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Adding enzymes during corn stepping process

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Agenda

- Nixtamalization process
- Corn flour process
- Enzymes and corn
- Molecules change on cooked corn
- Rheology and hypothesis
- Conclusion

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Nixtamalization process

Nixtamalization

- **Origin: Mesoamerica**
  - *AZTECS*
  - *MAYA PEOPLE*

- **NIXTLI:** ASHES
- **TAMALLI:** DOUGH

- Ashes were the first calcium source to cook Corn.

- **Main objective**: softening the pericarp and endosperm to allow an easier grinding.

Nixtamalization process

	Traditional	Industrial
• Time	1 – 2 h	40 – 45 min
• Lime	1 – 2 %	0.1 – 0.4 %
• Resting time	8 – 10 h	4 - 6 h

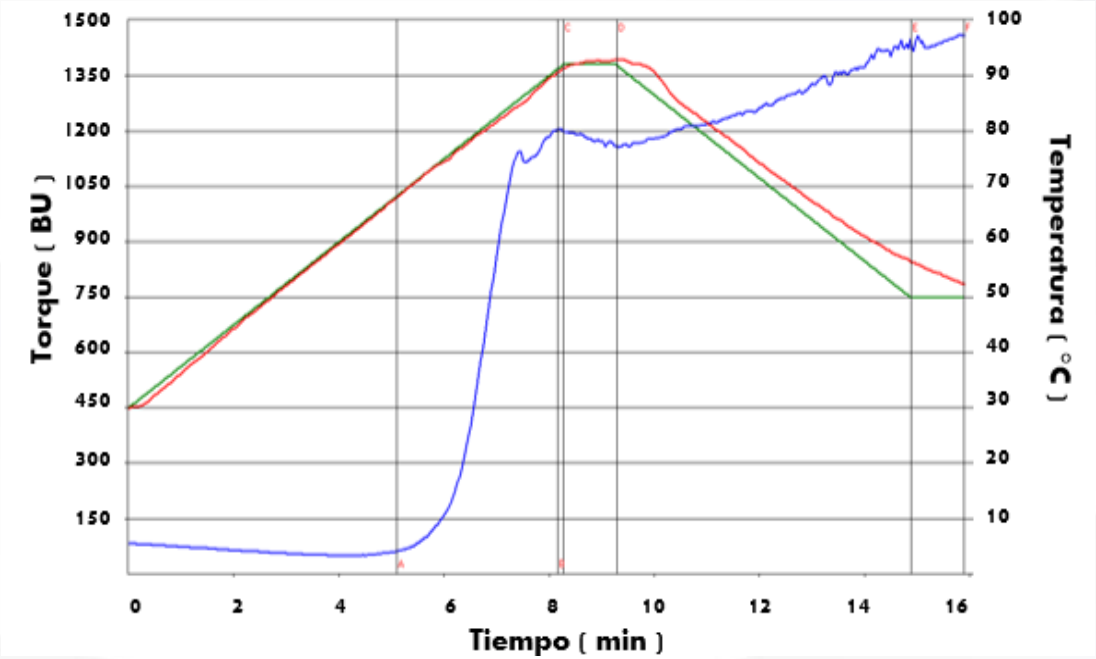
Flour Types

“Tortilla flour”

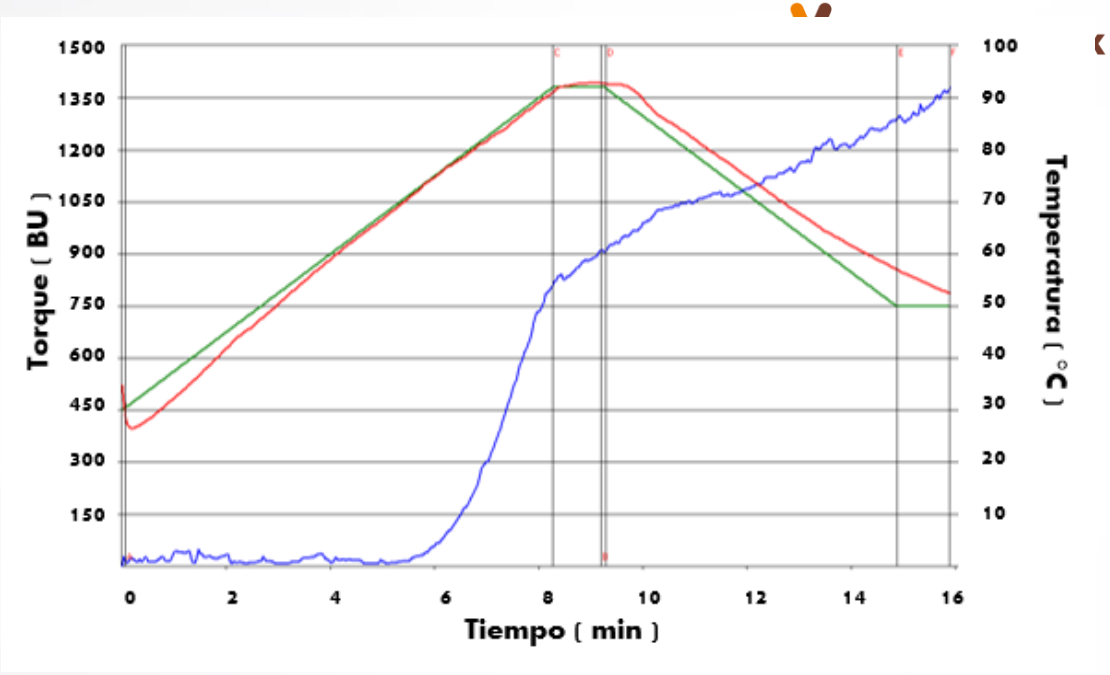
“Easy to prepare masa”
120–140 % water absorption

“Snack flour”

