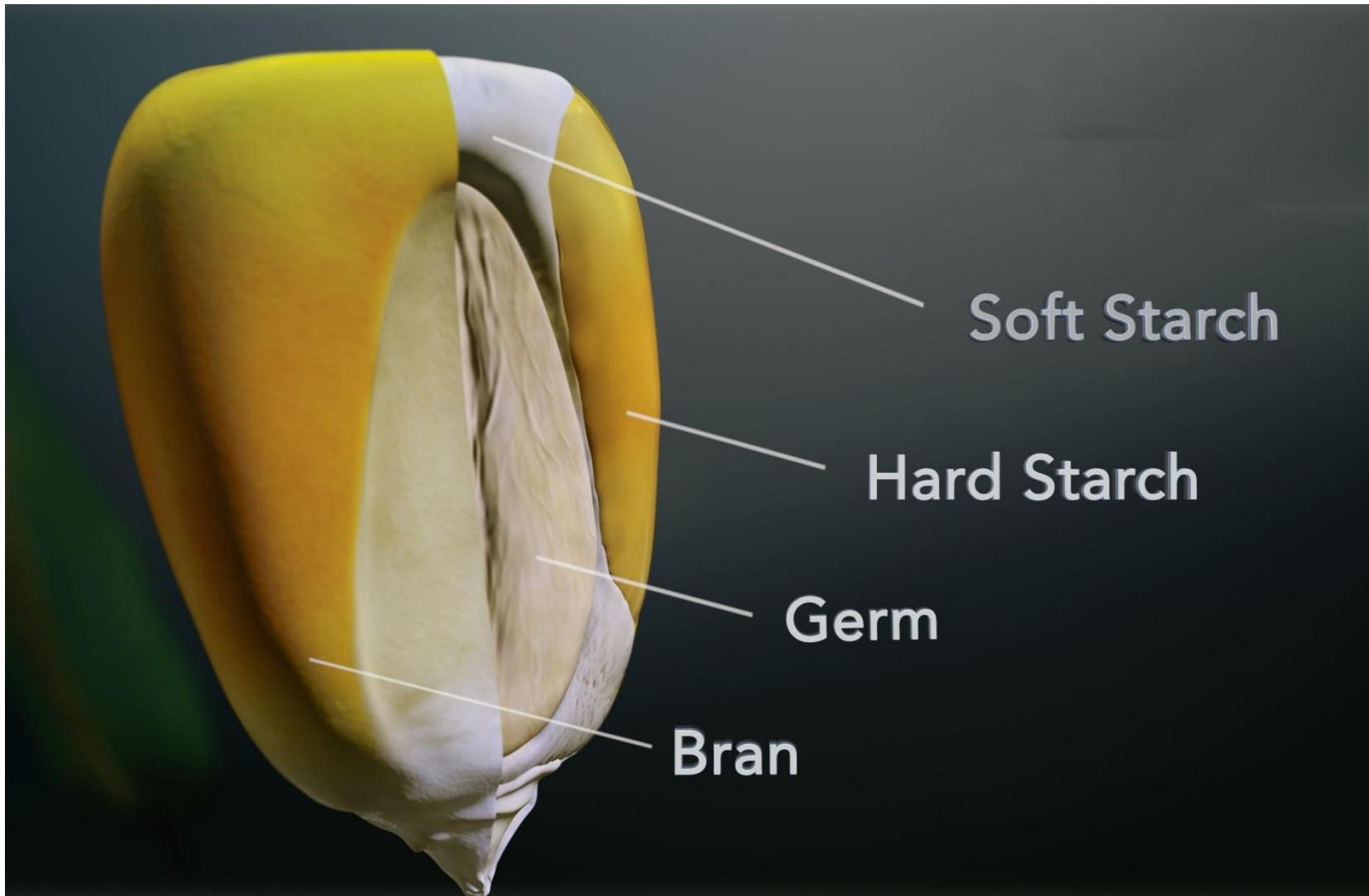


MASA PROCESS





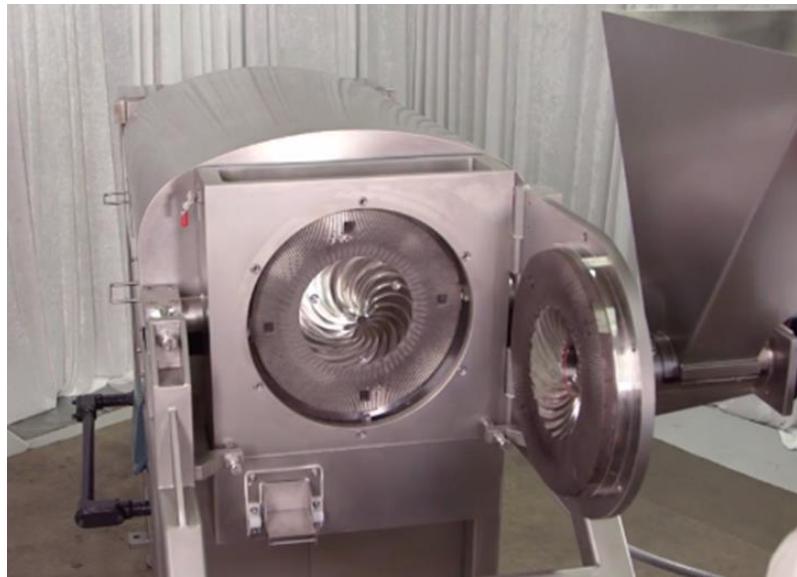
