

Overview of Coconut Water Processing, Production, and Sustainable Value Chain



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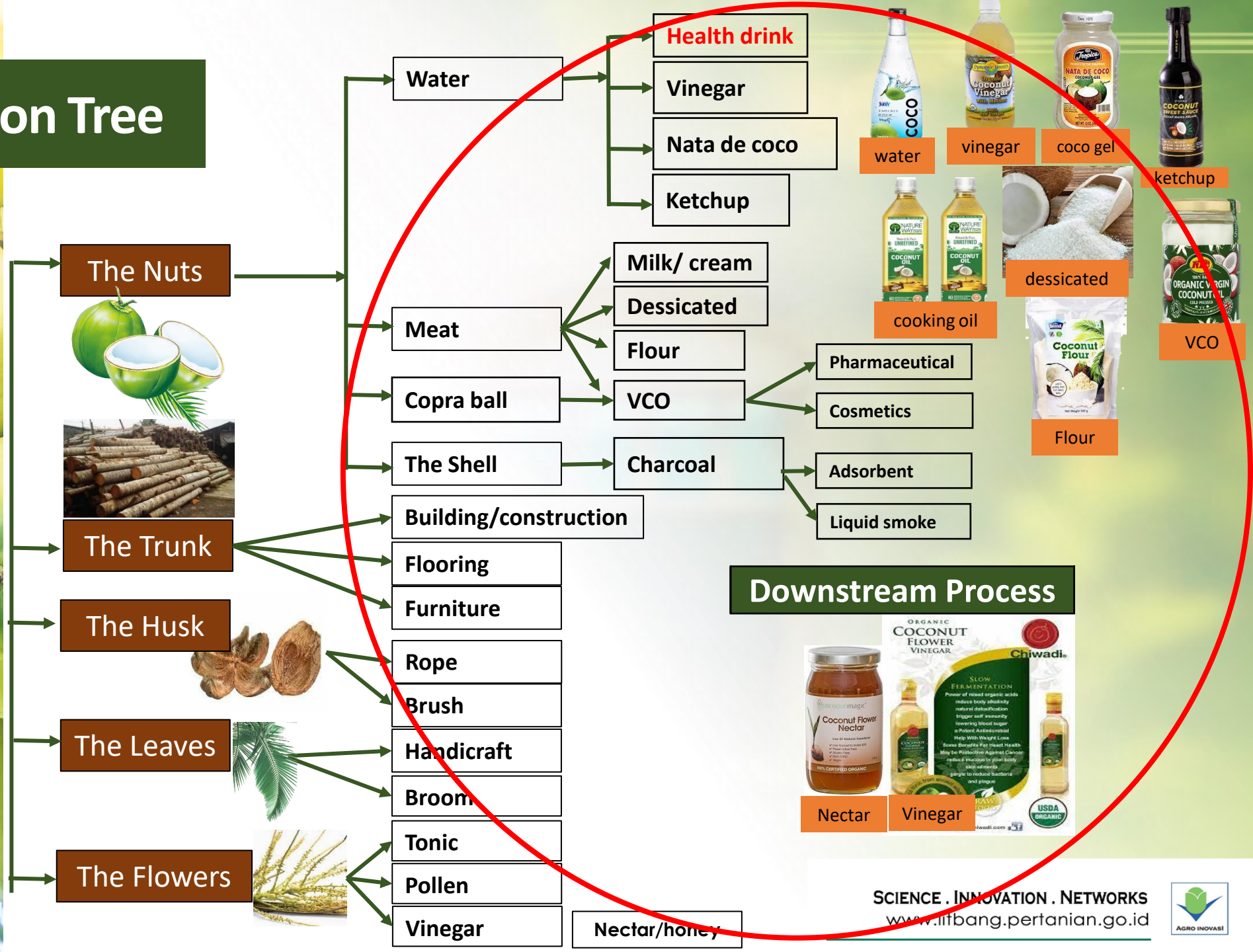
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Industrial Innovation Tree

Coconut tree
(*Cocos nucifera* sp)



Characteristic of Coconut Water

Coconut water will lose almost all its unique organoleptic properties & starts fermenting. Coconut water will turn turbid, yellowish, sour & has bad aroma.