“No cohesiveness. No MASA”
60–100 % water absorption



“Tortilla flour”

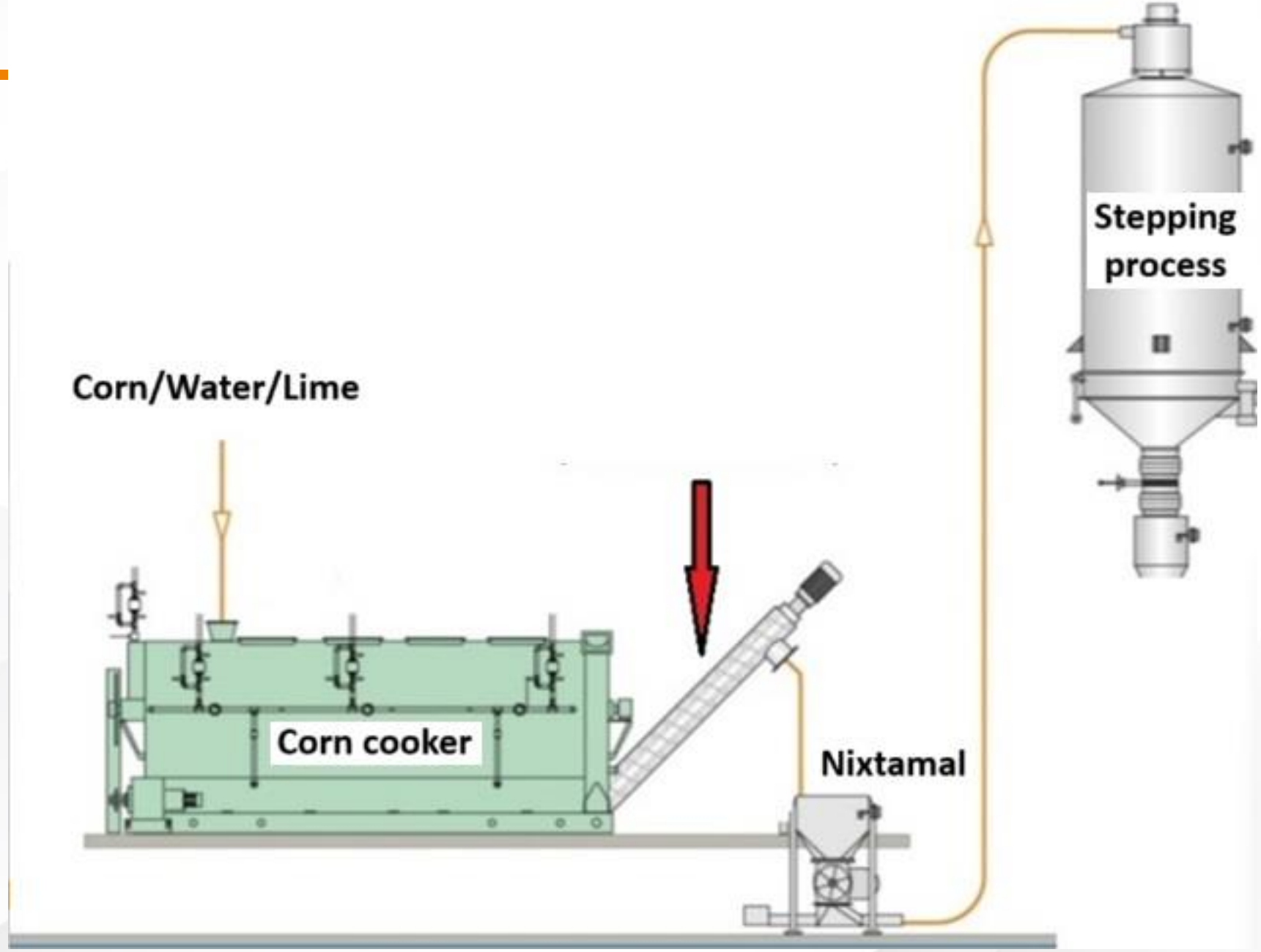


“Snack flour”

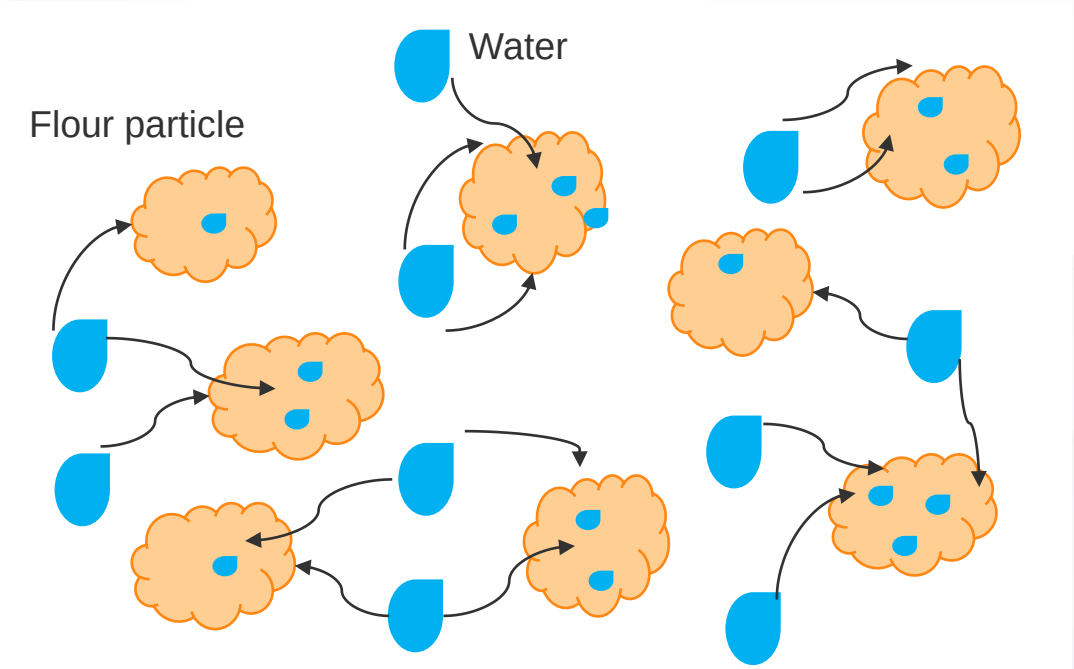
- Cooking grade
- Particle size
- Water absorption