Corn + Lime + water



Wash and drain

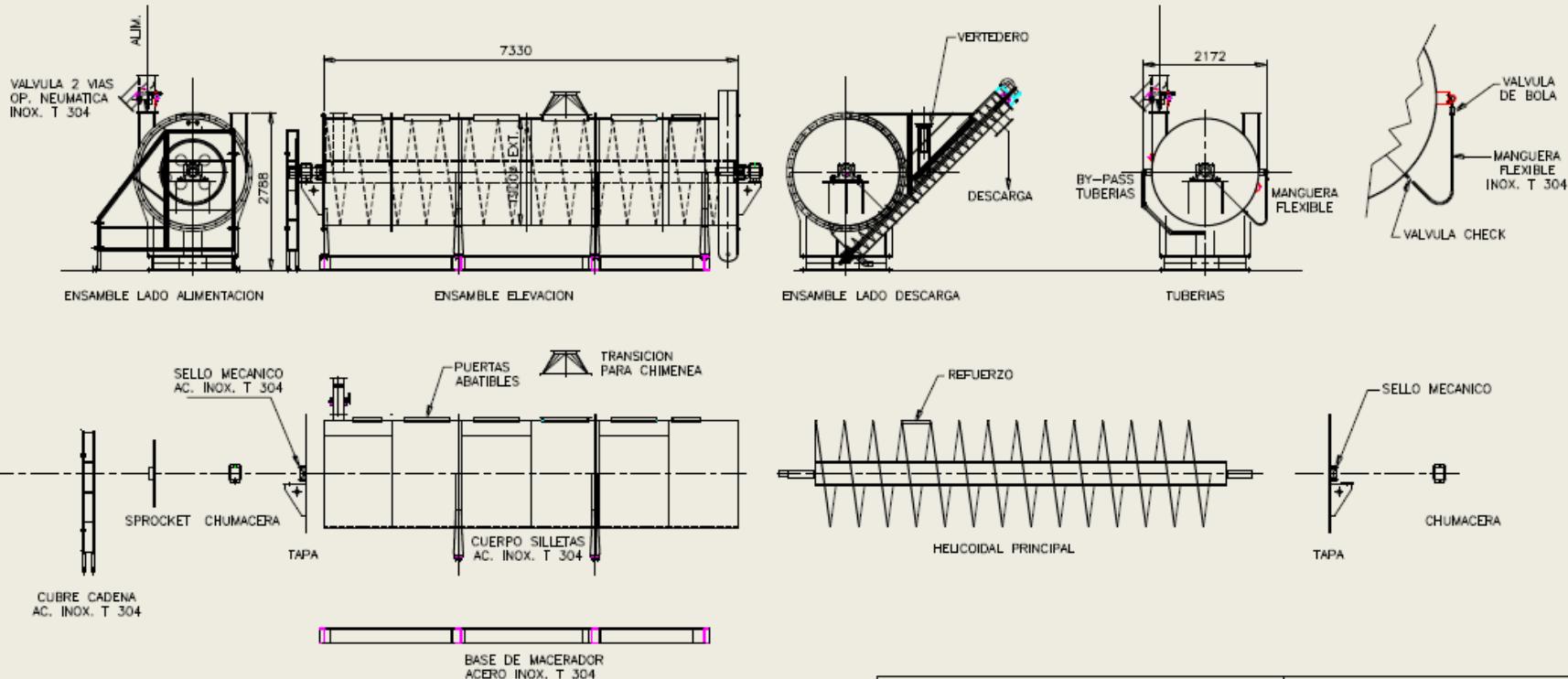
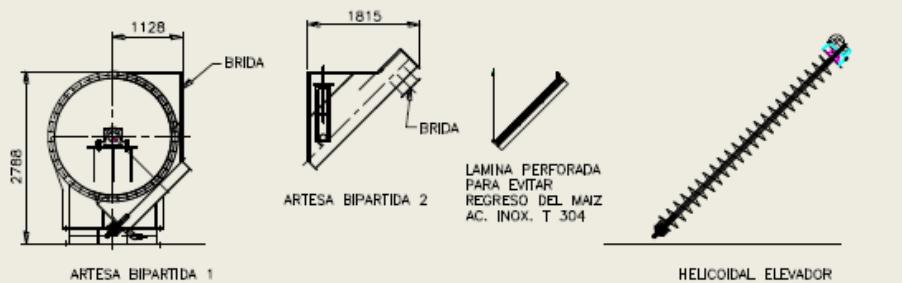




