TECNOLÓGICO NACIONAL DE MÉXICO®

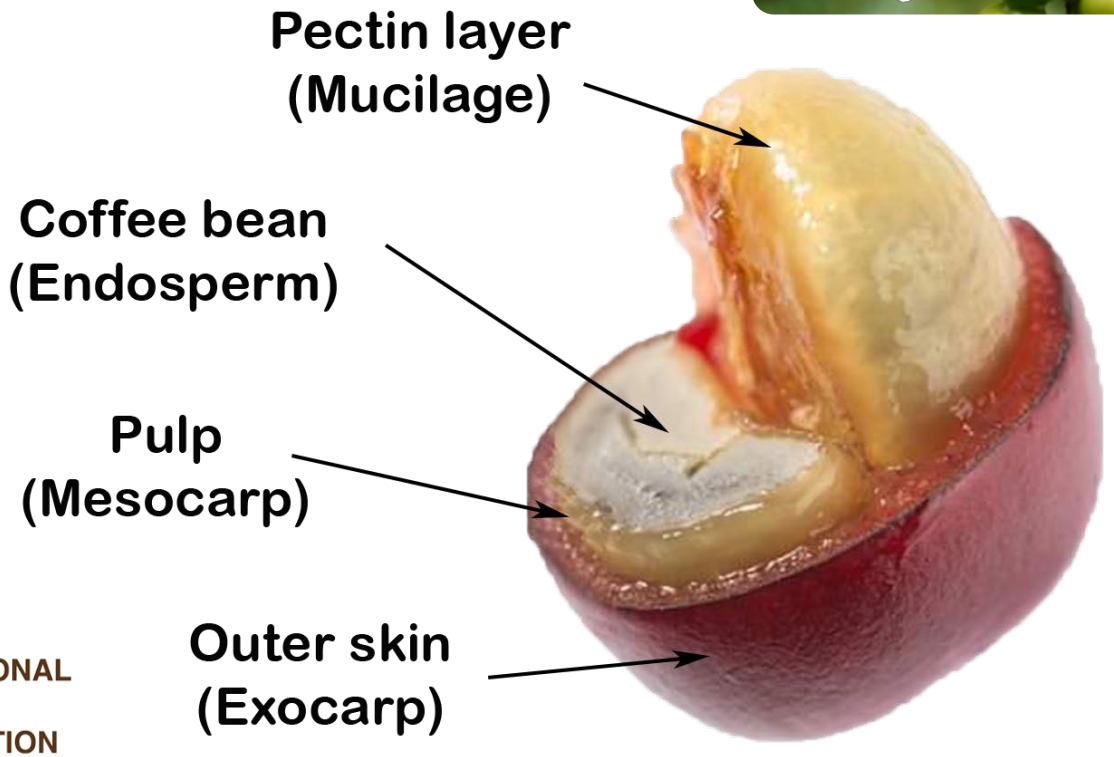
Effect of Coffee Cherry Pulp on Rheological Properties and Quality Parameters of Dough and Batters

Gustavo A. Rosas-Sánchez[1,2] Zorba J. Hernandez-Estrada[1], Mirna L. Suárez-Quiroz[1], Oscar González-Rios[1] and Patricia Rayas-Duarte[2]

1. Tecnológico Nacional de México / IT de Veracruz, Calz. Miguel Ángel de Quevedo 2779 Col. Formando Hogar, 91860 Veracruz, Ver., México
2. Robert M. Kerr Food and Agricultural Products Center, Biochemistry and Molecular Biology Department, Oklahoma State University, Stillwater, OK74078, USA

Coffee cherry Pulp

Coffee cherry pulp represents 50 % of whole fruit



The coffee cherry pulp could be used to fortify bread and muffins bakery products deficient in dietary fiber, among other nutrients.

INTERNATIONAL COFFEE ORGANIZATION

Coffee world production in 2019: 10.5 million tons

(Mussatto *et al.*, 2011; SAGARPA 2015)

Objetive

To determine the effect of coffee cherry pulp powder (CCPP) on the rheological and baking quality properties of muffins batters and bread dough.