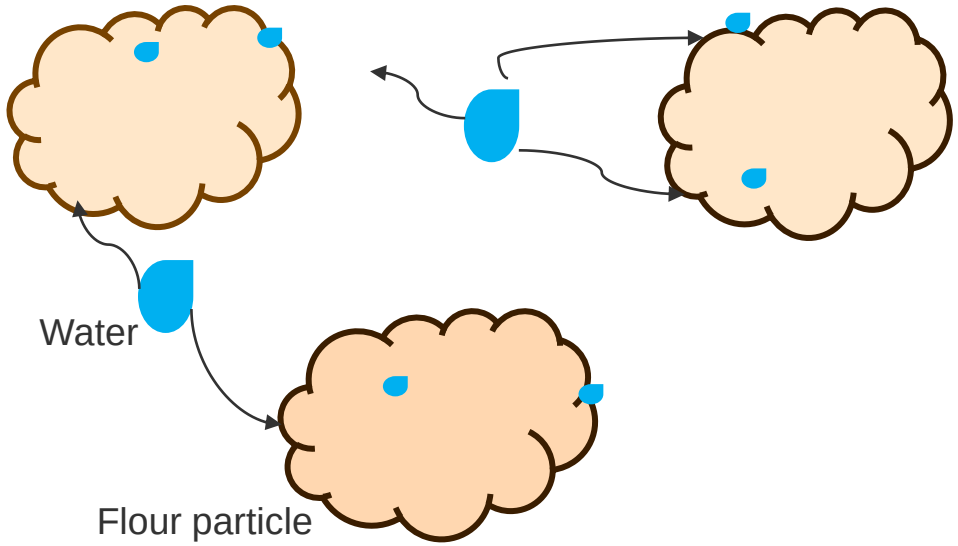
Main modifications on starch

Corn flour process


Corn/Water/Lime
Corn cooker
Nixtamal
Stepping process

Particle size





“Tortilla flour”

“Snack flour”

Dough machinability

- For plastic or stainless-steel roller head
- No warm or hot water needed
- Improved machinability

