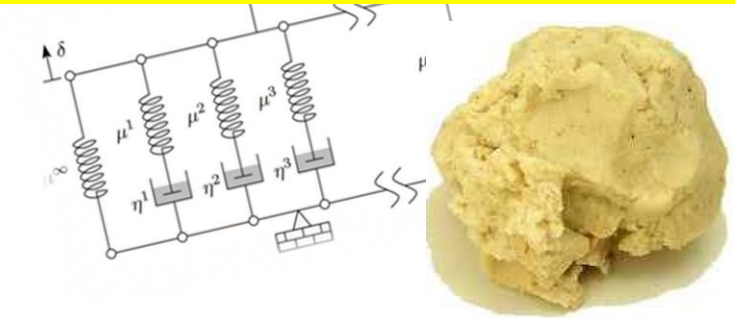
4th ICC Latin American Cereals Conference

LACC IGW

VISCOELASTIC behavior of masa from corn flours obtained by nixtamalization with different *calcium sources*



David Santiago-Ramos

Dr. Juan de Dios Figueroa-Cárdenas

Mexico City, March 12, 2018

Corn masa *viscoelasticity*…

Instant *nixtamalized* corn flour

Reconstitution

Mixing/kneading

Molding

- **Water absorption**
- **Tolerant to mixing**
- **Machinability**

NIXTAMALIZATION

Ca^{2+} source

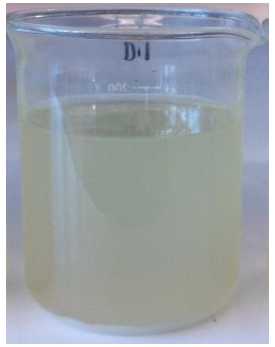
Corn → Cooking (>25 min) ← Water

Cooking (>25 min) → Steeping (>1.0 h)

Steeping (>1.0 h) → Rinsing ← Water

Rinsing → "Nejayote" (Cooking solution)

Rinsing → Nixtamal

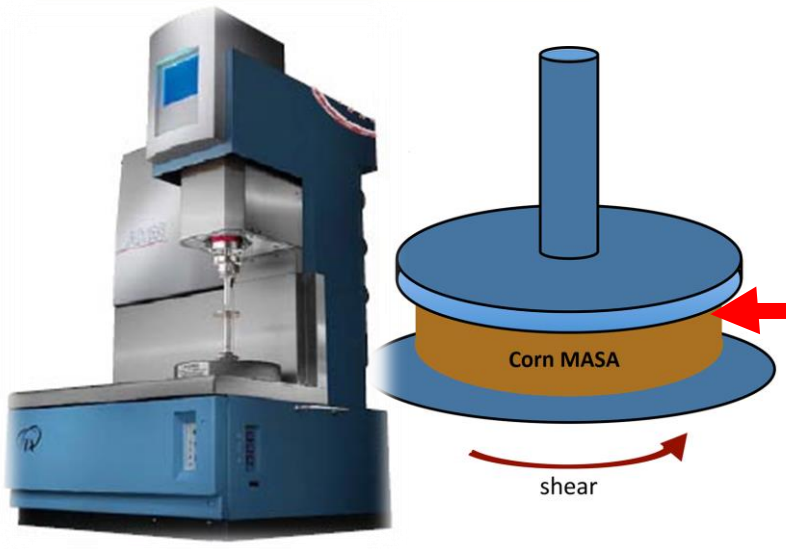


Nixtamal → Wet milling → Masa → Flash Drying → **INSTANT CORN FLOUR**

TRADITIONAL $Ca(OH)_2$

Corn masa *viscoelasticity*…

Dynamic oscillatory test



G' Storage modulus "Elastic modulus"