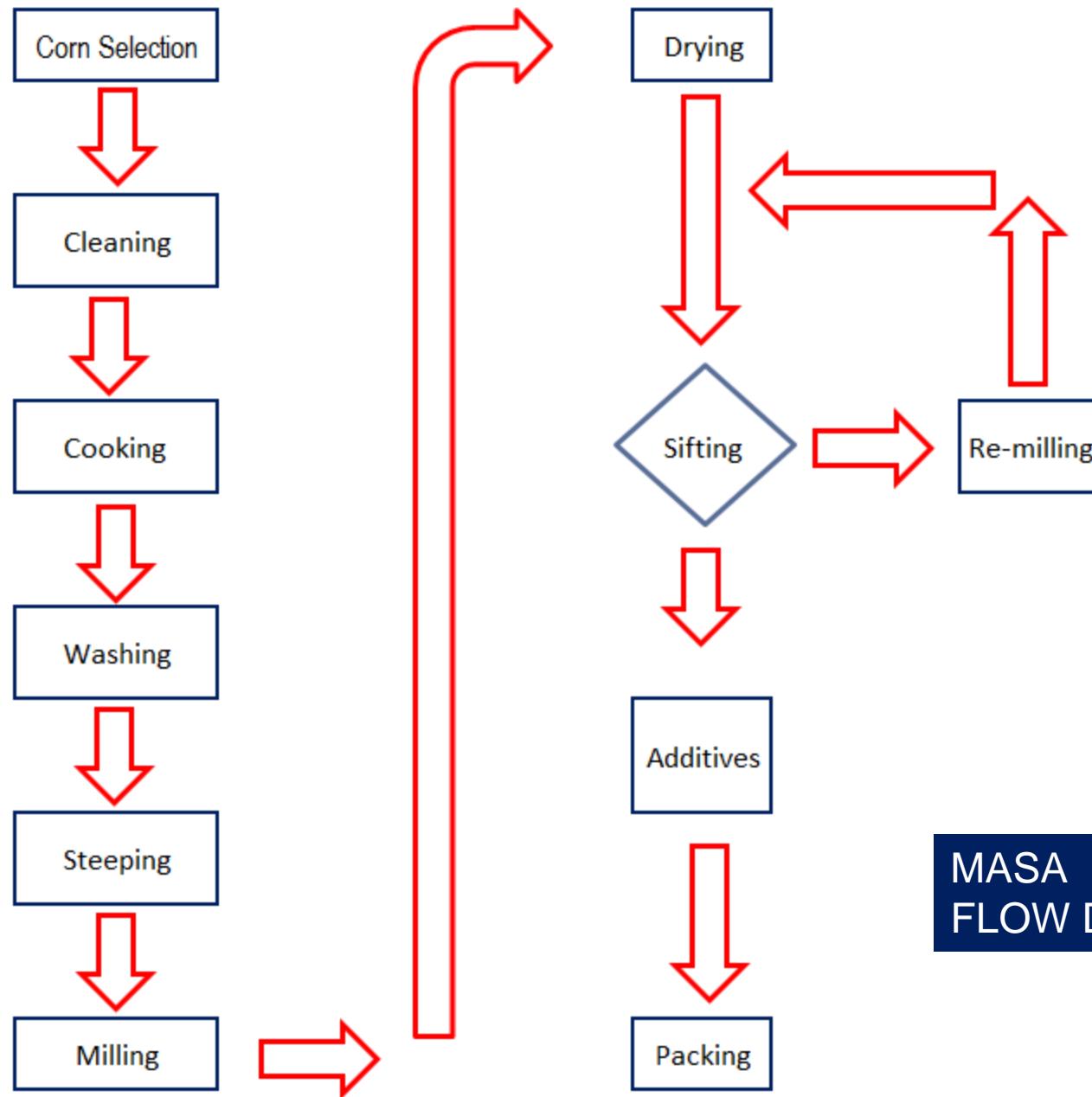




MANUAL DE COCEDOR CONTINUO DE MAIZ
CAP. 6 TON./HR.
FABRICADO EN ACERO INOX. GRADO ALIMENTICIO T 304
ALIMENTADO CON MAIZ SECO Y PRODUCIENDO
MAIZ NIXTAMALIZADO
UTILIZANDO UN CUERPO CILINDRICO DE 1.9M. DE DIAM. x7M. LARGO
UN TRANSPORTADOR HELICOIDAL INTERIOR
CON TAPAS Y CHUMACERAS EN LOS EXTREMOS
TUBERIA Y MANGUERAS FLEXIBLES PARA SUMINISTRO DE AGUA
UN HELICOIDAL ELEVADOR PARA DESCARGA DEL COCEDOR
SPROCKET Y CUBRE CADENA COMO PARTE DEL SISTEMA MOTRIZ.



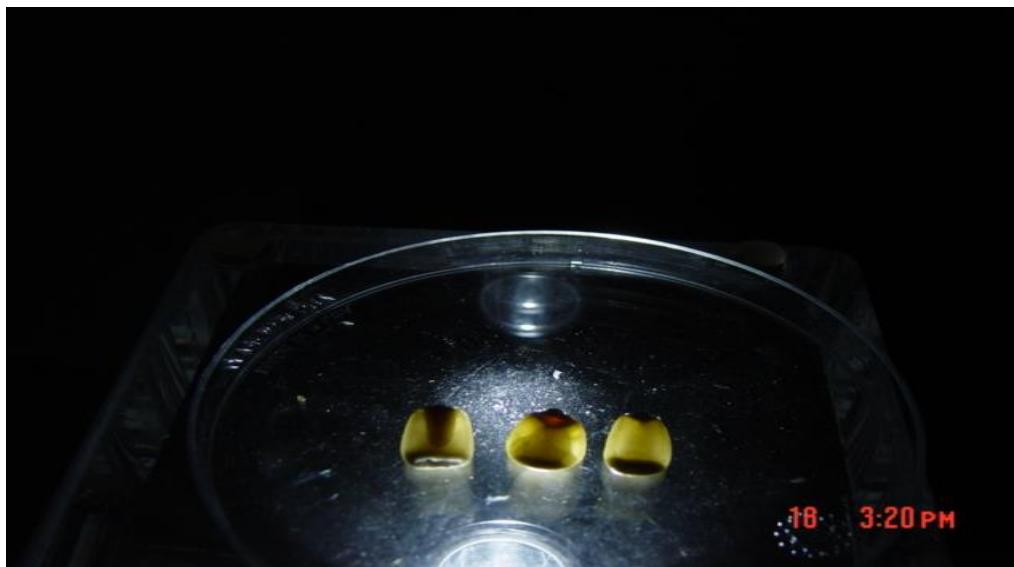
	EQUIINDUS	EMPRESA LIFE LINE FOODS
CONTACTO	ING. RAUL AYALA	
DIBUJO:	RdVeVI	FECHA 12-MAY.-2014
CANT. MATERIAL	PESO KG	DIBUJO EN EXPLOSION
1 INOX. T 304		MACERADOR CONTINUO
		DIBUJO No. LLF-MC-1-01
		REV. 0



**MASA
FLOW DIAGRAM**

CORN COOKING AND HARDNESS

1. Optimum Hardness level required
2. Hard corn requires longer cook time
 - a. More tolerant to handling
3. Soft corns cook quickly retain pericarp
 - a. Corn overcooked to remove pericarp
 - b. Dry matter losses increase significantly



