Enzymatic extraction and value addition of palm juice

Soberly Mohanty, Sabyasachi Mishra, Rama Chandra Pradhan

Department of Food Process Engineering,
National Institute of Technology, Rourkela, Odisha-769008

E-mail: mishrasa@nitrkl.ac.in; Phone: 0661-2462905

Abstract

Palmyra palm (*Borassus flabellifer L.*) has several uses including food, beverage, fibre, medicine and timber. Being seasonal, the fruit is not available throughout the year. Proper processing and value addition of the fruit is necessary for its consumer acceptability. Various traditional products like palm jaggery, palm sugar and palm candy are prepared from the edible parts of the Palm fruit. The fruit pulp is rich in vitamins and minerals. The fruit pulp has lot of other nutritional and medicinal values. The juice of ripened palm has not been explored to its full potential for commercial use. Complex structure of the fruit may be one of the many reasons limiting pulp and juice recovery. Use of enzymes could help in extracting clear juice from the thick and fibrous pulp and can be further processed to value added products.

Key words : Palm, Enzyme extraction, Value addition

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Introduction

- Palm or Palmyra is a tropical fruit
- It is abundantly available in South east Asia, Africa and South America
- Known for its fleshy seed and sweet sap
- Its very **nutritive**: Vitamins A, B & C and anti-oxidants and anti-microbials
- It has many **medicinal** values: Diuretic, anti-phlegmatic, anti-phlogistic and laxative
- Traditional products: ***Toddy, Jaggery, Sugar, Candy and Chocolate***

Nutritional composition

- **Sweet seed** - rich in ***calcium*** and ***phosphorous*** and ***vitamin B*.**
- **Ripen pulpy fruit**- ***high carbohydrate*** content and ***natural antioxidants*.**
- It contains very **less fat** and has **high calorific value**.

Composition of Palm fruit (per 100g)	
Composition	**Value**
pH	5.5-6
Total soluble solids (° Brix)	16.5
Moisture (%)	74-77%
Ash(%)	1.2
Fat (%)	0.8
Total Carbohydrates	22.5
Reducing sugars (%)	9.5g
Non Reducing Sugars (%)	13g
Starch (%)	12.6g
Maltose	0.5g
Protein	1.24g
Ascorbicacid(mg100g-1)	16mg
Calcium	8.76mg
Energy (Kcal 100 g-1)	102.83k.cal

Value Addition of Juice

- Processed Juice
- Jam, Jelly, Candy etc.
- Cake
- Powder

Various Products from Palm

gur

Fleshy seed

Wine

Bara

Pulp

Misri

Value added products

Palm Gur

Dried Seeds

Palm Wine (Toddy)

Palm Sugar

Palm pancake

Fruit pulp or juice Extraction Methods

- ✓Manual press
- ✓Mechanical press
- ✓Hydraulic press
- ✓Screw press
- ✓Rack and cloth press
- ✓Basket press
- ✓Crushing
- ✓Enzymatic Extraction

Enzyme Assisted Extraction

- Polysaccharides: ***Cellulose, Hemicellulose, Pectin*** etc. present in cell walls of fruits and vegetables,
- These are responsible for ***Haziness*** of the juice. ***Clarification is needed.***
- Enzymes: ***Hemicellulase, Pectinase, Cellulase*** helps in degrading the cell wall materials.
- Many advantages of using enzymes are
  - Increase in yield
  - Clear juice
  - Minimum waste
  - Better taste and flavor
  - Better storability
  - Improves quality

Objectives

- To determine the physio-chemical properties of Palm fruit pulp.
- To develop and optimise a process for enzymatic extraction of juice from Palm fruit.
- To develop various value added products from the optimized juice.
- To perform quality and storage studies of optimized palm juice powder and value added products.

Methodology

Physico-chemical properties of Palm pulp

- Viscosity, density, colour, total soluble solids, total dissolved solids, pH, ascorbic acid, protein, carbohydrate, fat, fibre, and vitamins

Enzymatic Juice Extraction

- Manual Pulp extraction
- Enzyme treatment of the pulp (Pectinase, Cellualse and combination of both) for extraction of juice
- Process optimisation for type of enzyme, quantity of enzyme and time of reaction.
- Physico-chemical properties of extracted juice