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STERNWYWIOL GRUPPE

Enzymes and corn

Composition

Pericarp

5% Fibers

Endosperm

83 % Starch

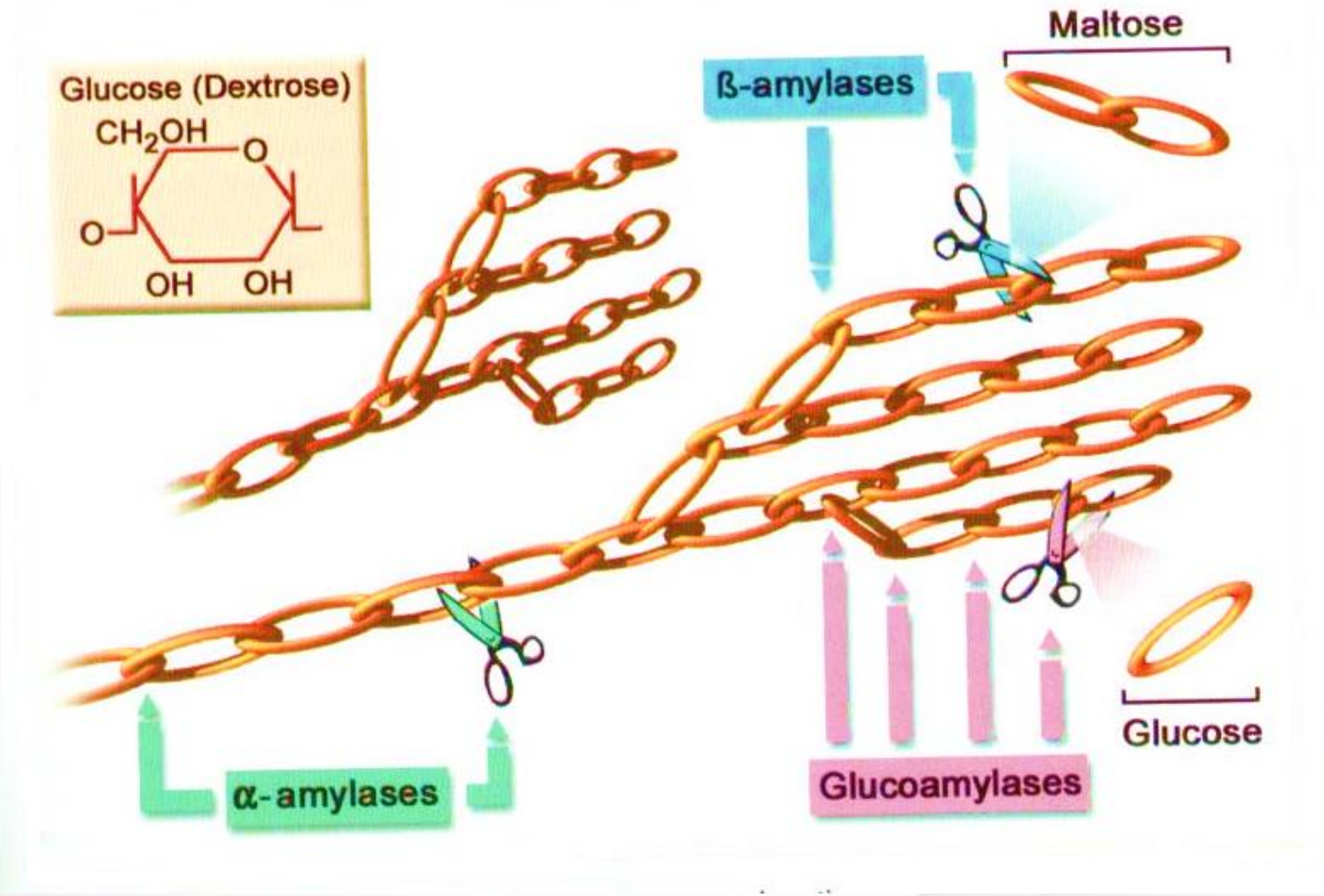
Germ

11 % Fat / Proteins

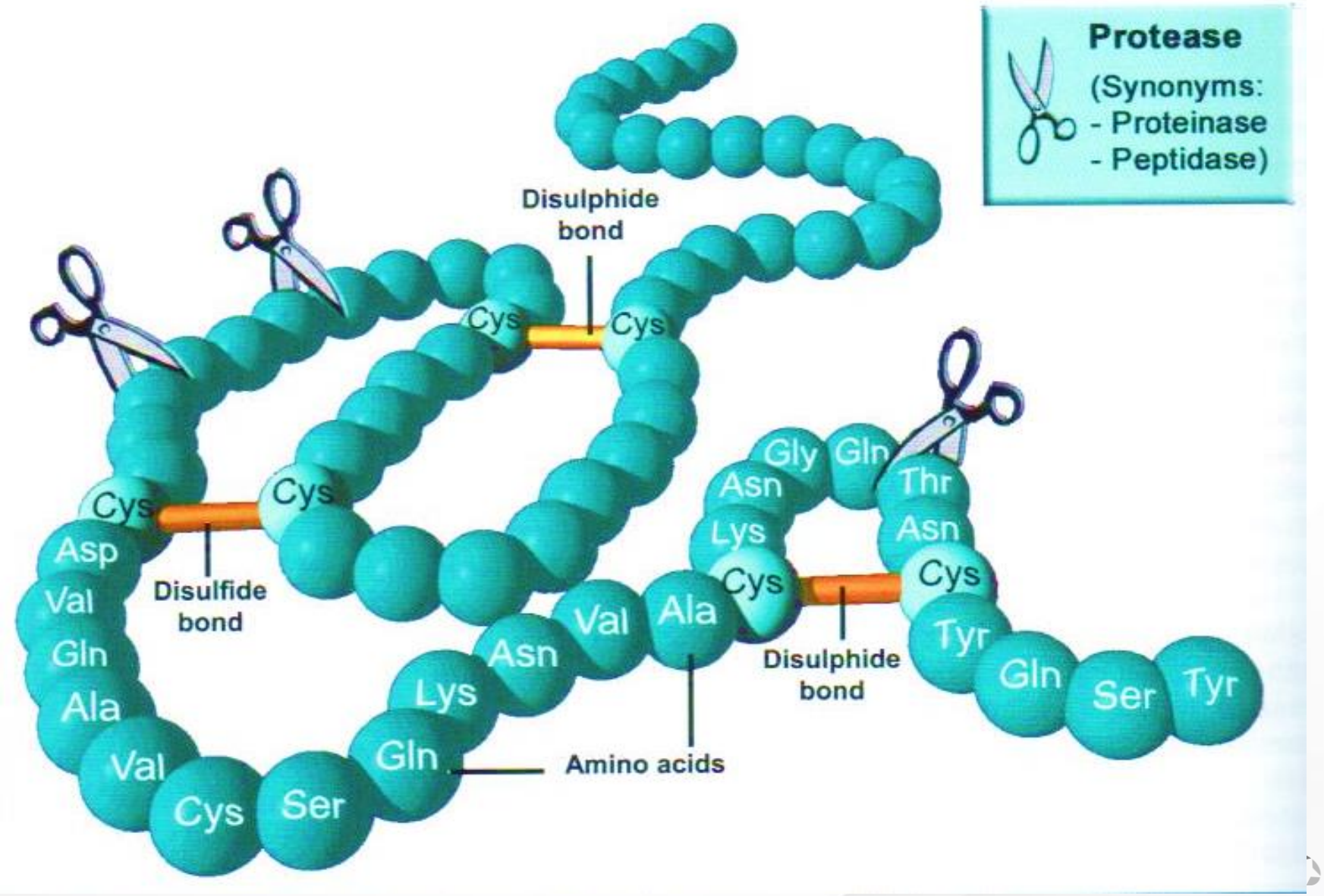
Pedicel

1 % Fibers

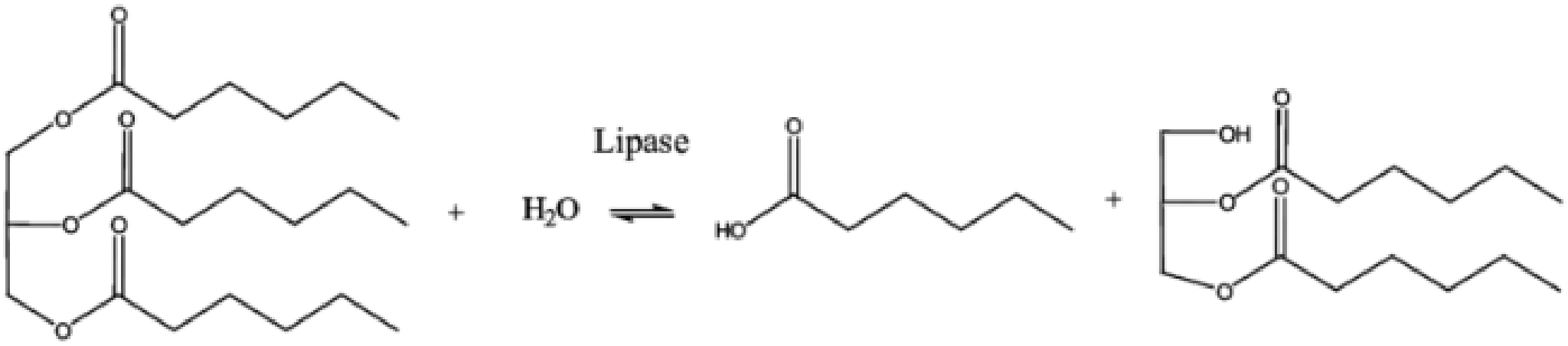
AMYLASE


Glucose (Dextrose)