METHODS OF DETERMINING HARDNESS

1. Subjective
 - a. Transmitted light
 - b. Proportion of hard starch
2. Floatation and density
3. Others

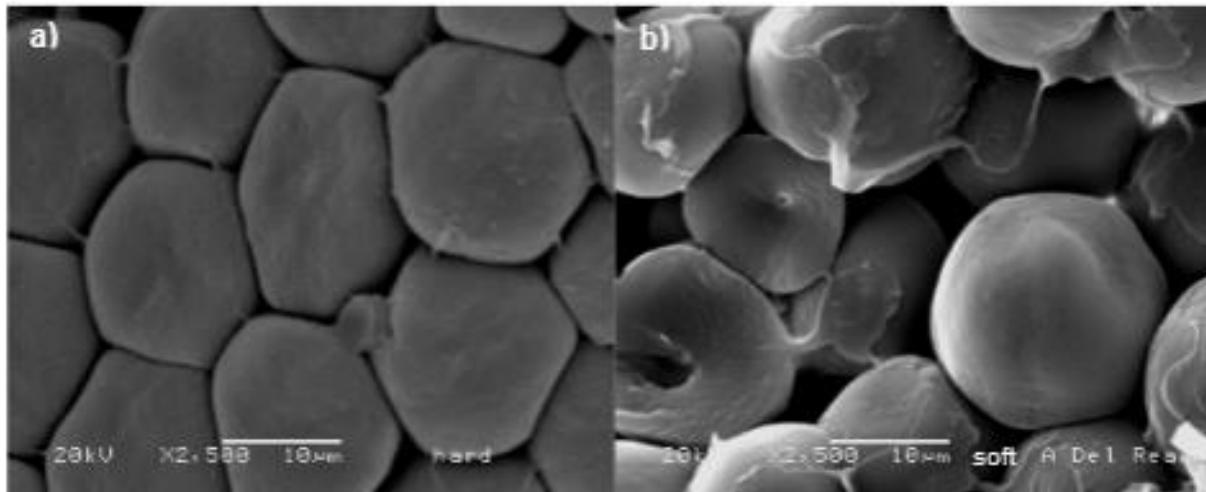


Figura 4.4 Micrografías de gránulos de almidón de maíz obtenidas a 2500X,
a) endospermo duro, b) endospermo suave

PERICARP (SKIN) REMOVAL

1. Corn variety
2. Environment
3. Lime quality can be critical
4. Heating – time / temperature / agitation
5. Washing methods



CHANGES DURING THE CORN MASA PRODUCTION

COOKING

- **Temp/Time profile = 175–212F / 35-55'**
- **Start hydration, from 12-16% => 35-42%**
- **Loosen pericarp**
- **Denature protein and Slight starch gelatinization**





OVERCOOKED CORN







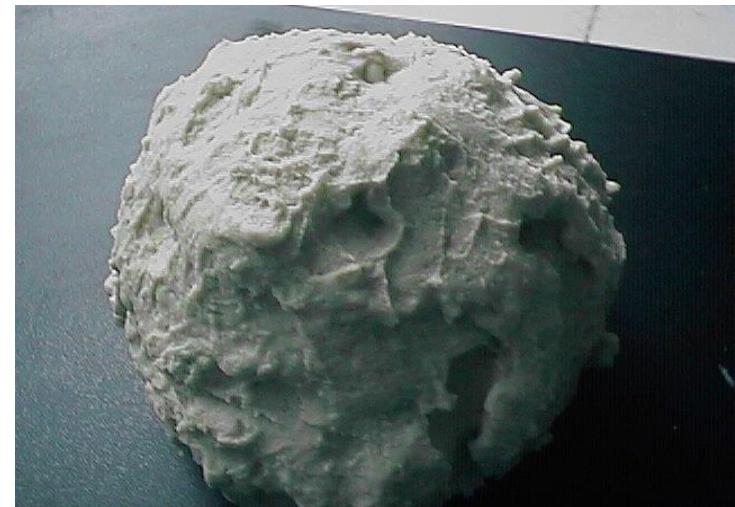
Proper Cook



Overcooked corn



Undercooked corn



Overcooked corn

COOKING (CRITICAL FACTORS)

- **Nixtamal Moisture**
- **Temperature and time profile**
- **Lime quality and concentration**
- **Even heat distribution**
- **Consistent and repeatable cooking conditions
(continuous vs batch)**



BENEFITS OF ALKALINE COOKING

- Removal of Pericarp
- Partial solubilization of protein and starch
- Flavor and taste
- Higher Calcium and release of Niacin

WASHING

- **Water Temp = 150-170F**
- **Lime removal**
- **Foreign material removal**
- **Lowers corn temperature**
- **Promote even properties of the bulk**



WASHING (CRITICAL FACTORS)

- **Residual Lime.**
- **Water Temperature.**
- **Even application of washing water.**
- **Adequate/homogeneous removal of excess lime and foreign material.**
- **Adequate drainage.**

Poor washing

Adequate washing

29 5:49 PM

STEEPING

- **Temp / Time profile = 140-150F / 2.5-4 hours**
- **Complete hydration to about 37-42% moisture (promotes even properties)**
- **Partial gelatinization of starch**
- **Improves color**



STEEPING (CRITICAL FACTORS)

- **Temperature**
- **Time**
- **Nixtamal Moisture**
- **Even steeping conditions**



GRINDING

- High speed hammer milling
- Temperature = 140-150F
- Particle size reduction
- Shearing effect
- Starch damage
- Additional cooking