Methodology *(Cont.)*

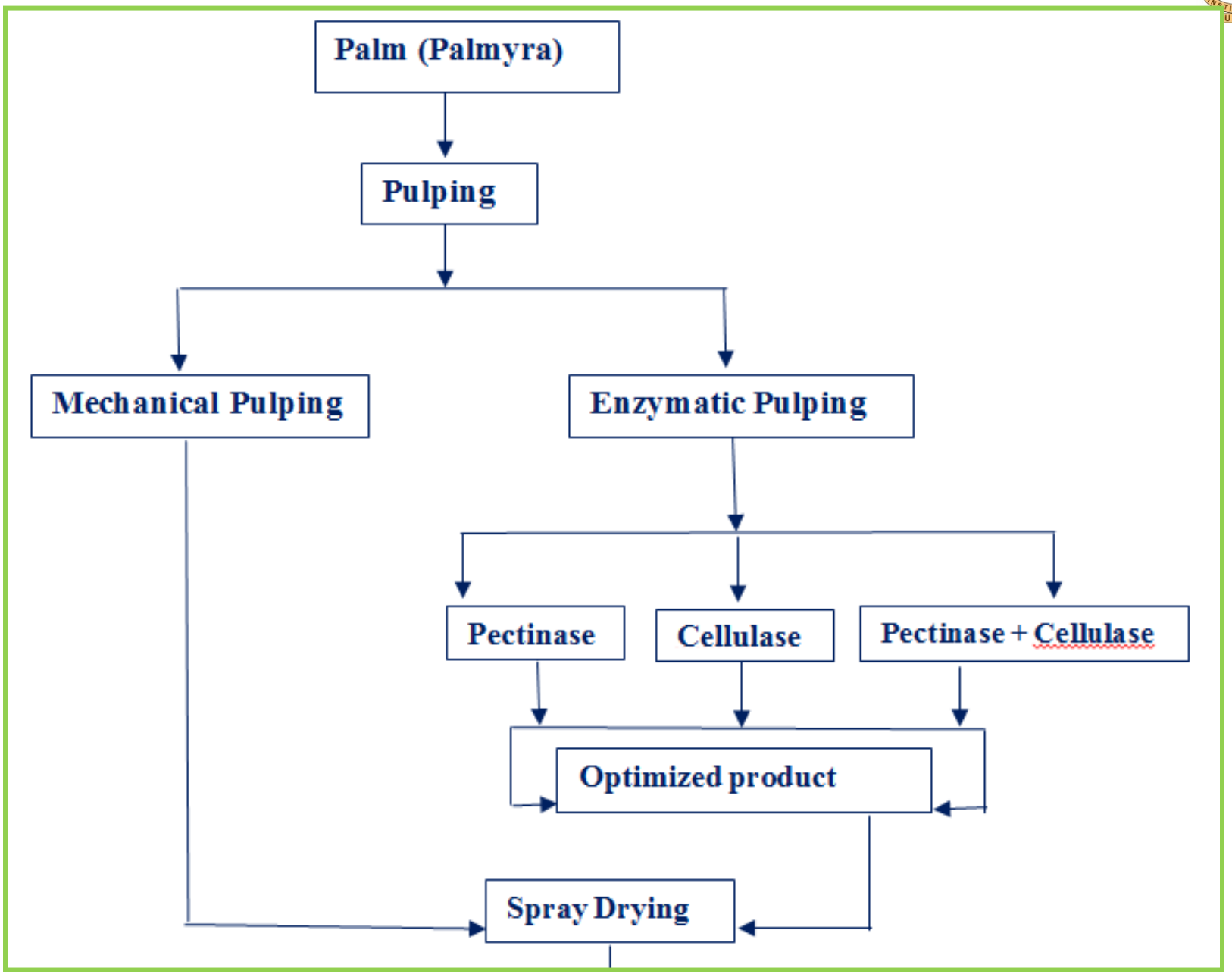
Spray drying with Micro-encapsulation

- Spray drying of juice and process optimization
- Micro-encapsulation with Additives (maltodextrin and /or liquid glucose)

