Controlling All Aspects of the Tortilla Chip Process

Tim Hulsey – Casa Herrera
+1 562.588.4962 Timh@casaherrera.com

Processing Parameters

and how they affect the finished tortilla chip production process

1. **Texture**
2. **Blistering**
3. **Bite**
4. **Oil Content**

Controlling these factors
to achieve the desired tortilla chip

Once we understand these processing parameters, we will look at the ways to control them to achieve the desired tortilla chip.

- **Todays example:**
  - **Using corn masa flour, instead of the raw corn nixtamalization process**
  - **The processing parameters from the rollers forward are the same for both raw corn and corn flour on the finished product**

Factors
affecting the finished product

- **Viscosity**
- **Granulation**
- **Moisture**
- **Thickness**
- **Equilibration**
- **Frying Temperature**
- **Fryer Exit**

Viscosity

- This relates to the amount of gelatinization that occurs during the nixtamalization process, with the combining of:
  - Heat
  - Calcium Hydroxide
  - Water
  - Time
  - (determines the amount of gelatinization of the masa)
- This determines the masa's ability to retain or release moisture during the baking and frying process.

Granulation

- **Corn tortilla for a *soft taco*:**
  - As fine a granulation as possible
  - As high a viscosity as possible

- **Goal: Retain as much moisture as possible**
  - So that when making the soft taco, it would not break apart and spill the filling

- **Since we are going to fry the chip we want**:
  - A coarser granulation
  - A much lower viscosity (so we can release as much moisture as quickly as possible)

Granulation, cont.

- **If we use and control the strata combination of large, medium and small particle sizes we can control the:**
  - Blistering
  - Bubbles
  - Crunch
  - Mouth feel of the finished tortilla chip
- **The chip will go into the fryer in the mid 30% moisture range and exit the fryer below 2%**

Moisture

- When we fry a tortilla chip with 36% moisture going into the fryer, we will exit with apx. 24% oil content
- There is a roughly 2/3rds exchange oil for water
- There are a few things that can change this ratio a little, but 2/3^{rds} exchange is a good rule to follow

Thickness

- The thicker the chip is, the farther the moisture has to travel to escape
  - So generally, a thicker chip will need to go into the fryer at a lower moisture or it can puff up and flake apart.
- Although, reducing product thickness does increase the overall percentage of oil content.

Equilibration

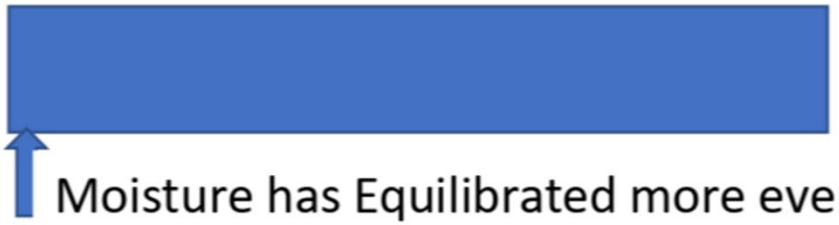
- Time that a chip rests between exiting the oven and entering the fryer
- When a chip exits the oven, it has spent its time in the oven with both sides sitting on 400c belts
- When it exits, most all of the moisture is on the interior of the chip
- The purpose that equilibration serves is to give it time to let the moisture spread more evenly throughout the chip

Equilibrator

Directly out of the Oven

Moisture

Out of the Oven for 5 Minutes



Moisture has Equilibrated more evenly

Equilibration, cont.

- With some of the moisture closer to the surface of the chip, when the water turns to steam in the fryer, it escapes easier and will cause less puffing
- The total moisture changes very little during this equilibration time
- You can shorten or lengthen the equilibration time to affect the texture and bubbles on the finished chip
  - Shorter time creating more bubbles and more oil pickup
  - Longer time creating less bubbles and oil pickup

Chip Removal from the Fryer

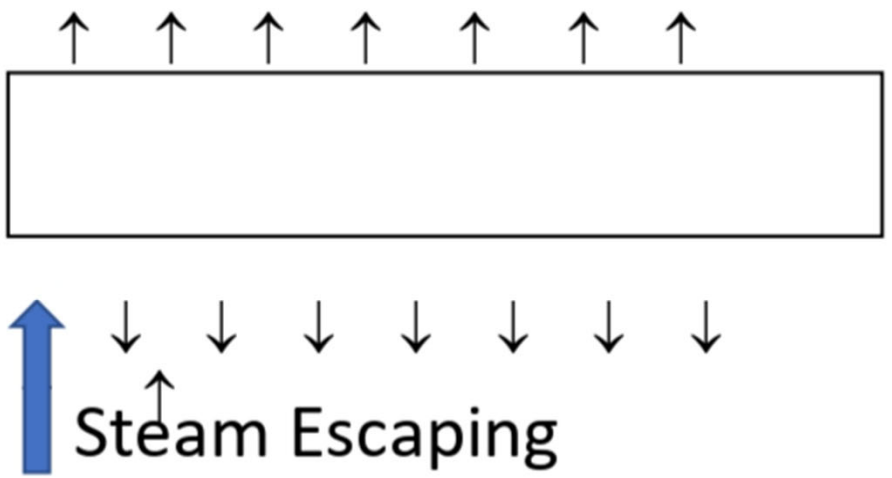
- As the steam is exiting the chip, it pushes out against the oil, and oil absorption will be at a fairly low level