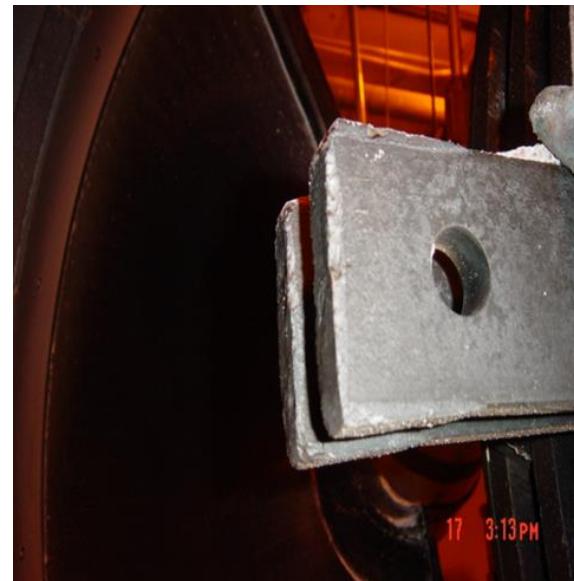






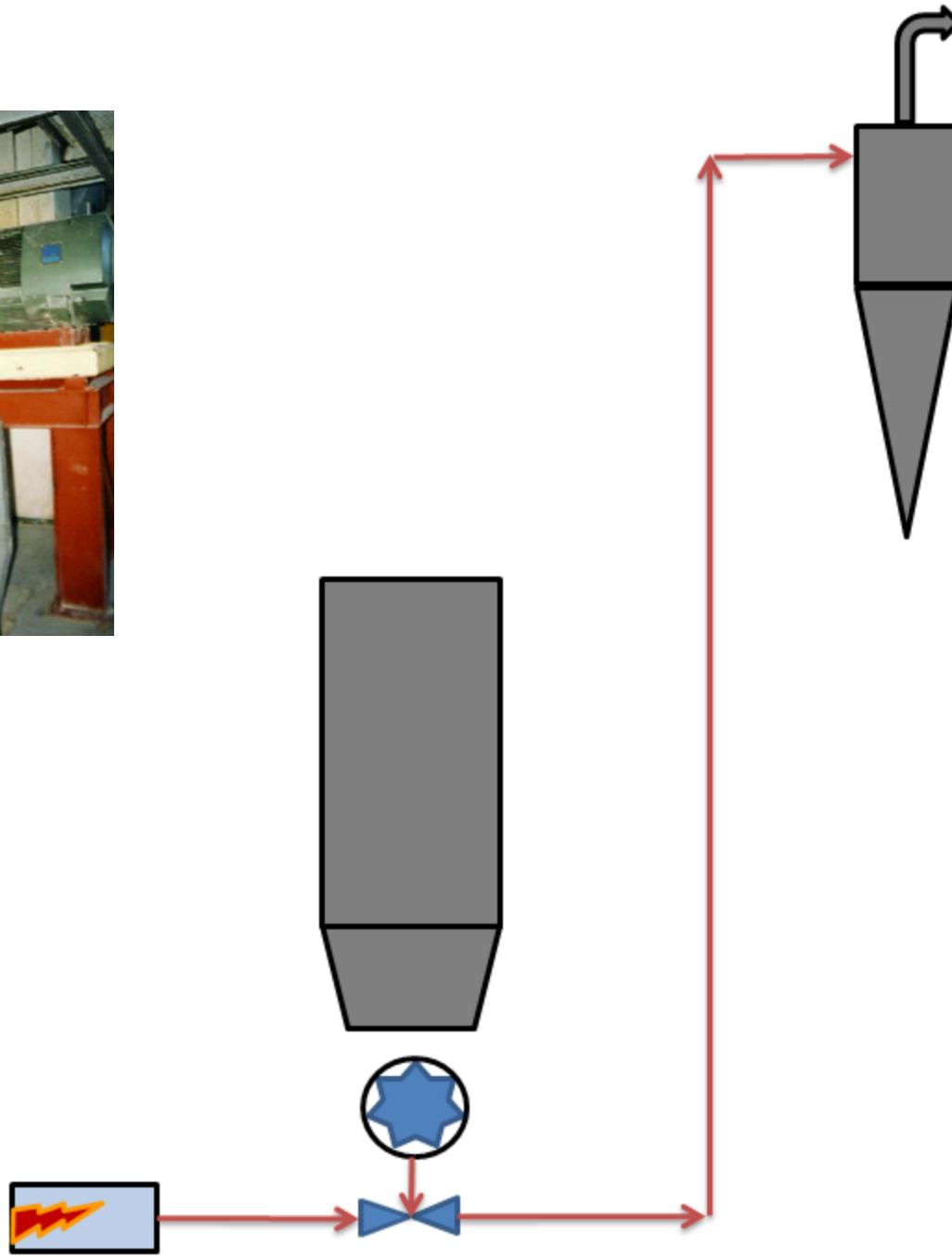
GRINDING (CRITICAL FACTORS)

- **Assure consistent particle size reduction.**
- **Avoid development of excessive heat.**
- **Hammer wear.**
- **Efficiency**



DRYING

- **Small particles**
- **High temperature > 580F**
- **Short time**
- **Additional cooking**
- **Partial gelatinization and retro gradation of starch**



DRYING (CRITICAL FACTORS)

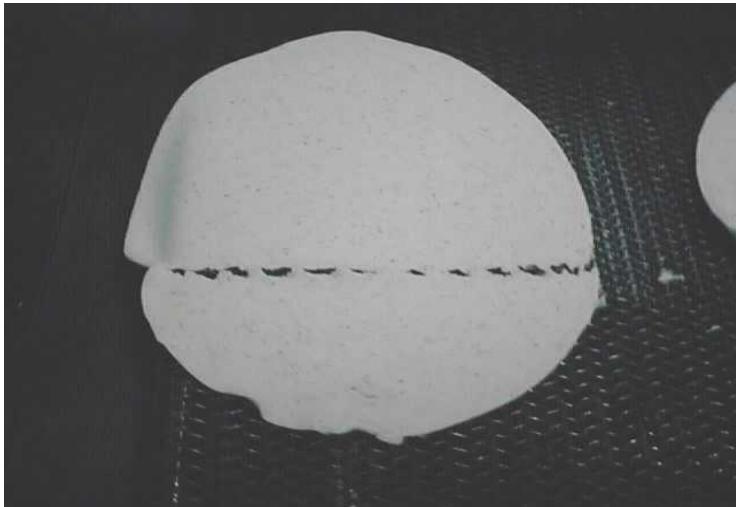
- **Air temperature**
- **Air flow rate (particle residence time)**
- **Temperature – Time profile**