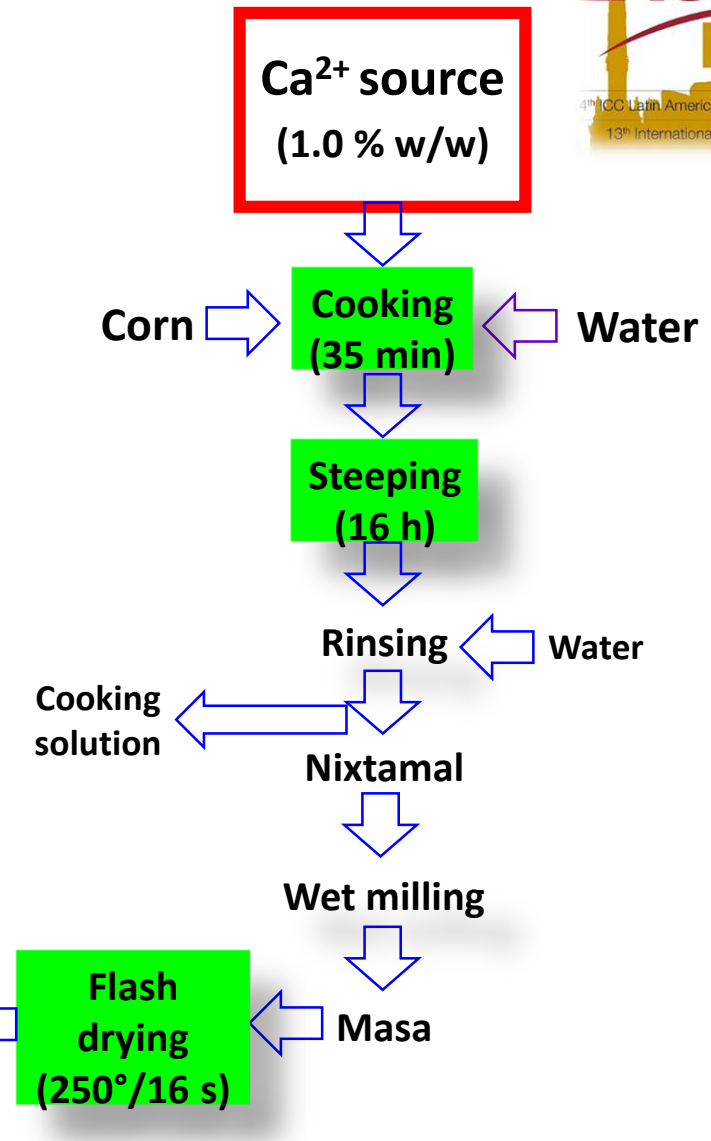
G'' Loss modulus "Viscous modulus"