This caused by the existence of oxidase enzymes, i.e. polyphenol oxidase & peroxidase (Duarte et al., 2002; Magalhaes et al., 2005); the microbe contamination (Magalhaes et al., 2005).

Ensuring the elimination of the causes of its quality degradation using methods to preserve coconut water.

Preservation Technologies:

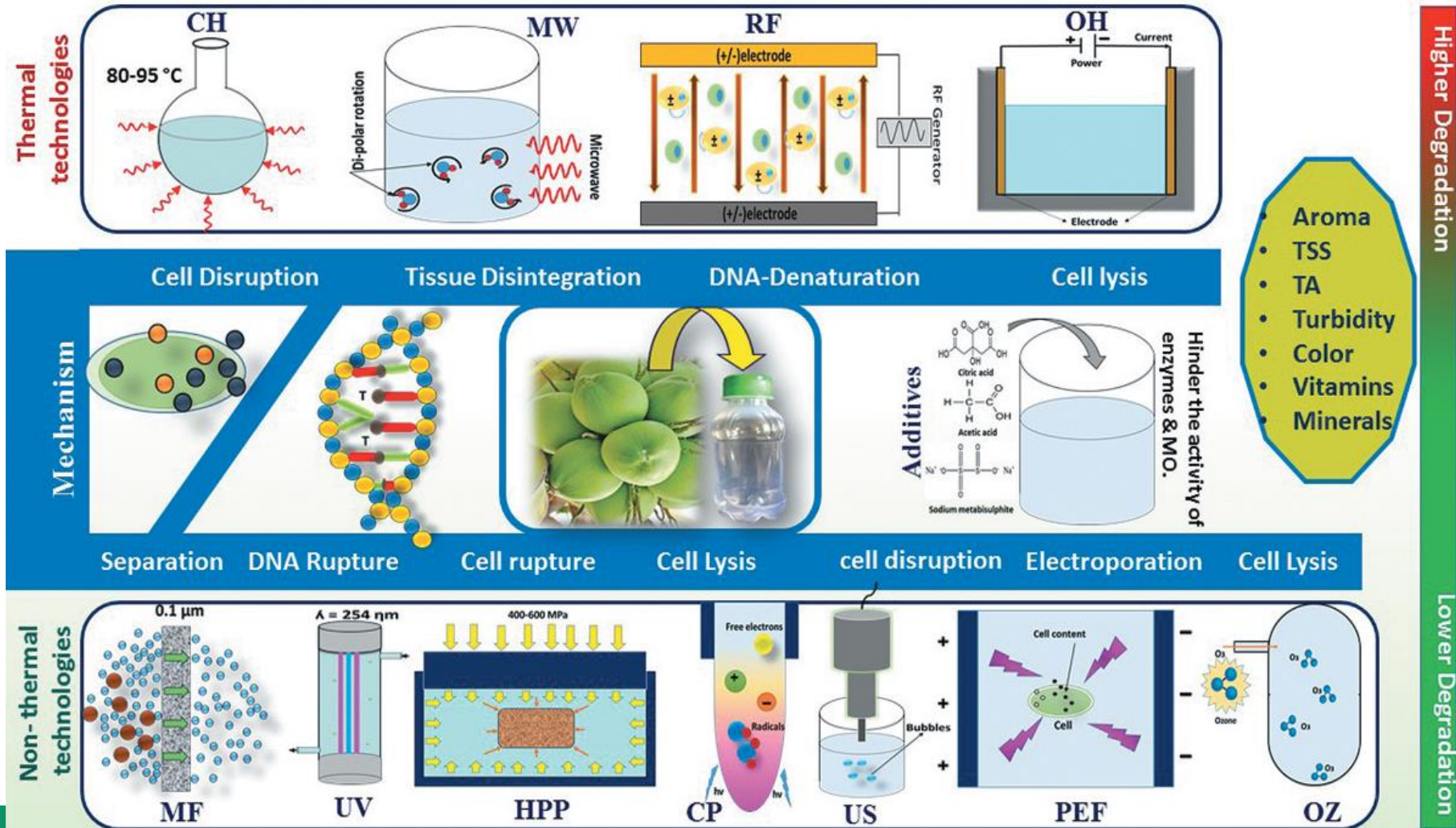


Coconut Water

- Food Composition, relatively high in minerals: potassium content, amino acids, phytohormones and beneficial bioactive compounds, such as vitamin-C, vitamin-B, potassium, calcium, magnesium, sodium, glutamic acid, lysine, arginine, alanine, cytokinin. Its major constituents are sugars which range in concentration from 1.4 to 5 percent depending on the coconut variety and the maturity stage. Coconut water also contains fat (0.2 percent). The nutritional composition of coconut water varies with maturity, variety, location, soil condition, and other environmental factors.
- Specification for packaged natural coconut water (Food & Agricultural Organization of the United Nations, 2007 - Rosa Rolle)
- Good practice for the small-scale production of bottled coconut water
- Nutrient Database for Standard Reference for Nuts, Coconut Water (liquid from coconuts, Release 20, 2007)
- Cold preservation technology, for producing coconut water has a shelf-life of at least ten days under refrigerated conditions.



Recent Advances In Various Thermal, Non-thermal Processing And Preservation Methods



Recent Advances In Various Thermal, Non-thermal Processing And Preservation Methods

	Thermal Processing	Non-Thermal Processing
Benefits	Conventional Heating: • Temperature 100°C; Time 10 min: preserve the coconut water up to a sixmonth • Effectively inactivates the enzymes • Reduction in microbes • Thermal inactivation of peroxidase achieved at 95°C for 5 min • Temperature 85°C; Time 10 min: Microbiologically safe for consumption till the fifth week of storage (5 — 1°C)	Membran Processing: Temperature 85°C; Time 60 s; Wavelength 253.7 nm; Time 14 s: Microbiologically acceptable (<50 CFU/ml) and safe for consumption; Reduces the E.coli