulses into edible form.

The removal of the outer layer of husk and splitting the grain into two equal halves is known as milling of pulses. To facilitate dehusking and splitting of pulses alternate wet and drying method is used. In India traditional milling methods produce dehusked split pulses. Loosening of husk by conditioning is insufficient in traditional methods. To obtain complete dehusking of the grains a large number of abrasive forces are applied resulting in high losses in the form of broken and powder pulses. Yield of split and dehusked pulses in traditional mills are only (65-75) % due to the above losses compared to (88 -89) % potential yield.

Pulses are usually converted into Dal by dehusking/decorticating and splitting. Mostly carborundum emery rollers are used for dehusking and burr grinders for splitting the pulses. Decorticating is seldom complete in single pass thereby requiring multiple passes. Each pass produces around (1.5-2) % fines thereby reducing the overall recovery of Dal during the milling operation. Basic processes in milling are cleaning, grading, conditioning, dehusking, splitting, separation, polishing and bagging.

2.1.3 Technology

The model unit is based on the versatile Dal mil technology developed by Central Food Technology Research Institute (CFTRI), Mysore and the machinery is fabricated under the supervision of the scientists from CFTRI. PDKV –Mini Dal Mill

Processing of Pulses

A. **Primary processing:** Primary processing activities consist of production of cleaning, grading of pulses.
B. **Secondary processing:** Under secondary processing activities such as dehusking, splitting, polishing, turmeric/ spices/ salt coating and powdered besan and packaged Dal are done.

C. **Tertiary processing:** These activities mostly consist of preparation of roasted, fried Dal and other associated Dal products.

Graph No-1: Plant and Machinery in Dal mill

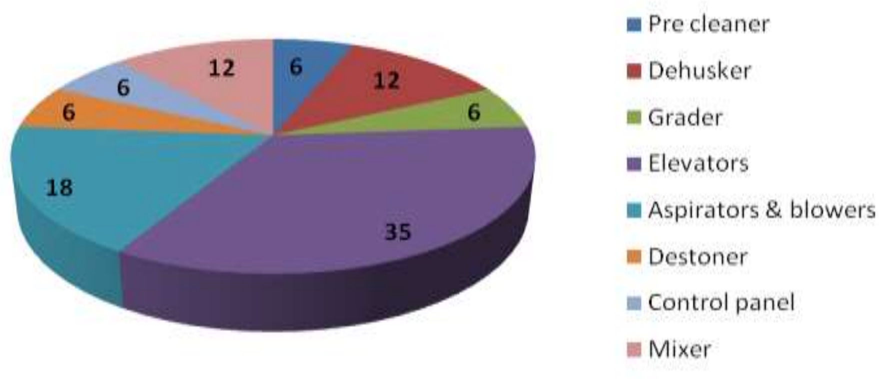
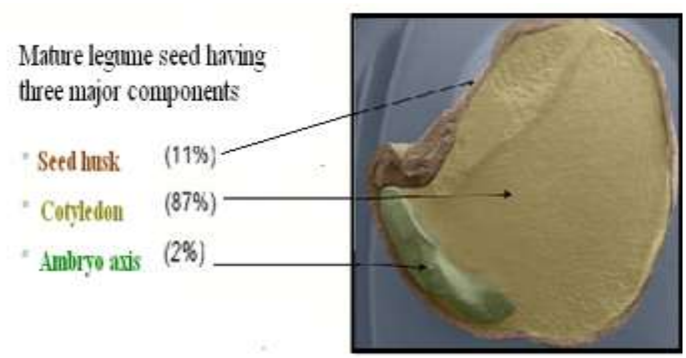


Figure No-1: Pulse Content



Processing of pulse purpose:

- Removal of seed coat.
- Splitting of cotyledon on in two halves.

Reasons:

- To make it digestible -remove anti nutritional components.
- To avoid bitter taste.