η* Complex viscosity

$$\eta^* = K\dot{\gamma}^{n-1}$$

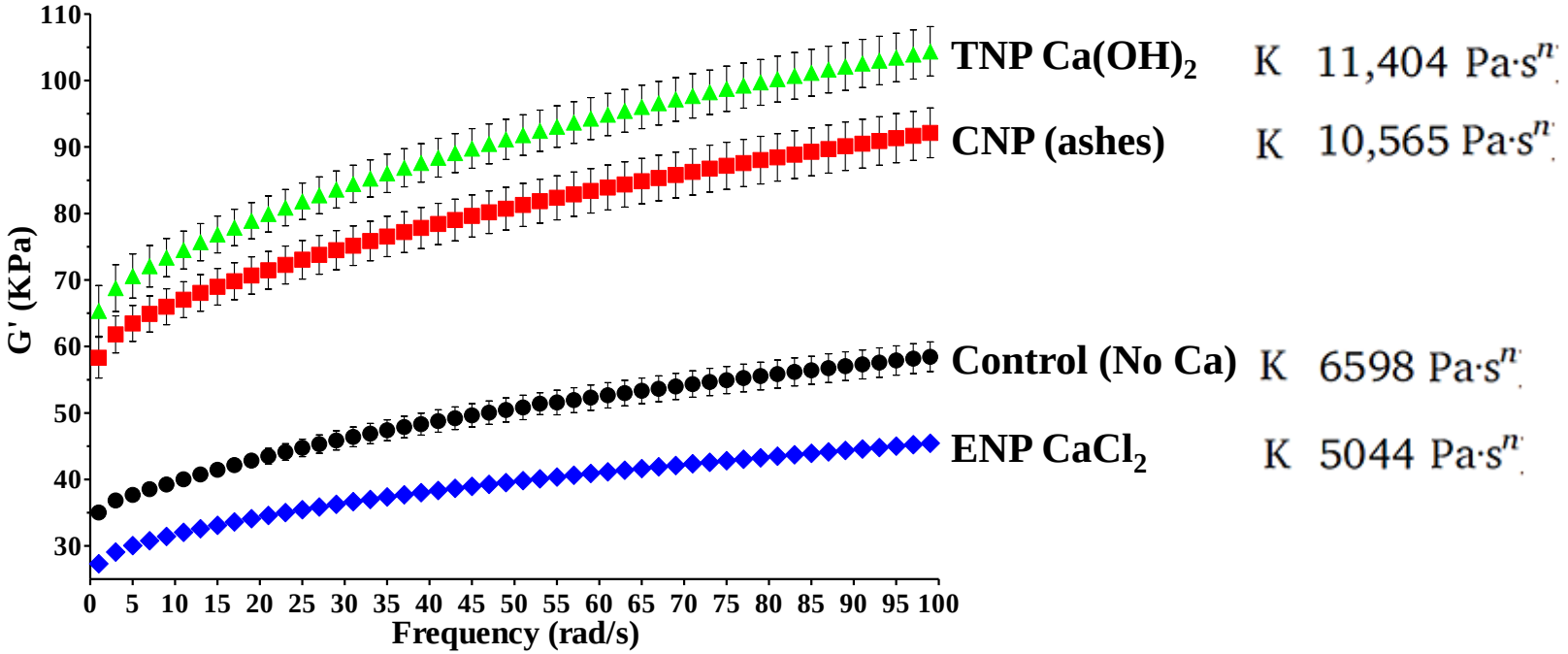
n flow behavior index

K consistency coeffiecient

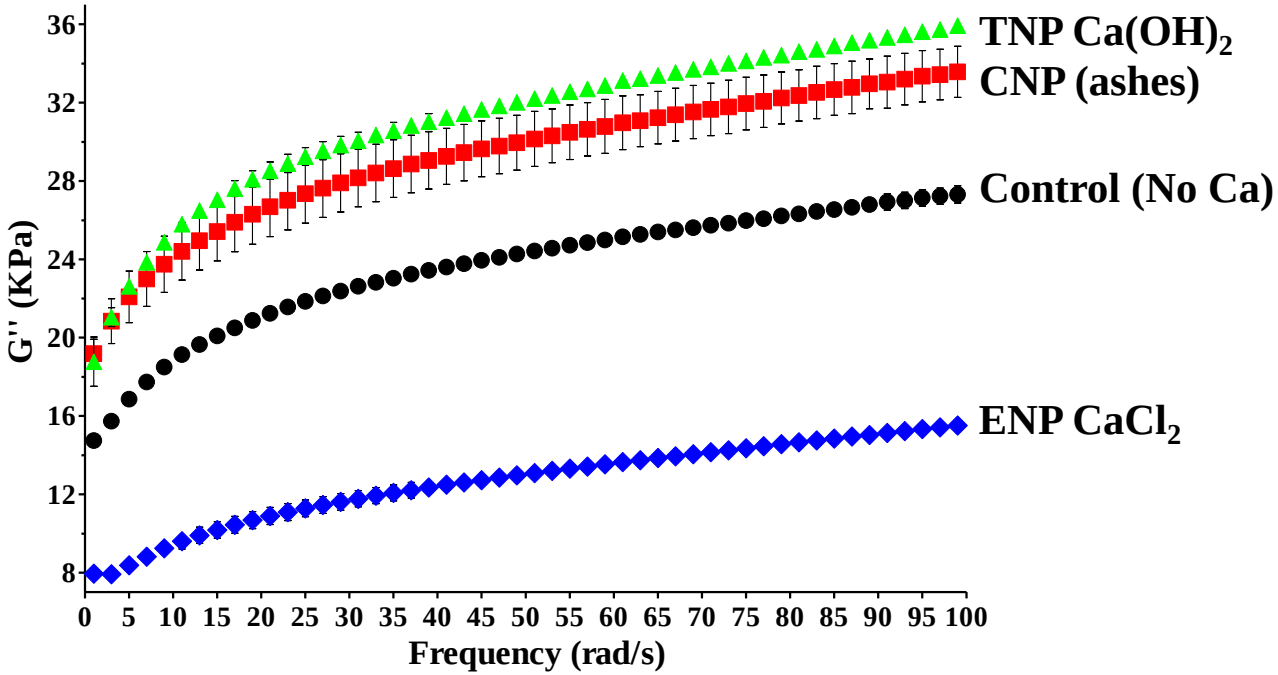


Corn masa *viscoelasticity*…

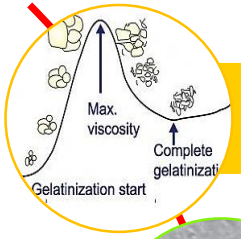
G’
(storage modulus)



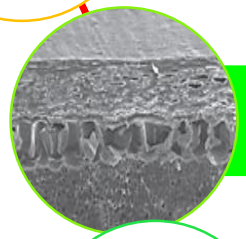
G’’
(loss modulus)