Coffee cherry pulp powder (CCPP) and wheat flour proximate and caffeine analyses *

Compounds	CCPP (g / 100 g)	Wheat flour (g / 100 g)
Moisture	6.1±0.0	12.58
Protein	9.7±0.1	11.87
Dietary fiber	44.5±0.6	2.37
Ash	4.2±0.1	1.09
Lipids	1.5±0.0	<1.0
Caffeine	0.04±0.0	n.a.
Total carbohydrates**	33.96	71.09

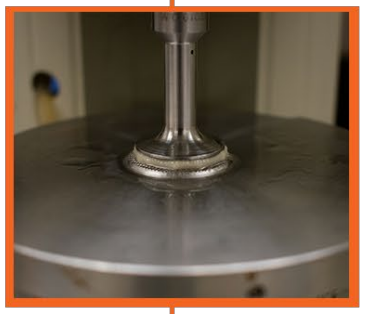
*Means (n=2 ± standard deviation) of two independent analysis. n.a. = not analyzed.
**Total carbohydrates were calculated by difference

Coffee Cherry Pulp Powder

Particle size < 150 µm

1.25, 2.5, 5 % Bread dough

10, 20, 40 % Muffins batters



Creep-recovery and Frequency sweep

Bread-making method AACCI 10-10.03

Crumb firmness AACCI standard procedure with TA-XT2

Frequency sweep on muffins batters

Comercial muffins recipe

AIB standard procedure for muffins firmness

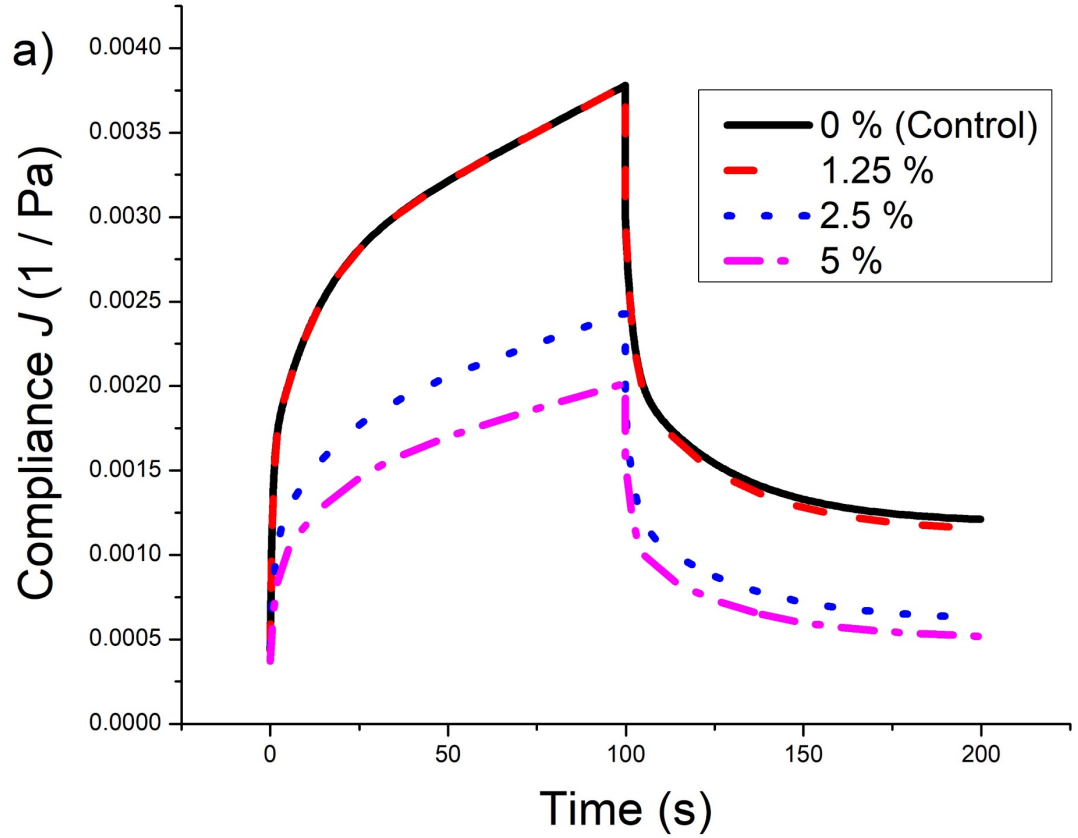
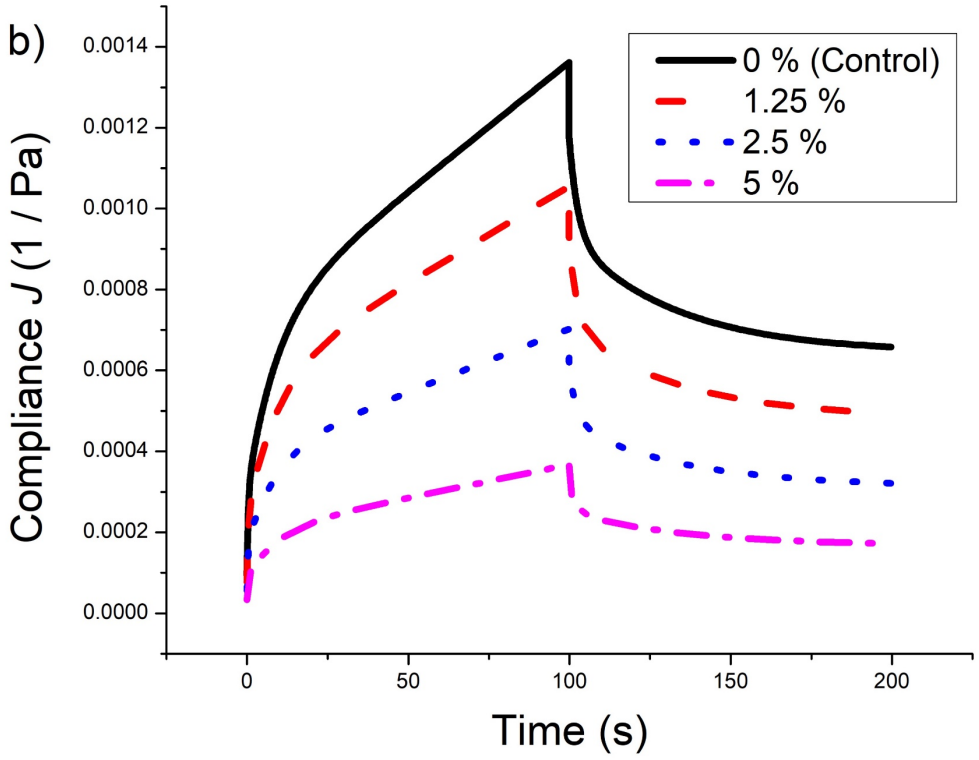


Figure a): Creep-recovery curves for gluten, with different levels of coffee cherry pulp powder (CCPP) substitution. Graphs plotted with averages of Kelvin-Voigt model.