Figure No-2: Dal milling Flow Process Chart [v]

Tur Milling :

1) Pulses → 2)Cleaning → 3)Drying → 4) Grading

5) First Pass (Rolling Machine) → 6) Oil Addition Grading → 7) Second Pass (Rolling Machine) → 8) Oil Addition Grading

9) Third pass (Rolling Machine) → 10) Grading → 11) Sortex → 12) Sortex Accept

Chana Milling:

1) Pulses → 2) Cleaning → 3) Drying → 4) Grading

5) First Pass (Rolling Machine) → 6) Water Addition (Screw Conveyor) → 7) Drying (Driers/Open Plots) → 8) Second Pass (Rolling)

9) Third pass (Rolling Machine) → 10) Grading → 11) Sortex → 12) Sortex Accept

2.1.4 Analysis from existing Dal mill:

1. Comparatively low yield, inconsistent quality and more consumables.
2. Many machines are founded running idle without product- wasting valuable energy.
3. Lot of leakages due to poor quality of machines and improper engineering.
4. Creates dust mixes products with by- products.
5. As it is a (20-30) ton per day local non-automated, mill having individual starters, without any additional monitoring facilities.
6. The industry requires 15 people to run the complete system (including unloading, bagging and loading laborers)
7. Owners are quite busy in studying the market intelligence, price movements, collecting and analyzing data from various markets in India. Spend less time in reducing the losses in production/processing.

2.1.5 Facts of the Industry [vi]

Small capacity mills (15,20,25 & 40) tons per day capacity in multiples adding to cost of overheads, resources, infrastructure and cost of operation – leads to higher cost of production /ton, market demands are met by procuring readymade Dal from processing centers. Quality standards are getting more and more stringent market demands for ISO 22000 and HACCP.

2.1.6 Improvement in the existing process:

2.1.6.1 Cleaning

Process can be improved by addition of oil and water.

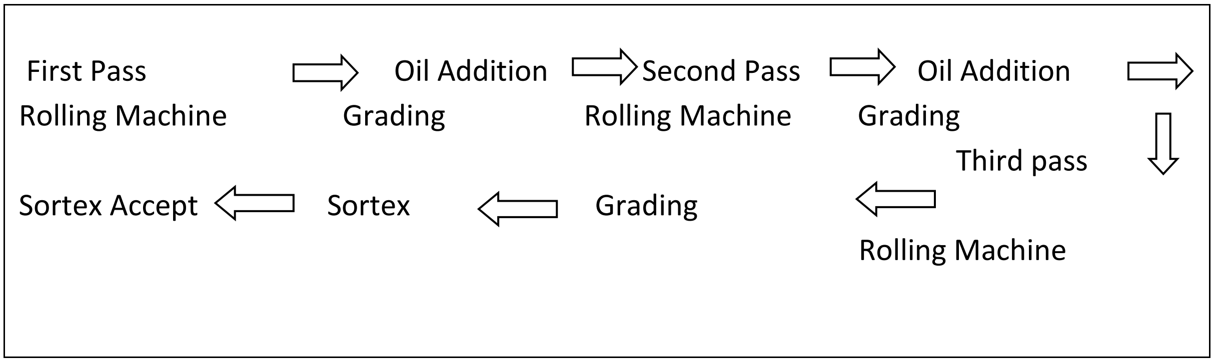
2.1.6.2 Grading

On the basics of size uniform grading can be done.

To improve the scratching ability and maintain uniformity in the process

Highest hulling efficiency in scratching leads to yield.