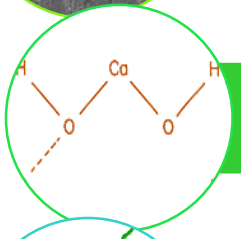
FACTORS INFLUENCING VISCOELASTICITY



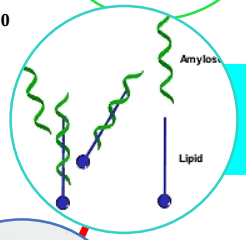
Starch gelatinization



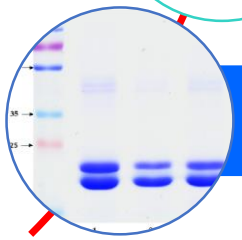
Pericarp hydrolysis



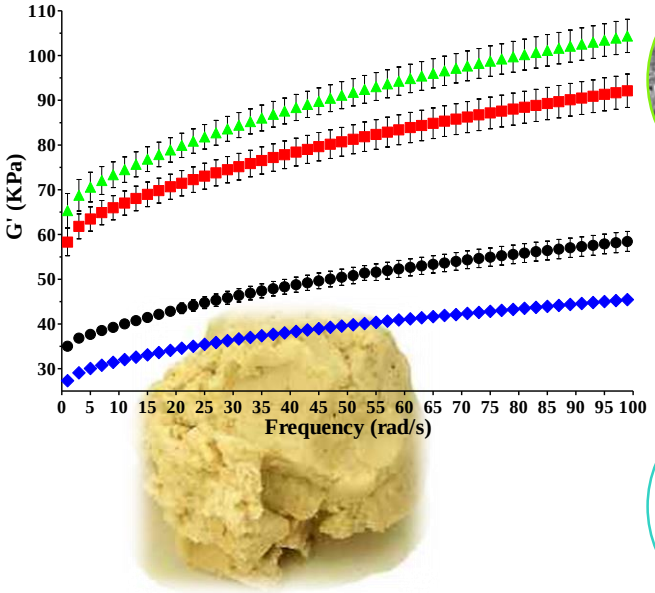
Calcium-starch interactions



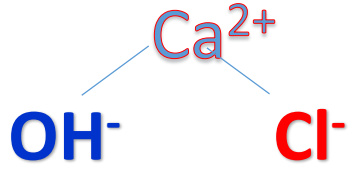
Amylose-lipid complexes



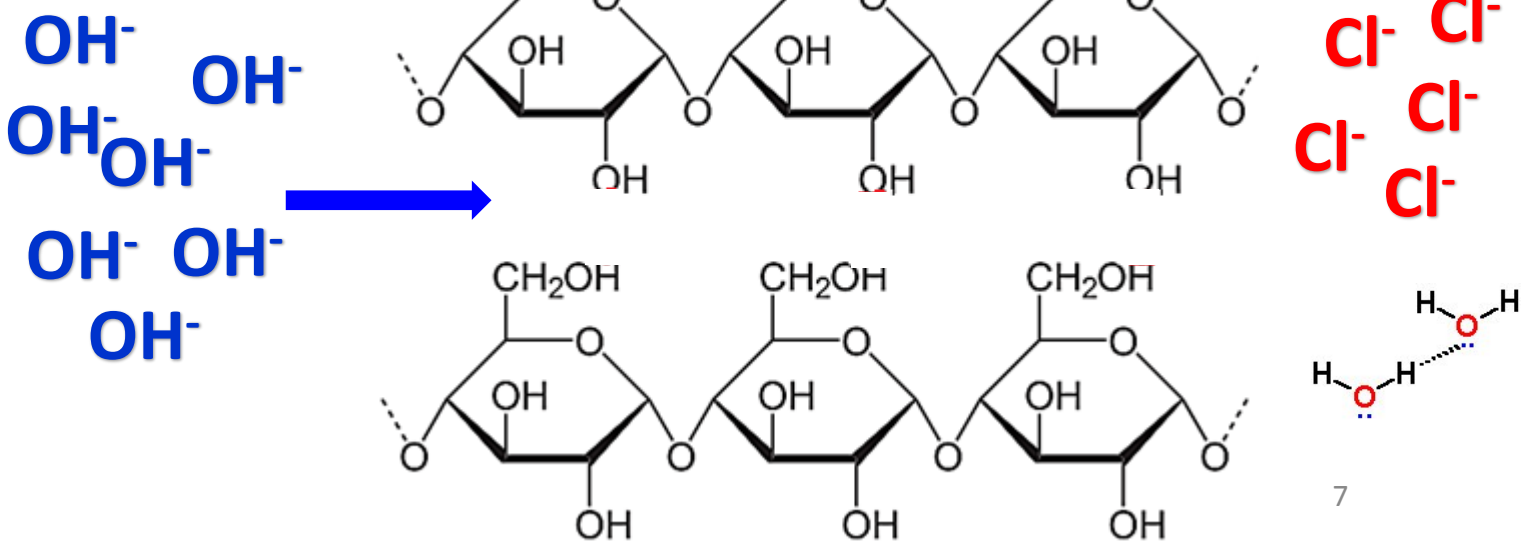
Calcium-zein interactions/Protein structure