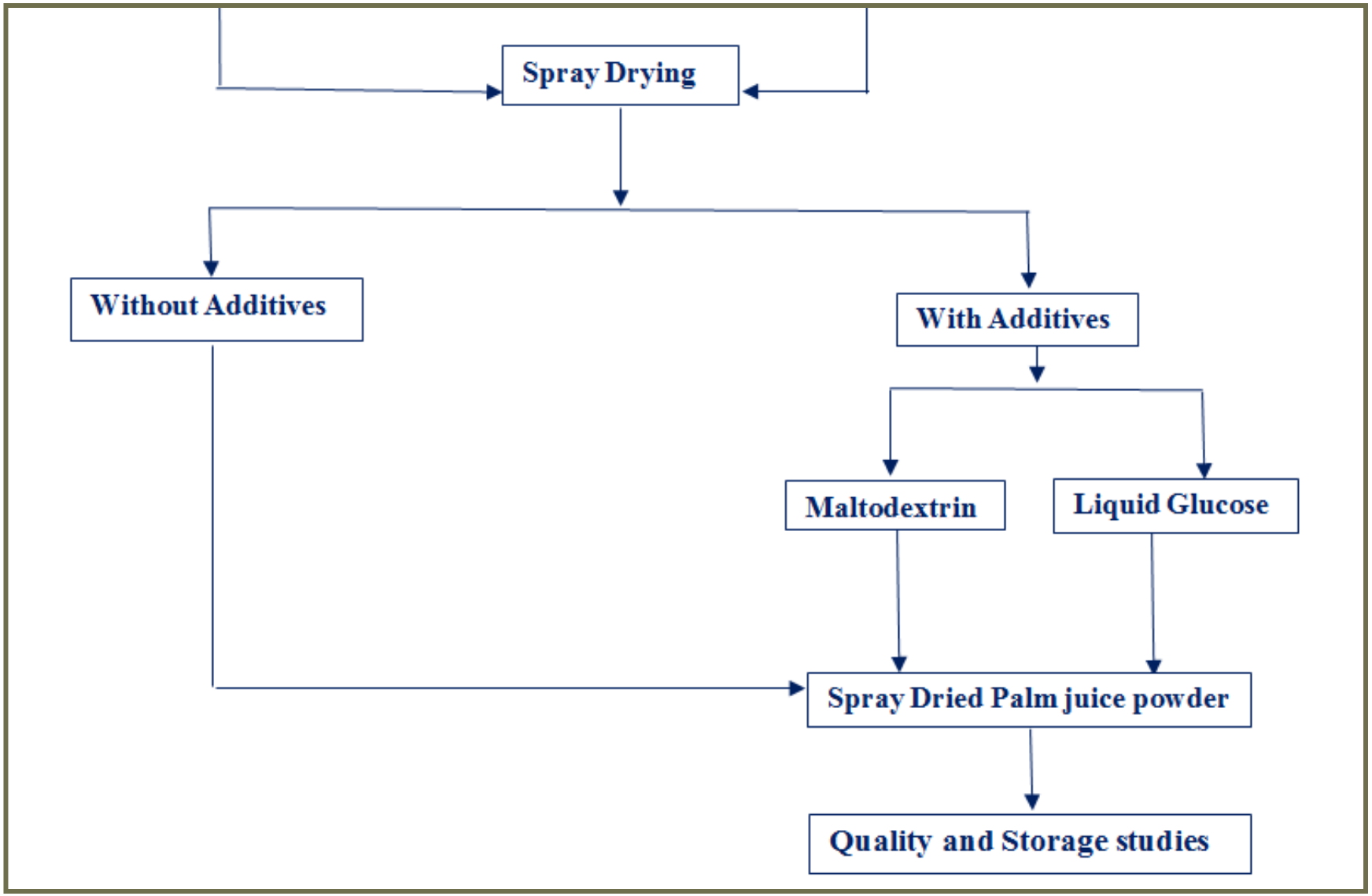
Quality and Storage studies

- Fruit powder obtained from optimized process is analysed for various physico-chemical and functional properties
- Microbial load and shelf-life of the final product would be investigated

Process Flow of Experiments



Process Flow of Experiments (Cont.)