CH_2OH
O
O
OH
OH
Maltose
ß-amylases
α-amylases
Glucoamylases
Glucose

PROTEASE

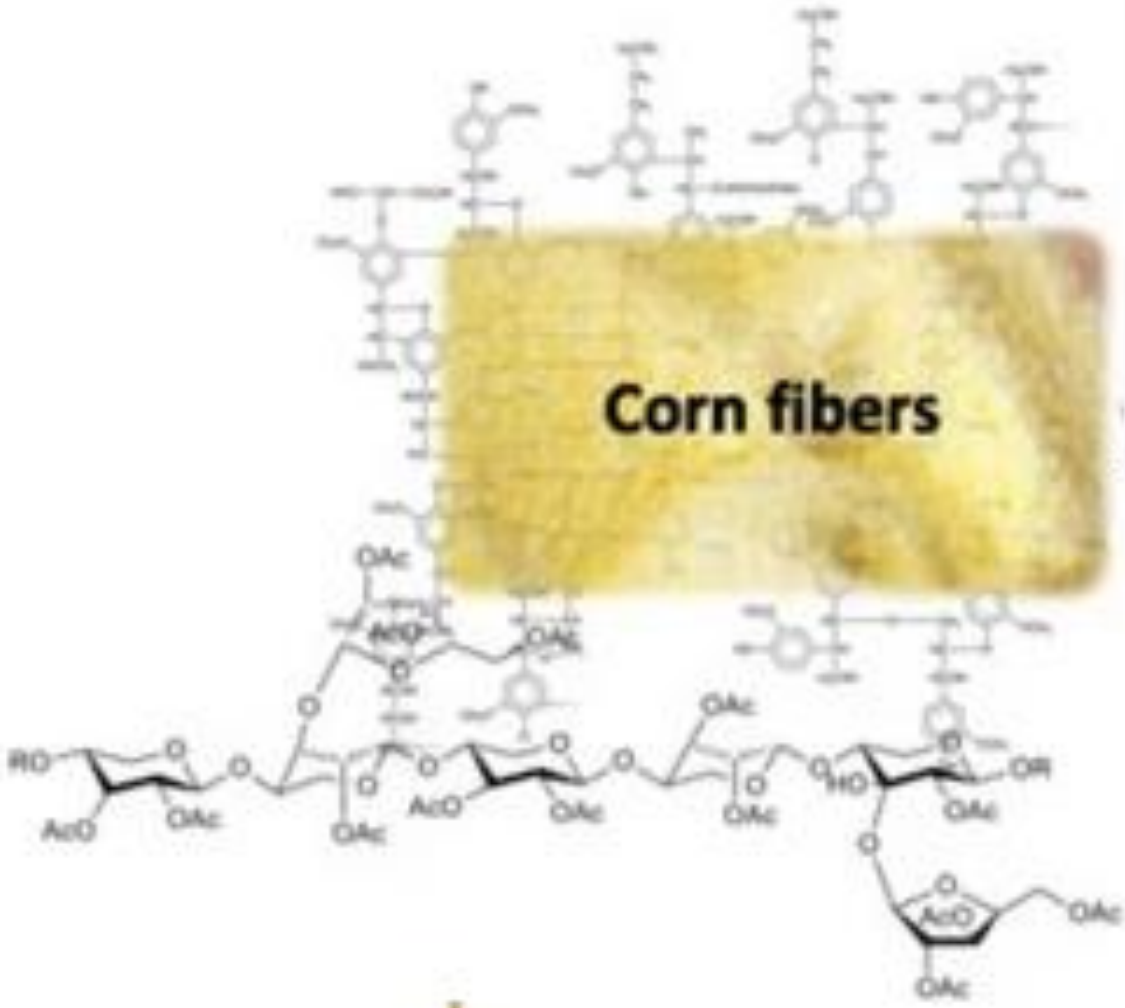

Protease
(Synonyms:
- Proteinase
- Peptidase)
Disulphide bond
Cys
Cys
Cys
Cys
Disulfide bond
Asp
Val
Gln
Ala
Val
Cys
Ser
Gln
Lys
Asn
Val
Ala
Amino acids
Gly
Gln
Asn
Lys
Cys
Thr
Asn
Cys
Disulphide bond
Tyr
Gln
Ser
Tyr