1. STARCH ?

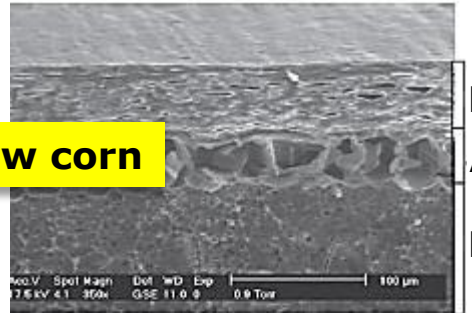


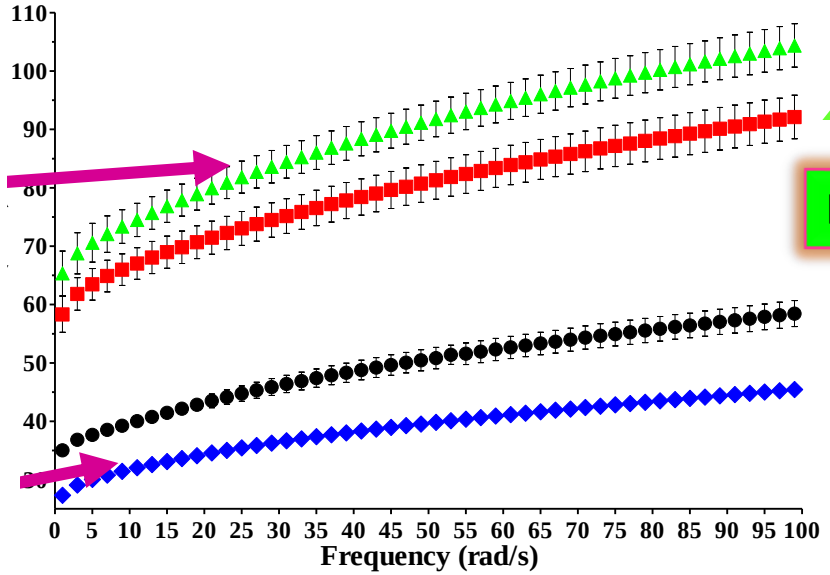
Cooking	~12.37 %	~0.8 %
Milling	~14-16 %	
Drying	~0.5 %	