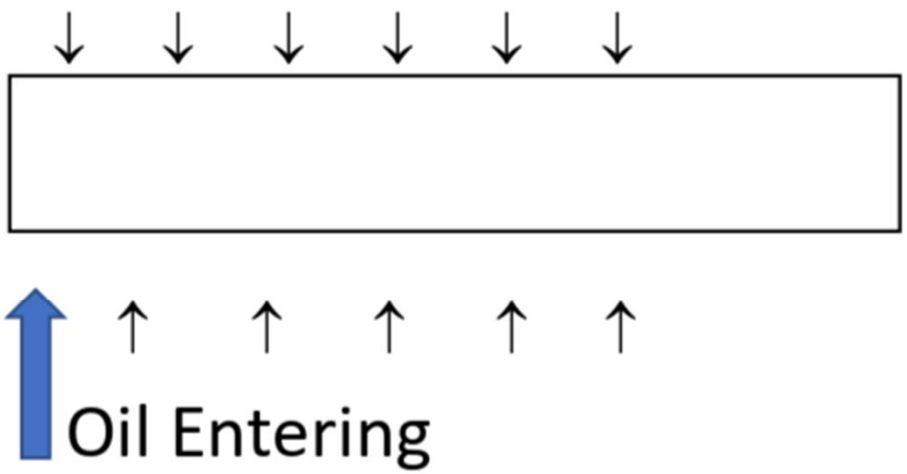
- As the amount of exiting steam begins to slow down in the final stage of frying, oil can more easily enter the spaces left by the dehydrated cells and cavities and will more easily adhere to the chip

- One other point to be aware of is when the tortilla chip reaches 2.0% moisture it is important to get the chips out of the fryer quickly

- Without any resistance from the exiting steam, oil will more quickly enter the chip, raising the oil content

Oil / Water Exchange





Chip Removal from the Fryer, cont.

- The chip will also begin to darken and take on a burnt smell and taste very quickly
- Most fryers have a submerge belt that moves the chips through the fryer while holding them under the oil
- The fryer should also have a separately driven take-out belt
- By running the take-out belt a little slower, you can stand the chips on end which will help them to drain oil resulting in a .5 to 1.0 lower oil content

Free Fatty Acids

- While FFA does not affect the finished product texture, it is something that needs to be monitored very closely
- FFA is a measurement of how broken down the oil is
- New oil should be less than .05%
- When it reaches .5% action needs to be taken to reduce it
- The moisture below 2% in the finished chip is too low for bacteria to grow so what determines shelf life is the stability of the oil

Free Fatty Acids, cont.

- Heat, light and air are what breaks oil down
- Under normal FFA levels of .5% or lower a 3-month shelf life should be easily achievable
- With certain packaging modifications,
  9+ months are achievable
- By understanding and controlling how these variables work, we can better use them to achieve the desired finished product

Controlling these factors using the *"Production Control Method"*

- It is based on the line operator having total control and responsibility for meeting all of the finished product standards for both production and quality control
- This is based on a finished product standard sheet which sets standards for all finished product specifications
- It also includes an absolute or a range of every measurable variable in the process
- A standard sheet will be made for each product produced

Controlling these factors using the *"Production Control Method", cont.*

- **Each product standard sheet will include:**
  - water amount and temp
  - type and amount of flour
  - mix time
  - product weight off of the rollers
  - roller speed
  - oven temp
  - oven dwell
  - moisture out of the oven
  - equilibrator dwell
  - moisture entering the fryer
  - fryer temp
  - fryer dwell- fryer paddle speeds
  - fryer exit moisture
  - chip weight after the fryer

Product Specification Sheet

PRODUCTION RUN SHEET

PRODUCT –Tortilla Chip yellow triangle
FLOUR TYPE—Yellow Tortilla chip #2

MIX - 100 kg flour
WATER—40 kg water – 30c temp
MIX TIME—10 minutes

SHEETER HEAD
Cutter type- Triangle
Cutter arm pressure- 80 psi
Dough weights
Right side 8-30g
Left side 8-30 g

BAKED WEIGHTS
Rt side- 8-//g
Lt side- 8-?
FRIED WEIGHTS
Rt side- 8-??
Lt side – 8- ??