and Listeria monocytogenes Ultrafiltration: Inhibits the enzymatic activity in coconut water without the use of heat treatment; Found maximal concentrations of 16.2%, 9.0% and 0.7% of sugar, sugar alcohol and protein Ozonation: • Little or minimum changes in titratable acidity, pH and total soluble solids • Complete inactivation of POD activity • Ozonization with nisin (5,000 IU/ • 200 ml was able to reduce bacteria and destroy the E. coli up to 3 weeks
Drawbacks	• Slightly decrease in acidity during storage • Develop undesirable pink color • Loss of the desirable sweet-sour flavor and development of astringent quality • conventional heating is to minimize quality loss without altering its nutritional composition during heating. • Generally, pasteurization and sterilization of liquids would be carried out to inactivate the spoilage enzymes and microbes. The use of two or more combined techniques could improve the	Stored under refrigerated condition (4°C)



Recent Advances In Various Thermal, Non-thermal Processing And Preservation Methods

	Treatments	Benefits
Chemical preservatives and additives	✓ Addition of L-ascorbic acid 25 mg/100 ml ✓ Immersion in sodium metabisulphite (2 g/L) solution; Time 5–10 min ✓ Immersion in sodium hypochlorite (200 mg/L) and peracetic acid (80 mg/L) solution; Time 2 min ✓ Acetic acid (0 to 100 ppm) and sodium metabisulfite (0 to 30 ppm) ✓ L-ascorbic acid (25 mg/100 ml) and 2-stage microfiltration	✓ Changes in nutritional composition and sensory qualities ✓ Alleviate browning problems in coconuts ✓ Sodium metabisulphite reduces the discoloration and effectively controls the rancidity than acetic acid ✓ Extend the shelf life up to 46 days at lowtemperature ✓ storage condition
Hurdle Technology	✓ 10.5 min UV-C light treatment; 100 µg mL⁻¹ cinnamaldehyde; 5°C storage temperature ✓ Temperature 53.0°C; Time 10; ✓ Carvacrol (200 µl/l)	✓ Synergistically inactivate heat resistant variants of E. coli O157:H7 (ATCC 43888) ✓ Able to achieve 5-log₁₀ reductions goal of the most heat resistant E. coli mutants without altering sensorial acceptability of coconut water