Kelvin-Voigt model

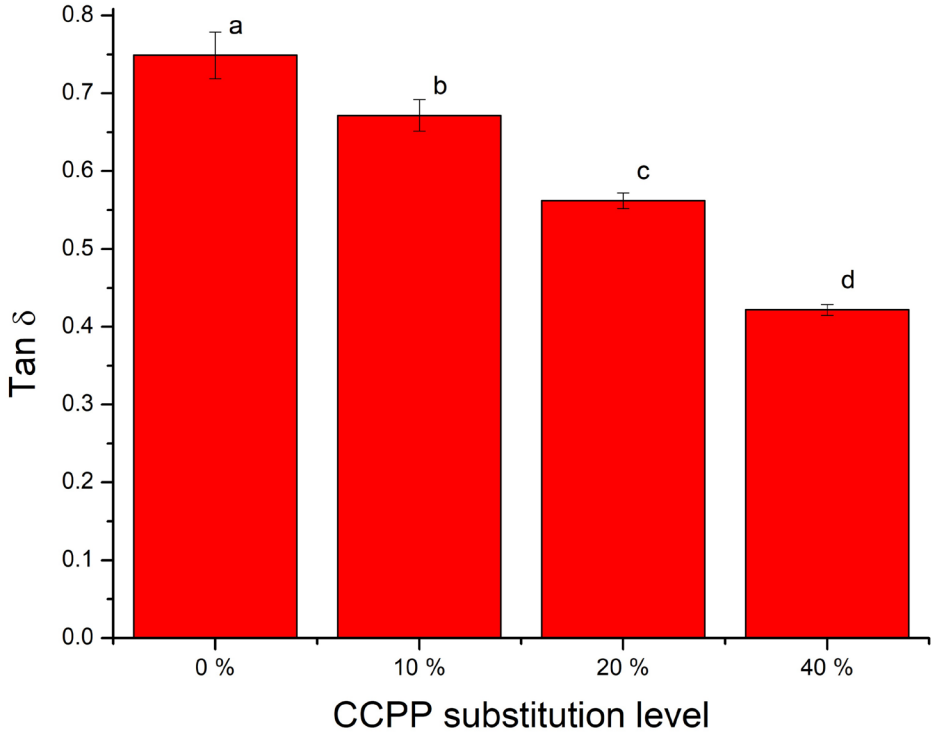
$$J(t) = J_0 + J_1\left(1 - e^{\frac{-t}{\lambda_1}}\right) + J_2\left(1 - e^{\frac{-t}{\lambda_2}}\right) + \frac{t}{\eta_0}$$

Figure b): Creep-recovery curves for dough, with different levels CCPP substitution.



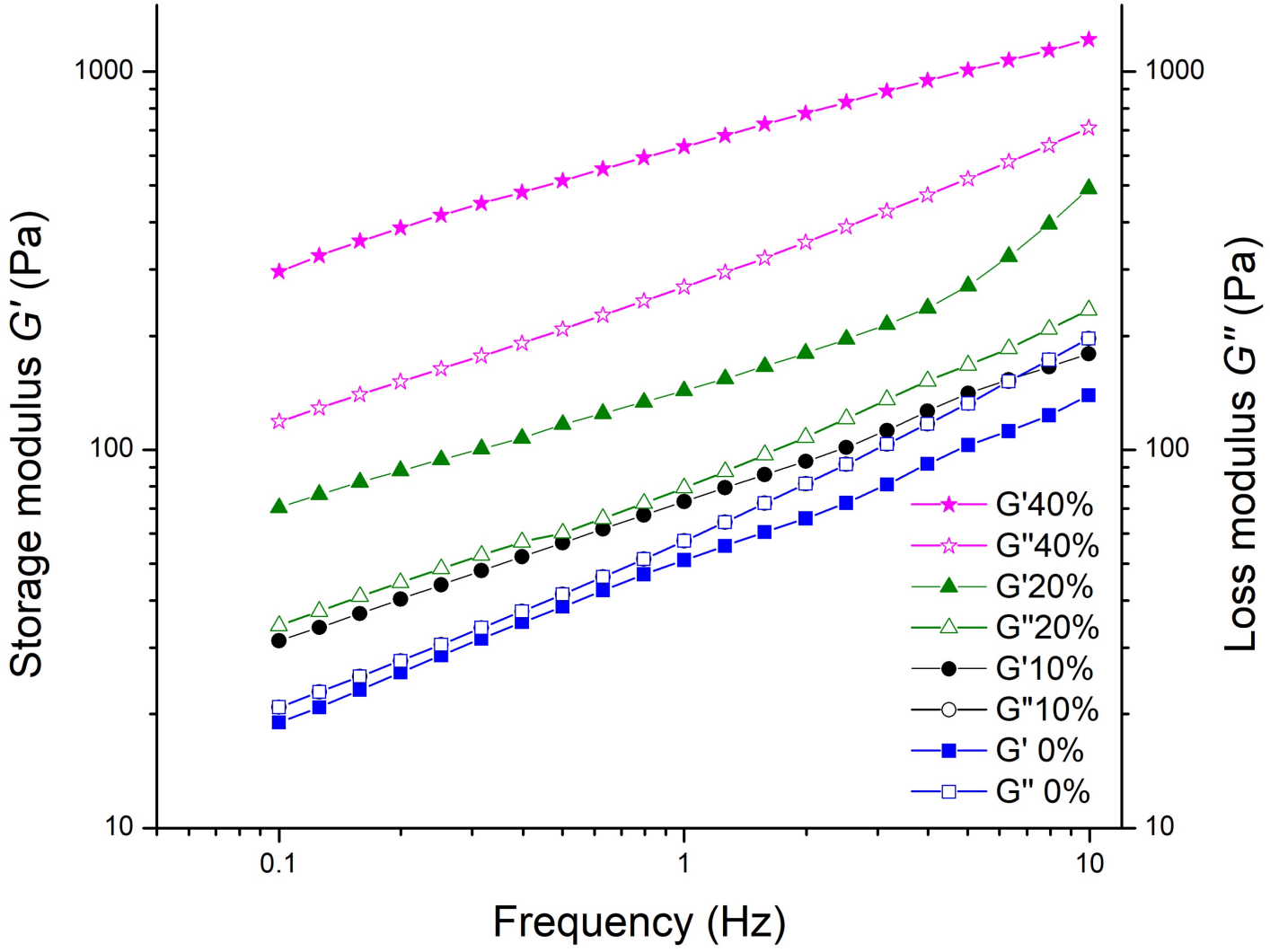
(Hernandez et al., 2017)