Corn masa *viscoelasticity*…

2. PERICARP HYDROLYSIS ?

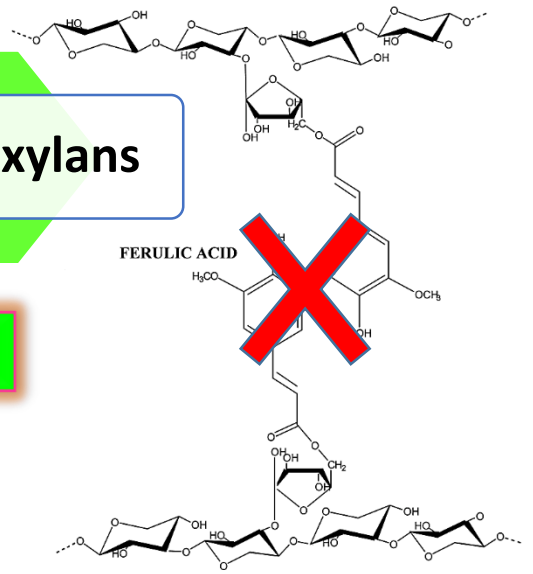




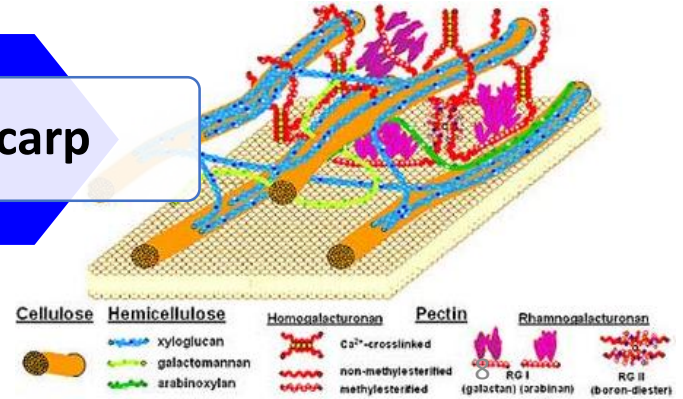
Arabinoxylans

Hydrocolloids

Vs

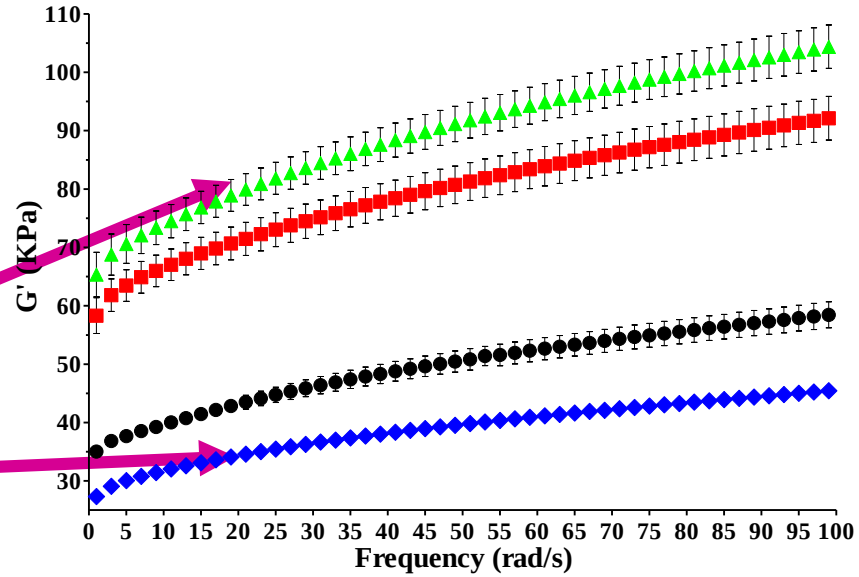


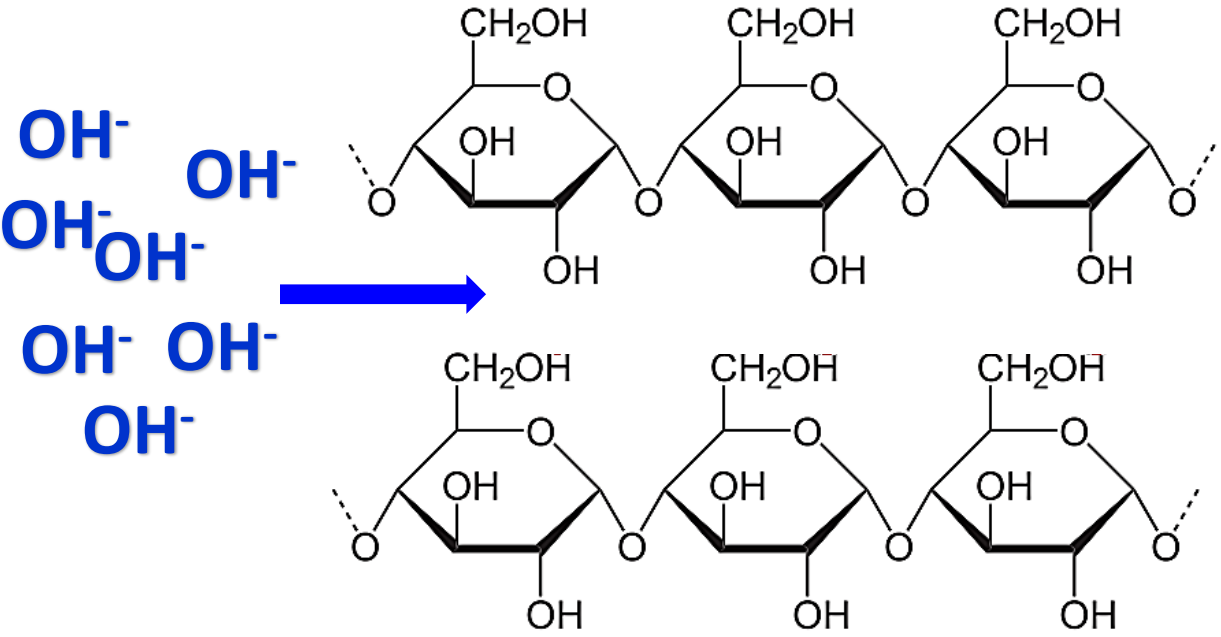
Pericarp

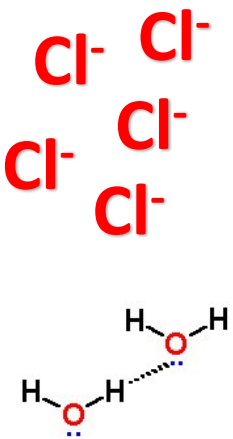


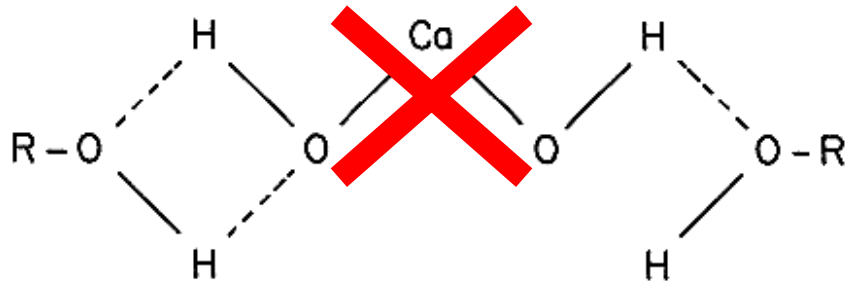
3. Ca-STARCH INTERACTIONS ?