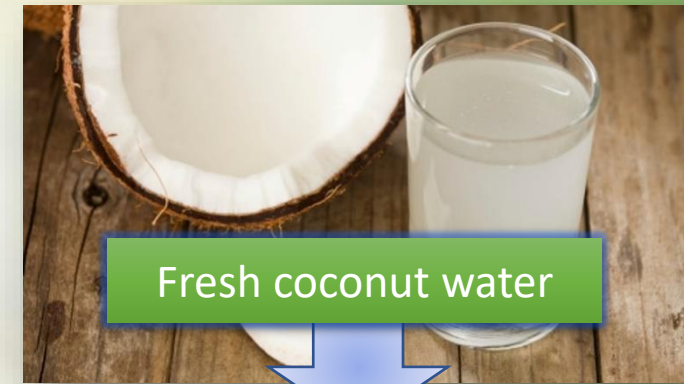
Coconut Water Production Method at SME

Ingredients:

- Coconut water (harvested between seven to nine months after pollination)

Preservation technology:

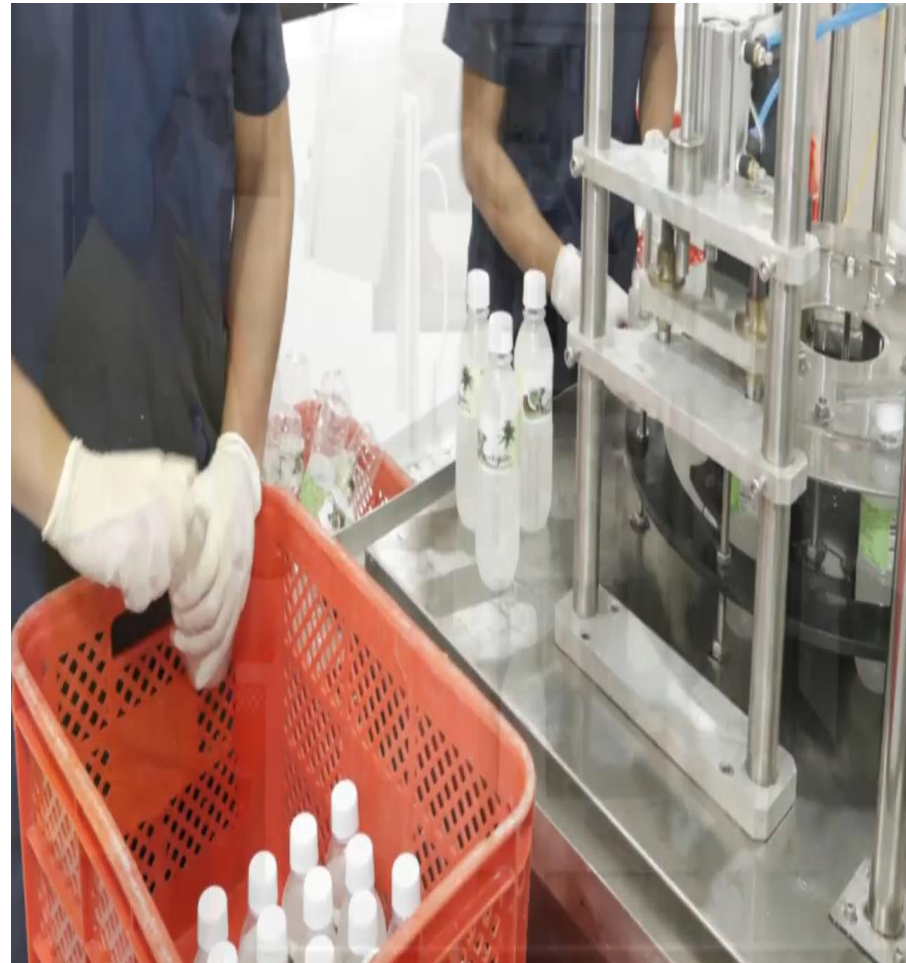
The use of pasteurization/ microfiltration for cold sterilization of the product; a middle level of cold preservation technology targeted for use by small and medium enterprises and an “appropriate” level of technology targeted to coconut water vendors.