OVEN
Temp-400c
infra red- ??
1st deck- 425c
2nd deck- 400c
3rd deck- 350c

Baked moisture- 32-35%
Oven dwell- 22 seconds

Equilibrating conveyor
Dwell time-4 minutes

FRYER
Temp- 180- 190c
Fryer dwell- 24 sec
Paddle speed- ??
Take out speed- ??
Fried moisture >1.8
Fried weights 8- ???

Daily Production Run Sheet

DAILY PRODUCTION RUN

SHIFT #: _____ LINE NUMBER: _____
PRODUCT – White Tortilla Chip-Triangle
BRAND – House Baked

Weights	**Dough**	**Baked**	**Fried**
1) TIME: _____			
Rt-8-?	_____	_____	_____
Lt-8-?	_____	_____	_____
MOISTURE	_N/A ___	_____	_____
2) TIME: _____			
Rt-8-?	_____	_____	_____
Lt-8-?	_____	_____	_____
MOISTURE	_N/A ___	_____	_____
3) TIME: _____			
Rt-8-?	_____	_____	_____
Lt-8-?	_____	_____	_____
MOISTURE	_N/A ___	_____	_____

Troubleshooting Guide:

To be developed for several scenarios

Example: Chip is too Oily

- Check moisture going into fryer
- Check fryer temp
- Check oil level to make sure chips are submerged
- Check baked chips weight

TESTING

- The manual testing takes too long
  - I.e. when a moisture test is taken, 15 minutes elapse before a result is given
  - In that time 250 kg of out of spec chips may have gone through the system
- Should record each of these settings once per hour

TESTING, cont.

- Recently, several companies have come out with testing systems that give immediate results on baked moisture, fried moisture and free Fatty acid fryer levels

.

- I am not recommending any one company , but the one that I am most familiar with is Tec5usa Nathan.stebbins@tec5usa.com

.

- They (and other companies) have a system that instantly monitors your baked moistures, fried moistures and free fatty acid levels in the fryer

.

- This can potentially save thousands of Euros by reducing reaction time from product being out of spec, and having to discard that product

.

- If a product tests out of spec, a correction should be made, and then retested in 15 minutes

Yield

Tortilla Chip Yield Using Corn Flour

- From **Corn Flour:**
  - 100 kg corn flour = 89 kg of corn solids (11% moisture) 89 kg corn solids + 24 kg oil + 1.5 kg moisture + 2 kg salt= 116.5 kg finished tortilla chips
- From **NIXTAMAL:**
  - 100 kg raw corn minus 14% moisture = 86 kg corn solids minus 10% corn solid cook loss (86 times .9) = 77.4 kg of corn solids ADD back 24kg of oil + 1.5% moisture + 2% salt =104.9 kg of finished tortilla chip per 100 kg of raw corn.
- **Doing it Backwards Using Corn Flour:**
  - 500g of finished tortilla chips x .725 (minus 24% oil + 3.5% salt & moisture) 500x .725 = 362.5 g of corn solids in a 500 g bag of tortilla chips. 500g x.275 % of 500g of oil, Salt & moisture. 500 x .275 = 137.5 g of oil, moisture, salt
  - 362.5 + 137.5 = 500 g tortilla chips.

Cost

(1 KG OF Tortilla Chips Using Corn Flour)

- **CORN**: Yield for 100 kg/dry masa flour is 116.5 of finished chips.
  - Price per cwt corn flour is 40 Euro.
  - 40 divided by 116.5 = .343 euro cents per kg of finished tortilla chips. Euro .343 c/kg
- **OIL**: Price per kg of soybean oil . Euro 2.75 kg X .24 = Euro .660 c/kg
- **LABOR:** 6 people x total hourly cost inc fringe = total labor per hr
  divided by Kg/hr produced ex, Euro 160 hr divided by 1000 kg/hr = Euro .160 c/kg
- TOTAL: Corn, oil, labor per kg = Euro 1.163
  per kg tc
- **UTILITIES:** Cost per btu divided by 1000 = btu cost per kg
- **GAS:** ?Electricity Kw cost divided by 1000= kw cost per kg Elec ?
- **DOES NOT** include overpack ,waste, box , bag liner, tape
- **COST** to produce 1 kg tortilla chips Total 1.163++++

Types of Chips

Q & A

Controlling All Aspects of the Tortilla Chip Process

Tim Hulsey – Casa Herrera

+1 562.588.4962 Timh@casaherrera.com