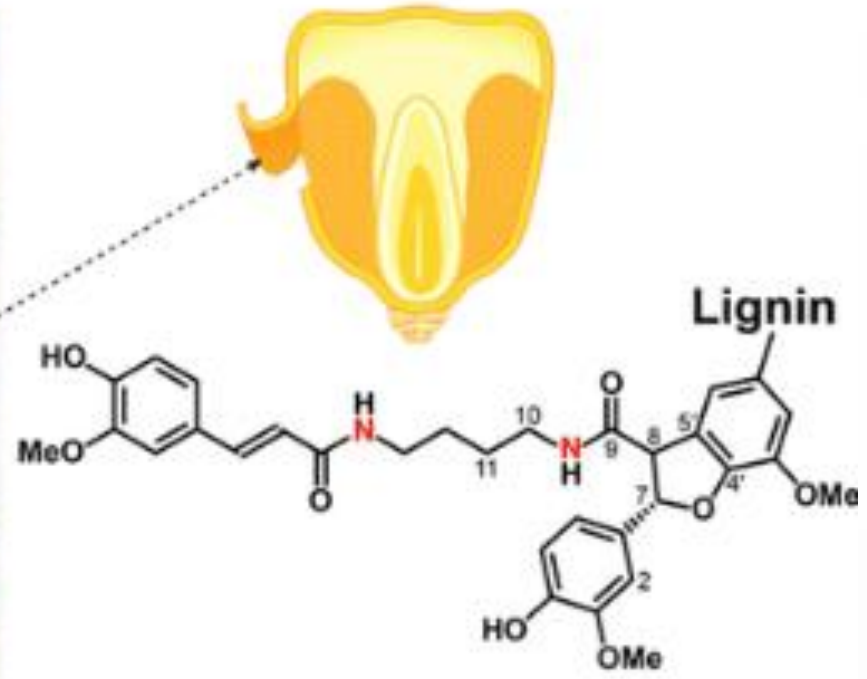
LIPASE



Jaeger y col. 1994.

HEMICELULLASE





Moreira y col., 2022; Del Río y col.,2018.

Molecules change on cooked corn

Starch

- Endosperm
- **72 %** of corn kernel
- Mayor role on rheology properties of dough and corn products
- Mainly fat - starch and protein – starch complex

Proteins

- Germ and endosperm
- **8** to **11 %** of corn kernel
- Low quality protein

LIPIDS

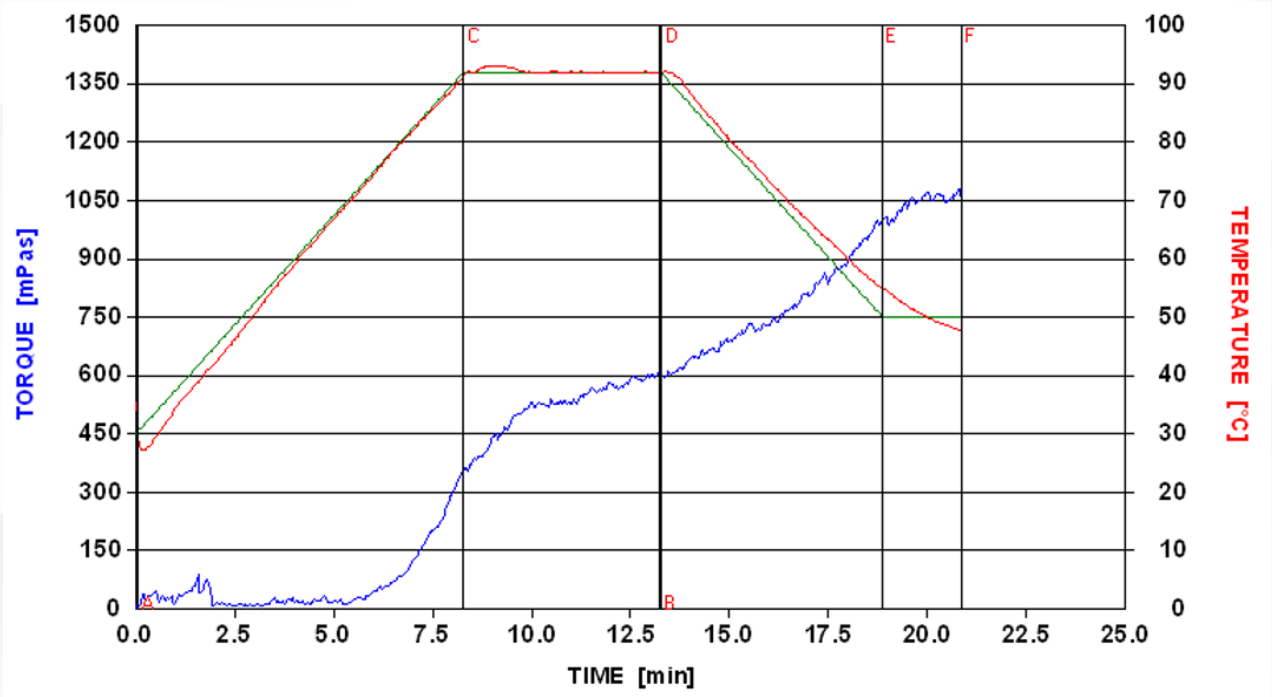
- Germ
- Less than 5% of the composition
- Low levels of saturated fats
- Rich in oleic and linoleic acids