Fresh coconut water

filled into hermetically sealed containers of various compositions, forms and capacities with or without the use of additives

Coconut water in packaging



Cocolife Production Process in Philippines:

<https://youtu.be/tikr9s4eTuo>



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Coconut Water Production with Ozonation Method



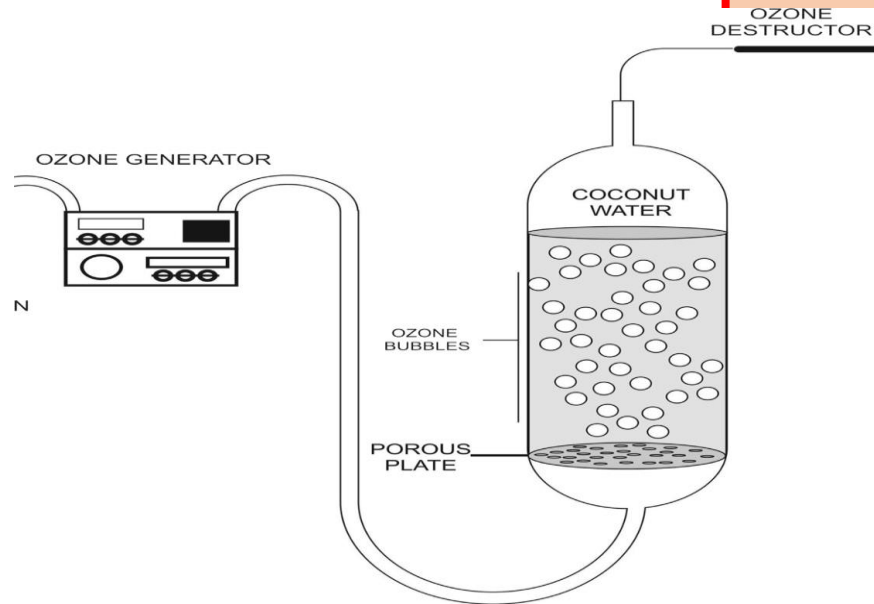
Washing + Chlorine



Extraction & Separation



Ozonization process: ozon generator 6000 USD



Illustration



Photometer



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Indonesian National Standard for Processed Coconut Water (SNI 4268:2020)

Parameters	Unit	Requirements
Colour, aroma, taste		normal
pH		Pure coconut water in packaging: 5,0-6,0 Processed coco water in packaging: 3,5-7,0
Total Dissolved Solid	%	3,0-7,5% in Pure coconut water in packaging; but, not required in processed coco water
Potassium	mg/100 g	Pure coconut water in packaging: min 120 Processed coco water in packaging: min 100 Coco water beverages in packaging: min. 40
Heavy metal contaminants	mg/kg	Pb: max 2 Cd: max 0,2 Hg: max.0,03 Sn: max 0,03 As: max 1,0
Microbial contaminants	CFU/ml	TPC: max 10^6 Mould& yeast: max 10^4

* SNI : Standar Nasional Indonesia



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Downstream Process

Value added

adding value to a raw product by taking it to at least the next stage of production
(Anderson&Hanselka, 2008)

Competitiveness
Products

Customer
Satisfaction

Quality
Products

- ✓ **Product Properties**
 - Physico-chemical
 - Nutrition
 - Functional
- ✓ **Food Safety**
 - Residue
 - Contaminant
- ✓ **Traceability**
 - Efficiency process
 - Supply chain



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