550 – 700 Mcal/MT

6 – 8 KWH/cwt

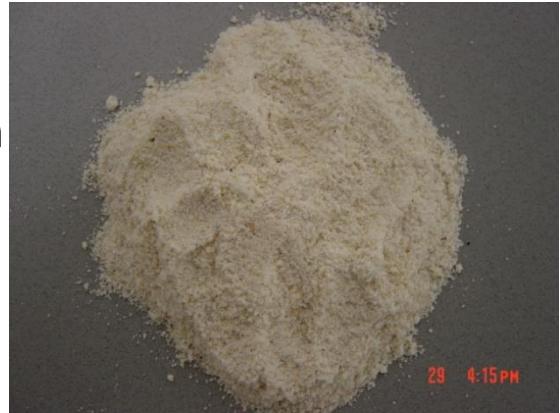
SIEVING

- Segregation of particles
- Homogenization of flour
- Assure consistency of flour properties
(adequate particle size distribution)
- Efficiency



REMILLING (DRY MILLING)

- Assure consistent particle size reduction
- Hammer wear
- Efficiency



ADDITIVES

Extend the shelf life

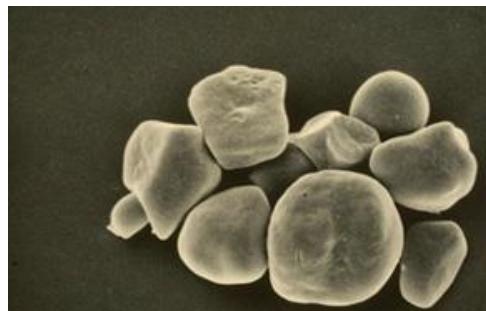
- Potassium Sorbate
- Calcium Propionate
- Fumaric Acid
- Sodium Propionate
- Color Aids
- Phosphoric Acid
- Titanium Dioxide

Texturizers

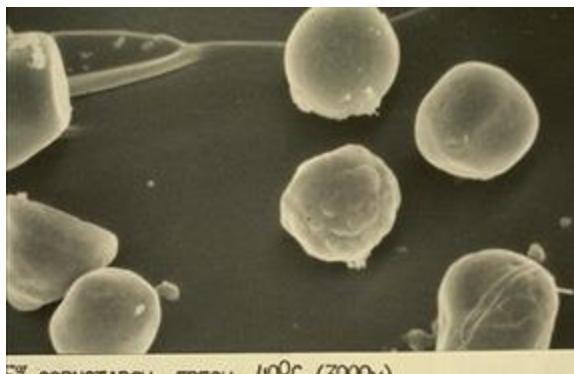
- CMC
- Guarr Gum
- Enzymes

STARCH GELATINIZATION

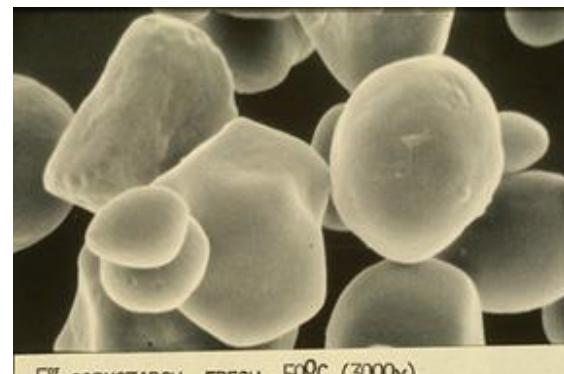
- **Loss of native structure**
 - **Swelling**
 - **Melting**
- **Depends on water and heat**
- **Starch granules are in a protein matrix that limits swelling (hard corns)**
- **Partial gelatinization**
 - **Increases water absorption and solubility**
- **Complete gelatinization**
 - **Disrupts whole structure and becomes soluble**
 - **Usually due to heat, water, shearing, alkali/acid and mechanical energy**



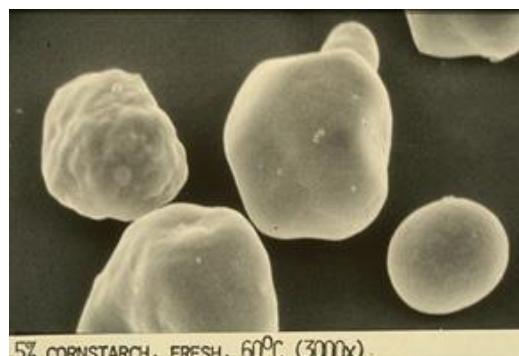
5% CORNSTARCH, FRESH, 30°C (3000x)



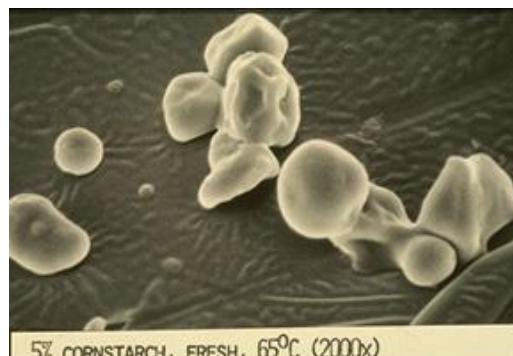
5% CORNSTARCH, FRESH, 40°C (3000x)



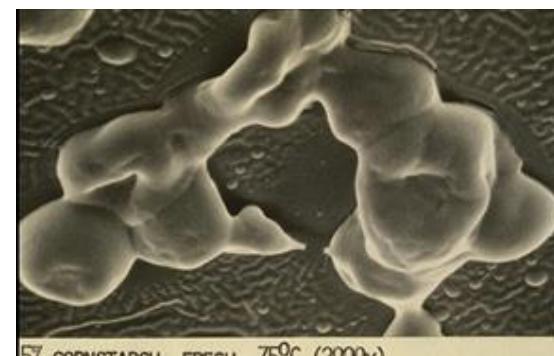
5% CORNSTARCH, FRESH, 50°C (3000x)