VITAMINS AND MINERALS

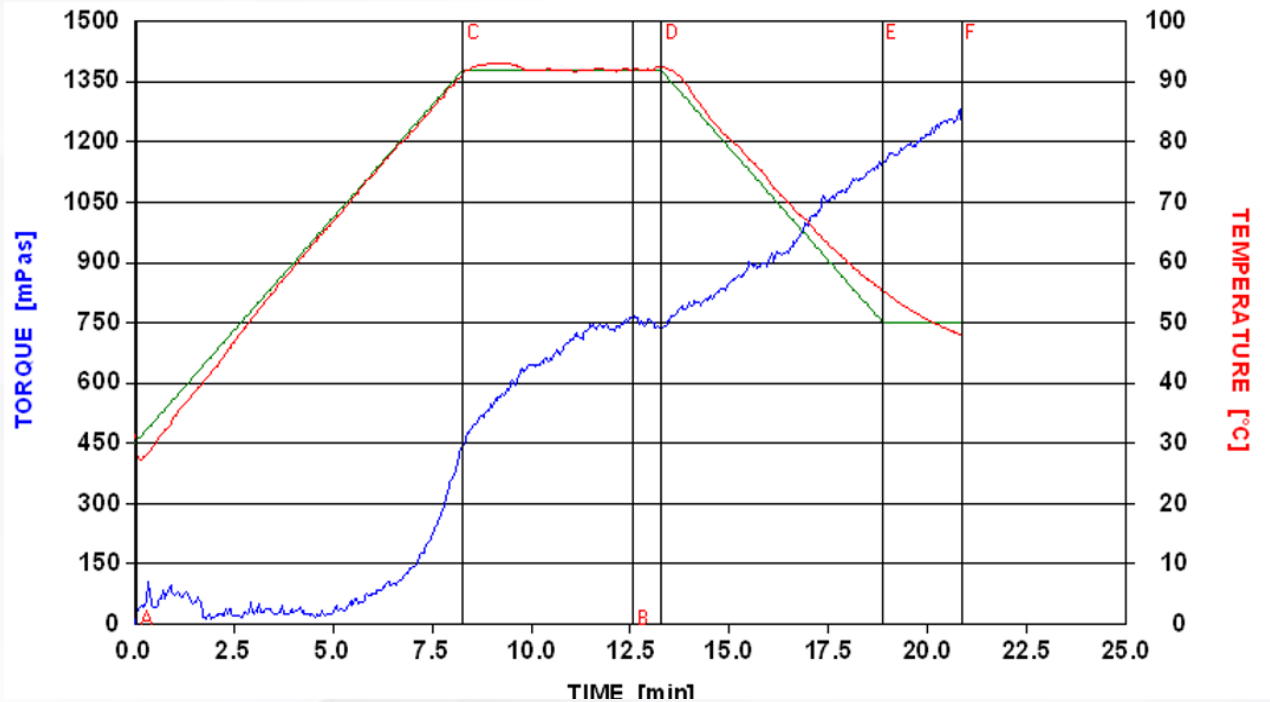
- Primarily located in the germ
- High niacin content, though not bioavailable
- Depends on the type of corn
- Phosphorus, potassium, magnesium, sulfur