Tan δ $\left(\frac{G''}{G'}\right)$ at 1 Hz of frequency



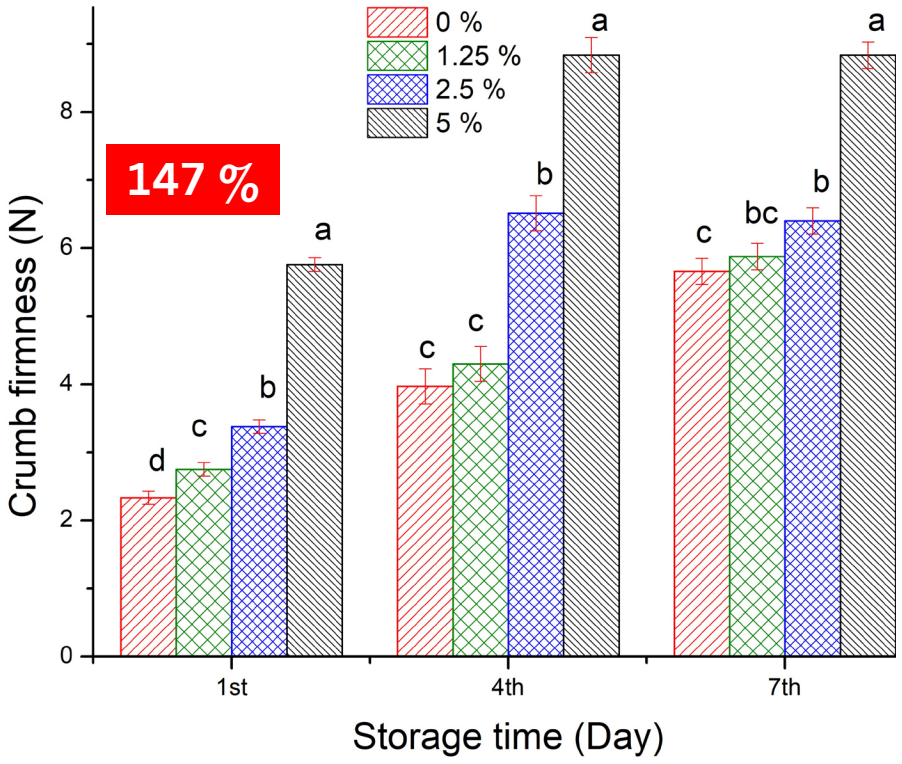
When the substitution level of CCPP increased, muffin batters showed more solid-like behavior.

