Citrus Pectin Production and World Market
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What if...You CAN! Company

What if...

- Food ingredient
- Water binding
- Citrus peel
- Value addition
1. Outline

1. Introduction
2. Raw materials
3. Quality evaluation
4. Pectin production
5. Applications
6. Juice process
7. World Market
8. Conclusion
1. Introduction

- **Pectin natural in all fruits**
  - Water binding
  - Structure (firm / soft)
- **Value added product from peel**
  - Gelling agent
  - Thickener
  - Stabilizer
  - Dietary fiber
  - GRAS
- **Juice industry**
  - Viscosity juice / oil emulsion
  - Cloud stabilizer
Who is CP Kelco?

- **Formed 2000 from**
  - Copenhagen Pectin (Hercules)
  - Kelco Biopolymers (Monsanto)
- **and later**
  - Noviant

- **Products**
  - Pectin
  - Carrageenan
  - Locust Bean Gum (LBG)
  - Xanthan
  - Gellan
  - Carboxy methyl Cellulose (CMC)
1. Plant cell wall

Outer, primary cell wall with random cellulose microfibrils in pectin

Middle lamella between cells — mostly pectin

Inner, secondary cell wall with regular cellulose microfibrils embedded in pectin and hemicellulose

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1. Structural unit

Galacturonic Acid Unit
2. Selecting raw material

- Potentially all fruits and vegetables...
  - Pectin quality
  - Pectin content
  - Commercial availability
2. Raw materials used for pectin
   (2009 estimated – MT pectin produced)

- Citrus (Lemon/Lime/Orange): 85.5%
- Apple: 14.0%
- Sugar Beet: 0.5%

Source: IMR international
2. The Lemons Tale

1 Lemon (200 g)

Lemon Peel (100 g)

Dried Peel (13 g)

Pectin (3 g)

Jam (1000 g)

Lemon Juice (100 g)

Lemon Oil

Cattle Feed (10 g)
2. Dry Peel Manufacturing Process

Peel is washed to remove sugars and color

Pectin peel

- Juiced peel
- Milling
- Water
- Washing
- Pressing 84% moisture
- Drying 550°C

CPP

- Juiced peel
- Milling
- 0.3% lime
- Reaction
- molasses
- Pressing 70% moisture
- Drying 900°C
3. Pectin stability
3. Quality is essential

- Careful processing of raw material is needed
  - Time
  - Drying conditions
  - Washing conditions

- CPKelco offers active support to peel producers

- Continuous improvements to
  - Utilize the available raw material
  - Maintaining and improving the high value
  - Reduce environmental impact
    - Water
    - Energy
3. Peel evaluation

Peel quality = pectin quality \times pectin yield

![Graph showing the relationship between softness and pectin quality and yield.](image)
3. Degradation of pectin

Softening of fruit…
Release moisture…
4. Pectin producing plants
4. Pectin Manufacturing Process

- **Citrus peel**
- **Water**
- **Acid**
- **Alcohol**
- **Sugar**

**Extraction** → **Filtration** → **Concentration** → **Precipitation** → **Drying** → **Milling** → **Blending** → **Standardized HM/LMC-pectin**

**Ammonia** → **Deesterification** → **Drying** → **Milling** → **Blending** → **Standardized LMA-pectin**

**Peel Waste (Cattle Feed)** → **Alcohol Recovery**
5. Pectin types

- CPKelco produces a wide range of pectins, each suitable for specific applications

- Careful controlling
  - Raw material
  - Degree of esterification
  - Distribution of esterification
  - Degree of amidation
  - Molecular weight
  - pH
  - Counter ions
5. Applications
5. Pectin Applications
(2004 world market estimated)

- High sugar jams: 30%
- Acidified milk drinks: 15%
- Low sugar jams: 14%
- Bakery jams: 9%
- Yoghurt fruit preparations: 8%
- Fruit beverages: 8%
- Confectionery: 5%
- Pharma/Tobacco: 2%
- Dairy: 1%
- Other: 1%

Source: IMR international

Typical use level: 0.1-0.6%
5. Gelling mechanism
5. Low ester pectin gel formation
5. Gel formation - low ester pectin

![Graph showing gel formation temperatures for different pectin samples.](image)

- LM-104 AS
- LM-12 CG
- LM-102 AS
- LM-18 CG
- LM 101 AS
- LM-22 CG
5. Stabilizing pattern in yoghurt beverages

- **A**
- **B**
- **C**
- **D**

**Viscosity**

**Sediment**

% Pectin
6. Pectin in juice process

• **Softer fruits lose pectin to juice**
  - Increases viscosity in
    - Juice (evaporation)
    - Pulp wash (yield)
    - Oil recovery (yield)
  - Pectinases commonly used
    - Careful if using for pectin raw material!

• **Stabilizes cloud**
  - Same pattern as acidified milk drinks
  - Positive charged proteins
7. Pectin Producers
(2009 market share estimated)

Annual production: 42 000 MT
Growth 3-6%

Source: IMR international
8. Conclusion

- Citrus peel is basis for
  - broad range of pectin products
  - Pectin used in many food products
- Water-controlling properties
  - Create problems for juicer
  - Create value in food product
- Know-how on upgrading the citrus peel
  - Value for juicer and CPKelco
- CPKelco is largest pectin producer
  - Constant high quality and constant functionality
  - Complete pectin product portfolio
- Pectin market is growing