Amylogram modification

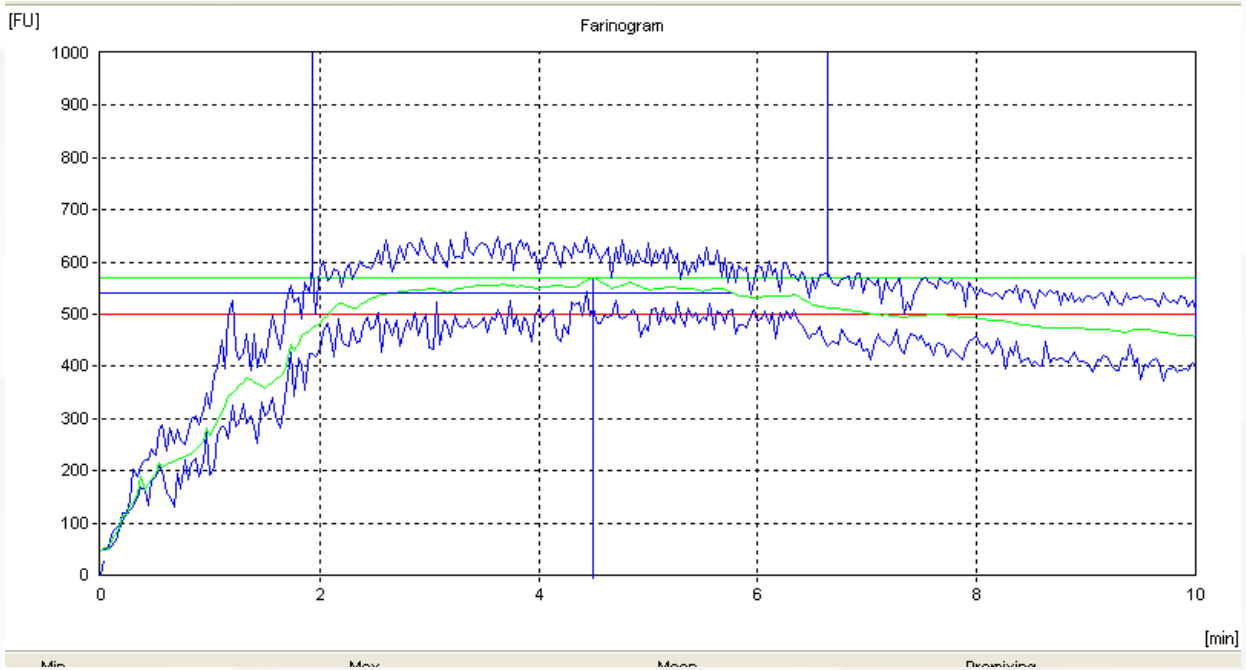
Snack flour

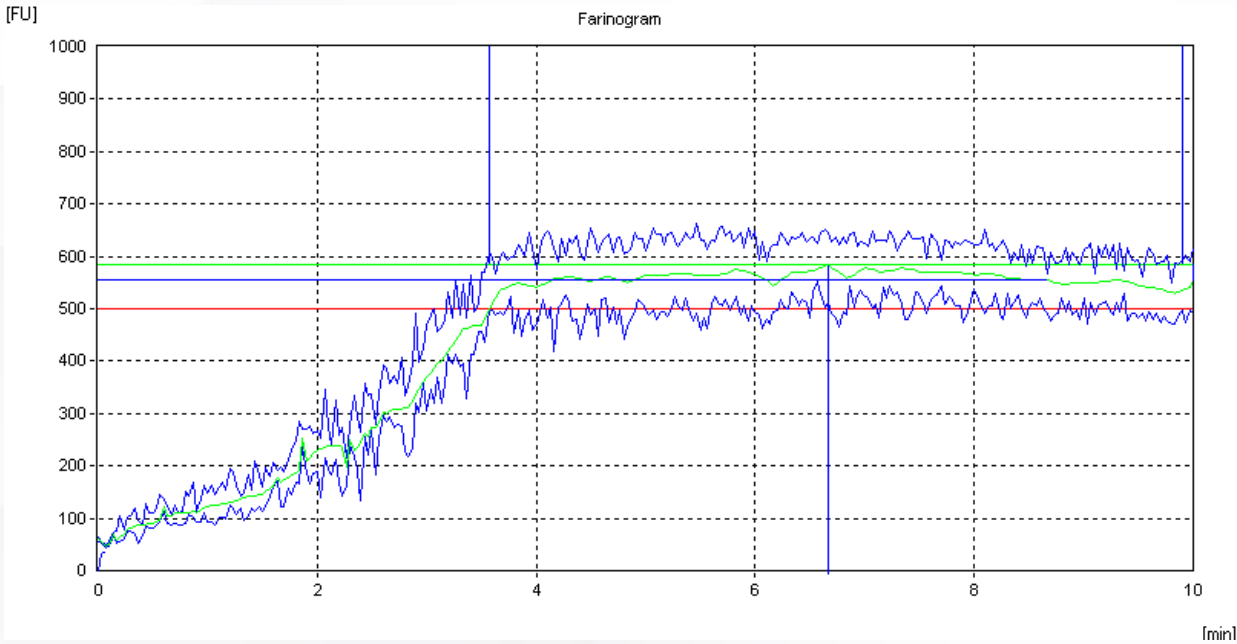


Snack flour + dough conditioner 0.5%

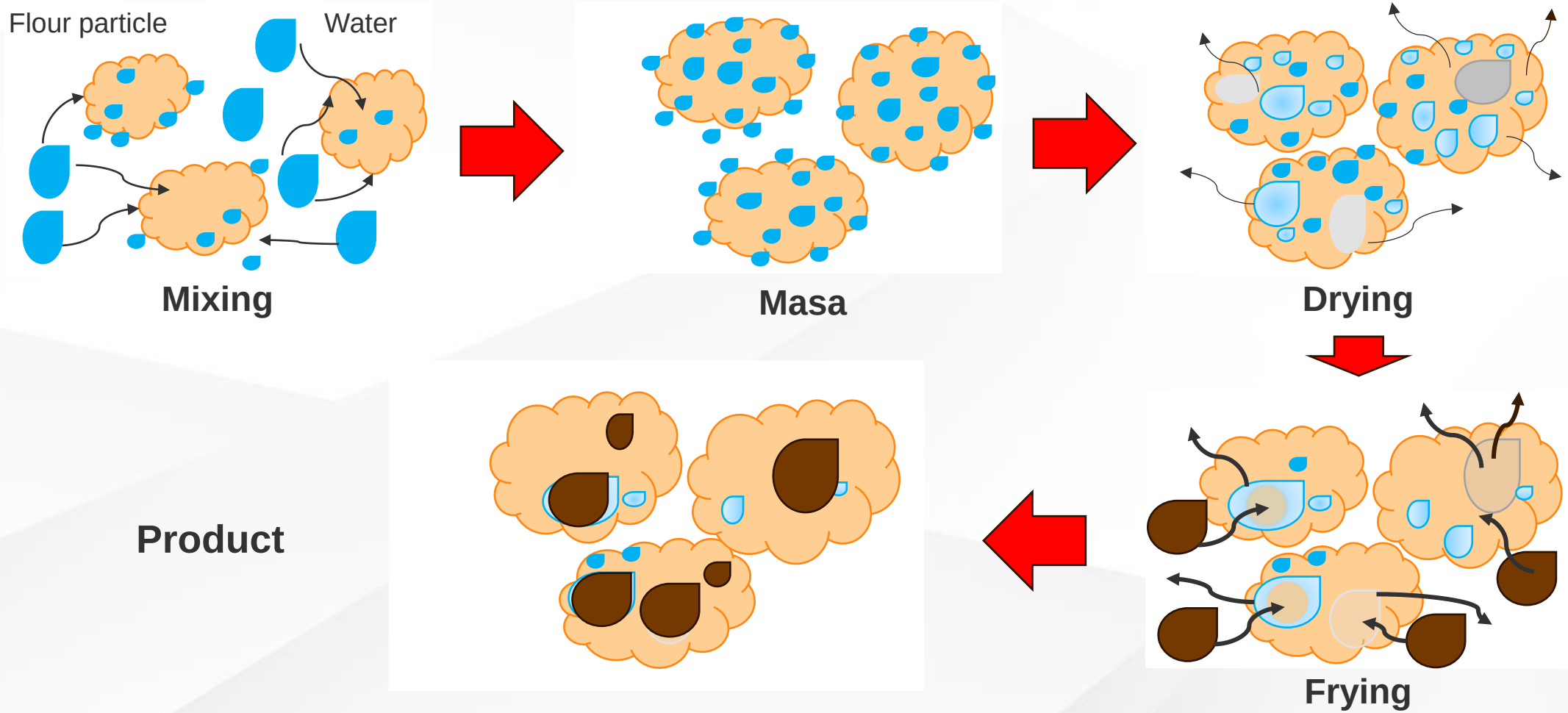


Consistence





Moisture ⟷ Oil



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Conclution

Changes

- ✓ It can change the yield of the flour (kg corn vs kg flour)
- ✓ It improves the milling process
- ✓ It changes the rheology of the flour/dough

Energy efficiency

- ✓ Less time to cook the corn kernel
- ✓ Improve the softness of cooked corn
- ✓ Improves the consistency of batch
- ✓ Change the rheology of the flour/dough

Dough improvers

- ✓ Increase efficiency of additives
- ✓ Reduce the dosage of dough improvers
- ✓ Synergy between ingredients

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Thank you very much for your attention

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