G' and *G''* modulus from frequency sweep test

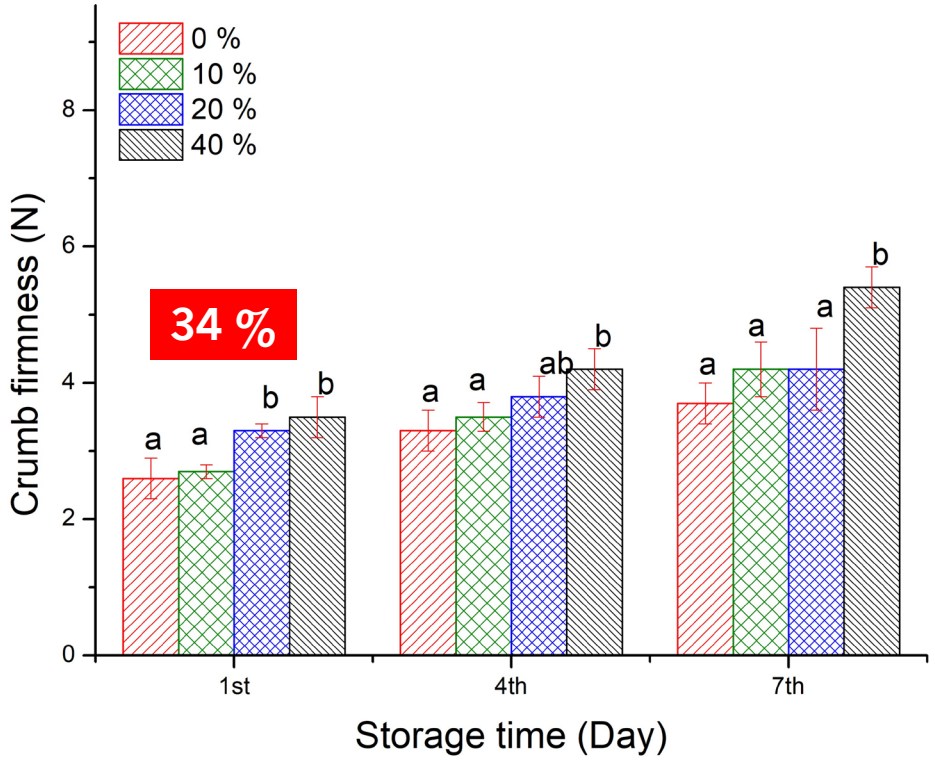


Bread and muffin crumb firmness

Bread



Muffins



CCP substitution level (%)	Volume (cm^3)
Bread	
0	3056a
1.25	2804b
2.5	2408c
5	2007d
Muffins	
0	84a
10	82a
20	83a
40	75b

36%

9.5%

The crumb firmness increases with CCPP substitution, as opposed to the volume reduction on bread and muffin due to dilute the protein network and weaken the gluten matrix formation.

Conclusions

The CCPP is a good source of dietary fiber.

The substitution of wheat flour by CCPP increases the stiffness of dough and gluten. It can to see with the reduction of max strain when 100 Pa of stress was applied.

This first approach has been performed without dough or bread additives (emulsifiers, enzymes, etc.), so more research should be done using dough and bread.

Significance

Coffee cherry pulp valorization as an ingredient in baked products is a way to add nutritional value and to reduce its waste and environmental impact.
Burgers model parameters are good predictors of bread quality and power law model parameters for muffins quality.