Figure No-3: Scratching Process[vii]



2.1.6.3 Requirements of Process

1. Well designed emery roll machine
2. Selection of RPM
3. Selection of grit size
4. Pressure –residence

2.1.6.4 Oil and water addition

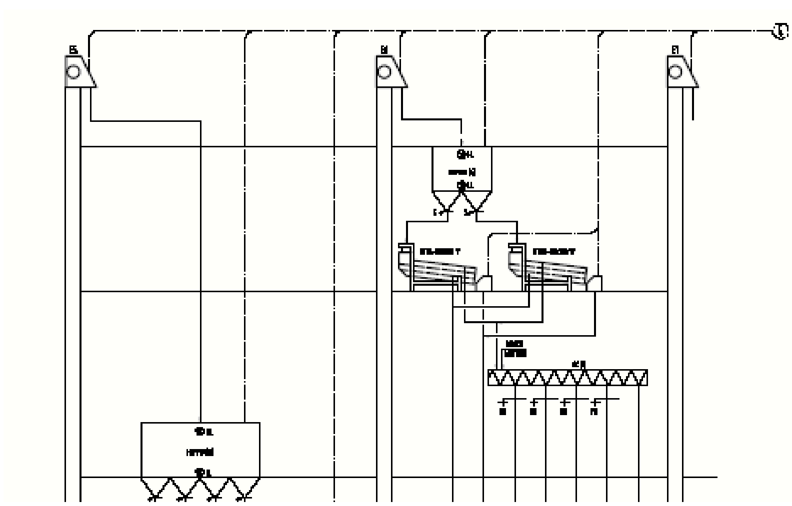
Proper mixing of water / oil can be achieved, through properly designed conveyors. Residence time, designing of mixing conveyor –peddle type.

2.1.6.5 Resting time (Incubation/tempering)

Properly designed and sized bins helps in penetration of oil/water and in turns helps to make gum slippery.

2.1.6.6 Overall process

Flexibility in the process to accommodate different product –route adjustment



2.1.7 Improvements in Splitting and Polishing:

Figure No-4: Splitting Process

Drying ⇒ Storage Room ⇒ **Splitting Section** ⇒ Grading ⇒ Sortex
(Proper water addition + drying (removal of core moisture) will help in getting maximum splits)

Figure No- 5: Polishing Process

Grading ⇒ **Polishing** ⇒ Packaging

2.1.7.1 Polishing

- Gentle polishing action provides waxy coating.
- Shining at low temperature.
- Leather belts should be avoided; instead food grade material can be used for polishing.

2.1.8 Modern machinery for Pulse processing[viii]

Requirements of Process:

1. Well Designed Emery Roll Machine 2. Selection of RPM
3. Selection of Grit size 4 Pressures –Residence

2.1.8.1 Roller Machine:

Abrasive, carborundum roller cylindrical mill of 1000 Kg per hour capacity, run by15 kW electric motor is readily available in the market. It has been developed for dehusking and splitting of food legumes, pigeon pea gram and black gram.

It consisted mainly of a 3000mm diameter cylindrical emery coated roller to give (13.5-14) m/s speed at 2400-2700 rpm and Dal (splits) recovery rate of 84 to 85%. Though the unit is similar to traditional miller machine and gives more or less the same Dal recovery, it is useful for large scale production (80 -100) quintal per day.

2.1.8.2 Cylinder Concave DE huller: This machine has been developed and consists of a 380 long and 220 mm diameter cylinder with truncated surface and a concave. The kernels are fed to the unit along the full length of the cylinder. A similar machine developed at IARI, New Delhi has cylinder concave set consisting of 150 mm diameter mild steel pipe of 6 mm thickness coated with 36 mm emery cloth to form a cylinder. The concave has 1 mm^2 grooves along the length and spaced at 25 mm apart. The unit runs on 1 H.P. electric motor when operated at 1080 rpm 8.48 (m/s) and gives a Dal yield of 85 at 8.69 % moisture content, with 94% hulling efficiency. The energy requirement of unit is 2.15 KW/Kg with a milling capacity of 140 Kg per hour. These units have been proved to be of high utility value due to higher recovery rates of splits and improved dehusking efficiency.

2.1.8.3 Under Runner Disc (URD) Sheller: The URD Sheller (1000-3000) mm thick, 2700 rpm can be used for milling of Bengal gram. It gives 82 % recovery of splits with 6% broken. The energy consumption increases with increase in feed rate up to 650 Kg/hr and remains constant (20 kW) up to 900 Kg/hr and then decreases. Thus total of 1200 MT/ annum. The capacity of the unit can be suitably changed as per location requirement.