5% CORNSTARCH, FRESH, 60°C (3000x)



5% CORNSTARCH, FRESH, 65°C (2000x)



5% CORNSTARCH, FRESH, 75°C (2000x)



5% CORNSTARCH, FRESH, 80°C (2000x)



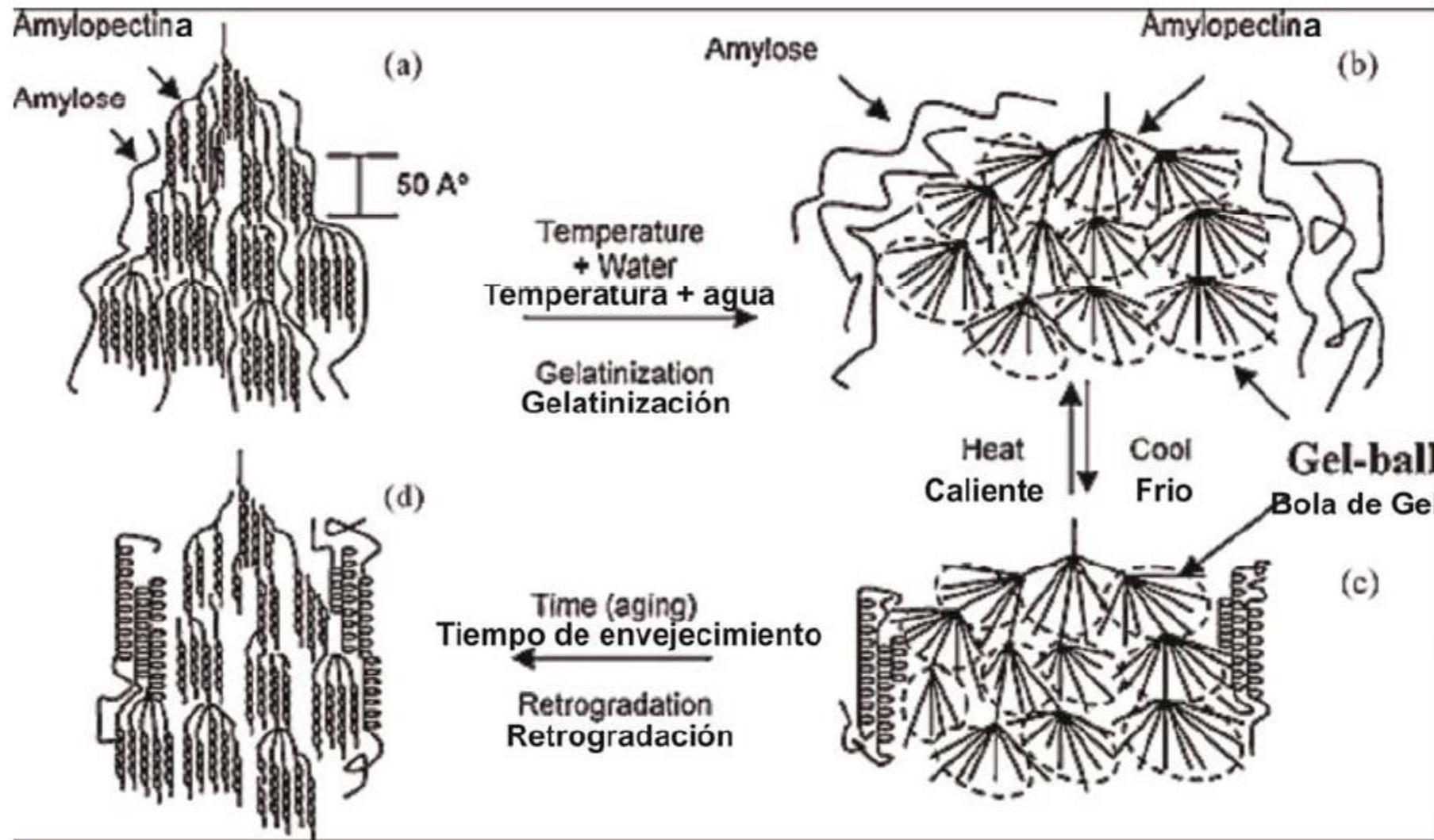
5% CORNSTARCH, FRESH, 85°C (2000x)



5% CORNSTARCH, FRESH, 90°C (2000x)

STARCH RETROGRADATION

- Opposite to gelatinization
- Affects masa properties
- Affects friability of chips
- Form backbone of tortillas and chips

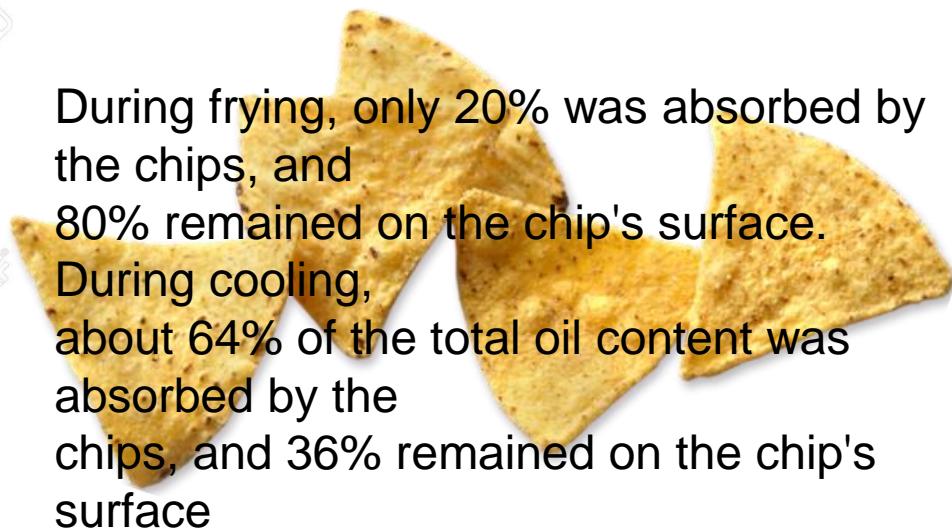


Fuente: Liu Hongsheng 2009.