Flour	Calcium mg/100 g
Raw corn	6.1± 0.4
Control (No Ca source used)	25.0d
Classic (Wood ashes)	70.9c
Traditional $Ca(OH)_2$	213.0a
Ecological $CaCl_2$	105.0b







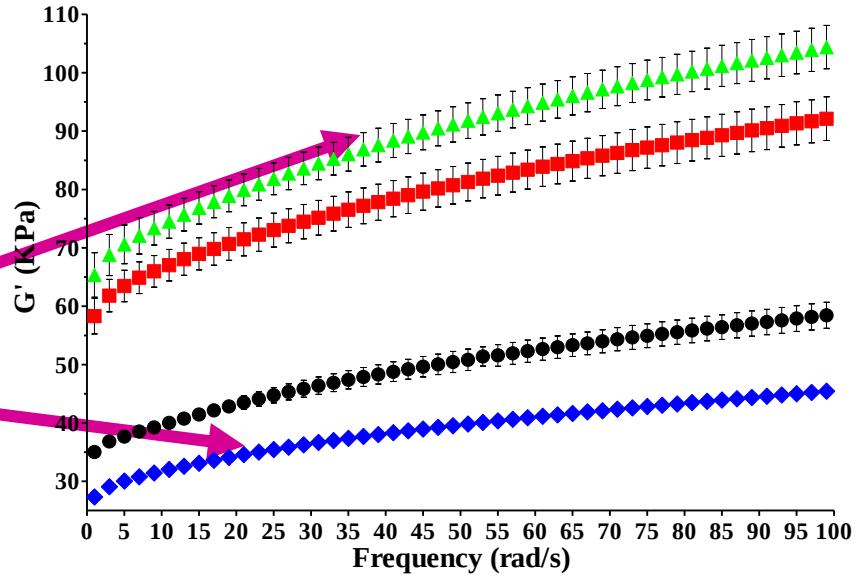


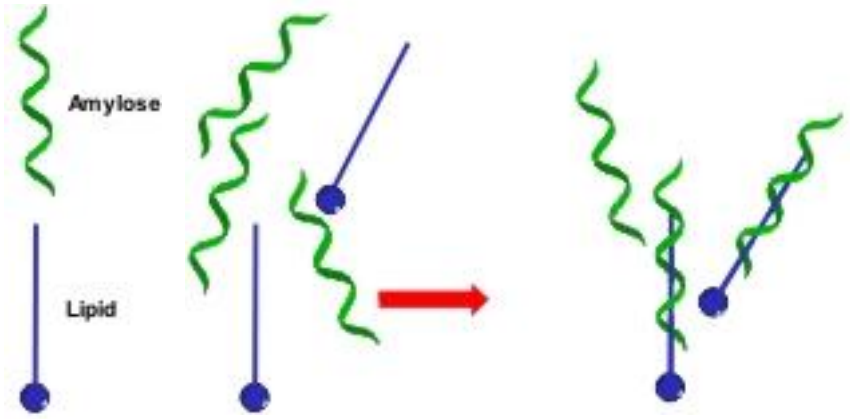
Rodríguez et al. (1996)