Table No- 4: Data collected after modernization in Dal mills[ix]

Sr. No	Pulse	Recovery (%)	Broken (%)	Husk (%)	Unsplit of Dal (%)
1	Tur	80	6	11	3
2	Chana	82	6	10	2
3	Urad	80	5	12	4
4	Mung	80	8	9	3

The table reveals that recovery we get is up to a maximum level around 80 %.

2.1.9 Challenges ahead in front of Dal industry:

- To achieve higher yield, saving in losses and dust free plants.
- Flexibility to accommodate various varieties with equal efficiency.
- Reduction of Dal flour, Dal - Churi will be the need of industry.
- Proper designed mill to give continuous and consistent production.
- Minimizing power/ ton with less number of labors.
- Higher capacity mills (100 - 200) ton/day etc.

2.1.10 Present status of Dal mill without automation:

A (20-30) tons per day local non-automated Dal mill has individual starters for motors, without any additional monitoring facilities. This would require 15 people to run the complete system (including unloading, bagging and loading labors)

1. More labor oriented - add costs
2. Difficult to calculate the yield - unable to arrive at actual production cost
3. Inconsistency in addition of oil and water - additional cost, spoils color
4. Less production during night shifts - no monitoring methods

Quality and quantity are more dependent on the skill / mood of supervisor– results in losses, poor capacity utilization of the plant (40 tons/day plant produces ~ (20-30) tons/day) – Idle / empty running, wastage of power.

1. Different quality Dal get mixed up -Direct loss
2. Bins/rooms overflow - Jamming of machines/quality loss
3. Jamming of machine / conveying - Product loss

Frequent breakdown due to single motor / common shaft drive – production loss results in high production costs and low profits.

All the above problems in processing can be avoided by automation. Study shows that a 130 tons/day Dal mill would have - 170 motors, 180 slide gates and 40 diverters.

2.1.11 Complication in (130 ton/day) Dal mill:

We will have 50 level indicators for 80 bins/silos, with proper automation;

130 tons/day Dal mills would require (2-3) operators, (10–12) people labours for unloading, bagging and loading to run the complete system.

2.1.12 Automation for Dal mill:

1. Optimum utilization of the mill capacity yields, lower power consumption per ton of production.
2. Equipment for automatic dosing of oil and water – controlled based on product flow.
3. Benefits would be less Atta (flour), clean, Churi, quality Dal, with continuous high Production and finally improved higher yield.

2.1.13 Conclusion results obtained from Automation:

- Higher yield around 80 %.
- Continuous and consistent production.
- Better / uniform and natural color with a smooth and shiny surface.
- Sharp edges maximum good grains get scratched so that oil will penetrate in the grains.
- Reduced oil consumption mechanized process help to reduce labours and

interlocking helps reduced energy hygiene, which is most important for HACCP / ISO22000/ BRC – Especially when it is export. Properly engineered plant is capable of achieving this efficient control system adds to highest level of productivity.

2.1.14 REFERENCES

1 Automating Business Process Reengineering: National Productivity Review.
2 Agri -watch Global Summit [2010]: Technological advancement by Buhler. Company.
3 Dr. Varsha S. Sukhadeve (2011) Modern Approach to Statistics.

4 Small Scale Pulse Milling - The Success Story CFTRI (2001)

5 Thomas Susan (2003): Agricultural Commodity Markets in India; Policy Issues for Growth, Indira Gandhi Institute for Development Research, Mumbai.

6 Vohra N.D and Bagri B.R., Futures and Options, 2nd edition Tata McGraw-Hill-New Delhi

7 Design of Machine Elements R .S Khurmi Data collected from various electronic sources through internet: www.mcxindia.com, www.pwc.com/in/en, www.nseindia.com, www.ag.ndsu.edu, www.agriwatch.com, www.iipr.res.in, www.indiaagristat.com