Tortillas vs Chips



Moisture @ 50%



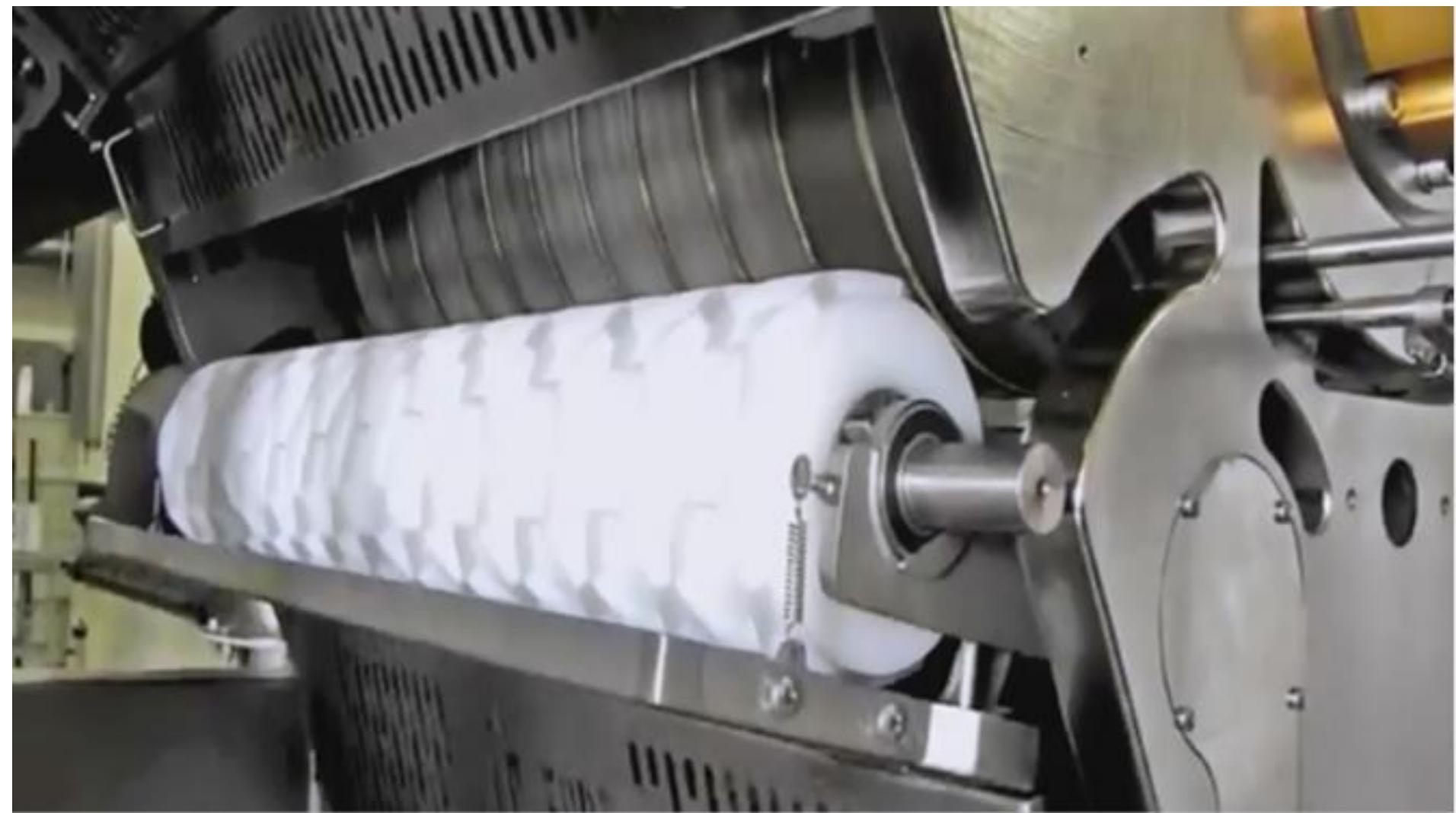
Moisture 2-3%
Oil 21 to 30%

During frying, only 20% was absorbed by the chips, and 80% remained on the chip's surface. During cooling, about 64% of the total oil content was absorbed by the chips, and 36% remained on the chip's surface

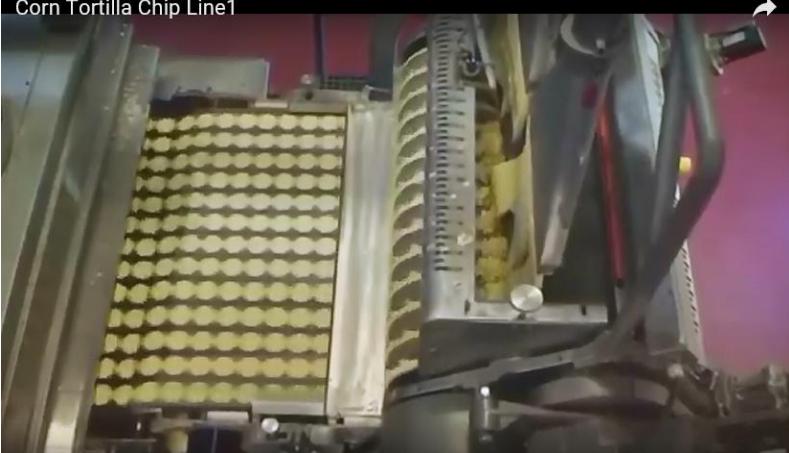




- Direct Cutter/Wire Arms



Corn Tortilla Chip Line1



Corn Tortilla Chip Line1





Thank you!