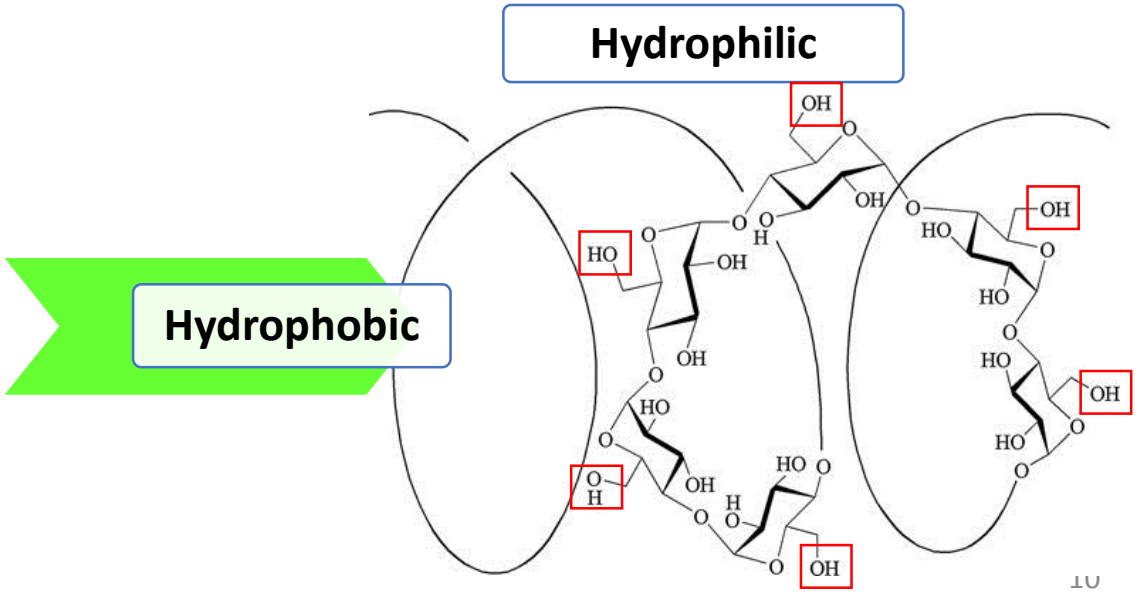
9

4. AMYLOSE-LIPID COMPLEXES ?

Flour	Tp_{RS5}	ΔH_{RS5}
Raw corn	102.79±1.33	0.71±0.05
Control (No Ca source used)	97.65a	0.12b
Classic (Wood ashes)	98.57a	0.18ab
Traditional $Ca(OH)_2$	98.66a	0.28a
Ecological $CaCl_2$	98.67a	0.13b







5. PROTEINS ?

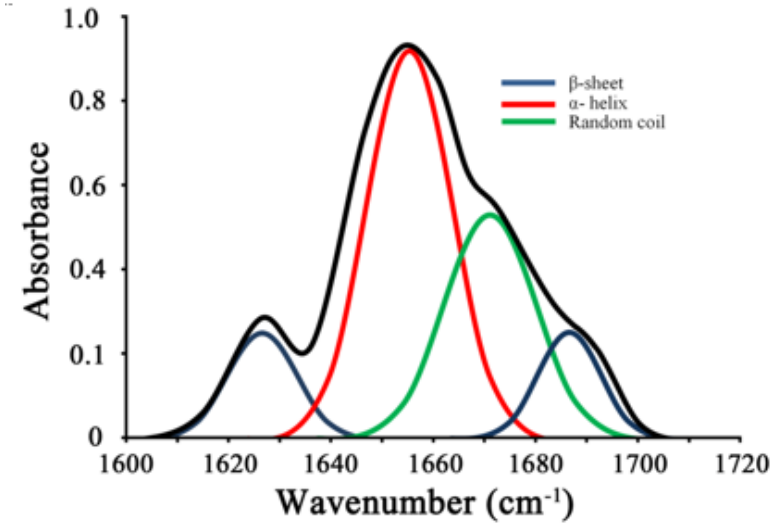
Calcium-zein interactions/polymerization

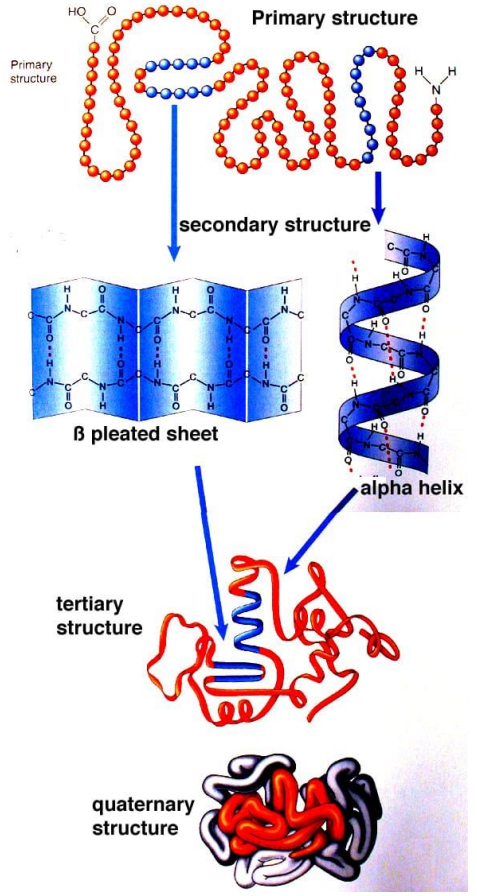
- Quintanar Guzmán et al. (2010; 2011)
- Chaidez-Laguna et al. (2016)

Structure/conformation

- **Dr. Figueroa's Lab**

FT-IR
Raman spectroscopy
Rheology





Final remarks

1. • $Ca(OH)_2$ and wood ashes enhance the viscoelasticity of masa
2. • Degree of gelatinization, fiber, and starch interactions influence greatly the corn masa viscoelasticity.
3. • Ecological processes: environmental solution vs masa quality?
4. • Nixtamalization and processing conditions (cooking, milling, …)?

4th ICC Latin American Cereals Conference

13th International Gluten Workshop

11-17 March 2018

Mexico City, Mexico

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