Juice extraction Process

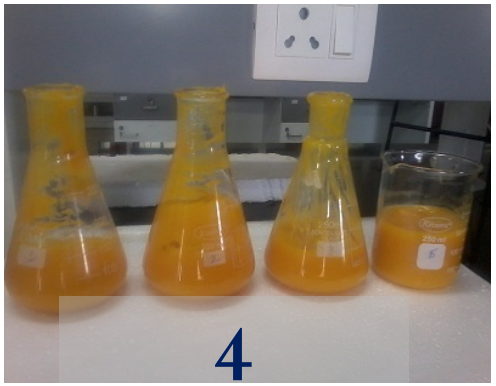
1) Whole fruit

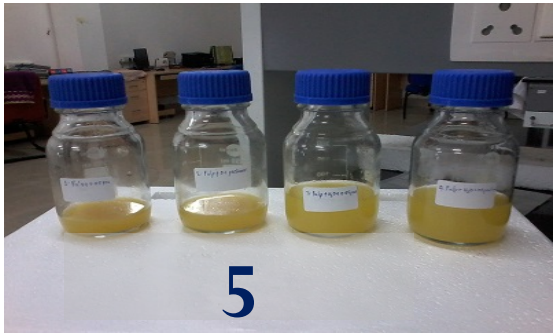
2) Deseeded Palm

3) Fruit Pulp

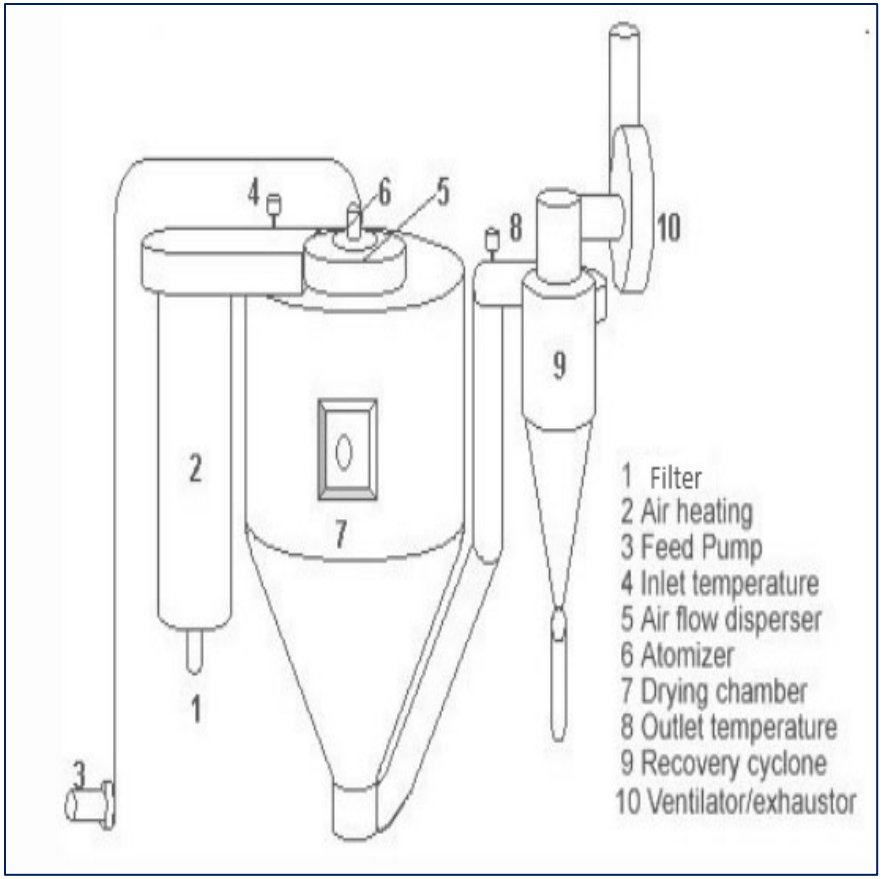
4) Enzyme treated pulp

5) Enzyme Extracted Juice





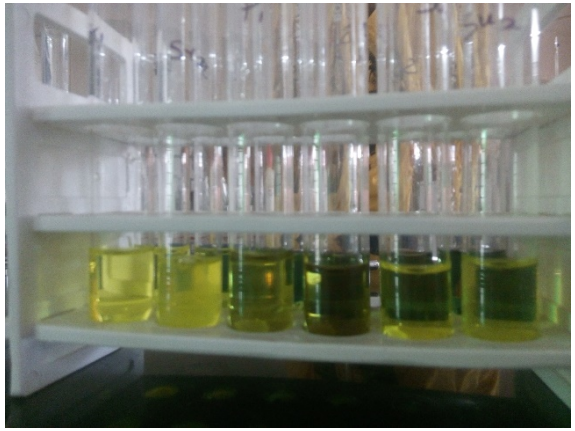
Spray Drying



Process Variables

Enzymatic Extraction		Spray Drying	
Dependent	Independent	Dependent	Independent
Viscosity	Enzyme Concentration	Hygroscopicity	Temperature
Sugar Content	Time of Incubation	Water absorption Index	Air Velocity
TSS	Temperature	Particle size	Feed rate
Yield	-	-	Additive concentration

Experiments



Physico-chemical Properties of pulp

Properties	Values
Moisture (%)	81.1
Total Fat (%)	0.39
Ash content (%)	0.93
Total Phenol (mg GAE/ml)	0.014
pH	4.9
TSS ($Brix^0$)	16
TDS (ppm)	174
Total Solids (%)	17.7

Textural Properties

Properties	Values
Hardness	82.38 N
Deformation at Hardness	29.95 mm
% Deformation at Hardness	44.50 %
Peak Stress	362921.00 N/m²
Strain at Peak Load	0.45N
Adhesive Force	0.28 N
Resilience	0.21N
Stringiness Length	15.11 mm
Gumminess	37.73 N
Chewiness	0.66 J

Conclusion

- Enzymatic extraction could give a better quality juice from Palm
- Various value added products (***palm juice, palm concentrate, palm health drink)*** could be developed.
- Enzyme assisted extraction of palm juice gives a ***better taste and maintains a better sensory quality.***
- The juice can be spray dried for making ready-to-mix powder (like *Rasana*)

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Thank You