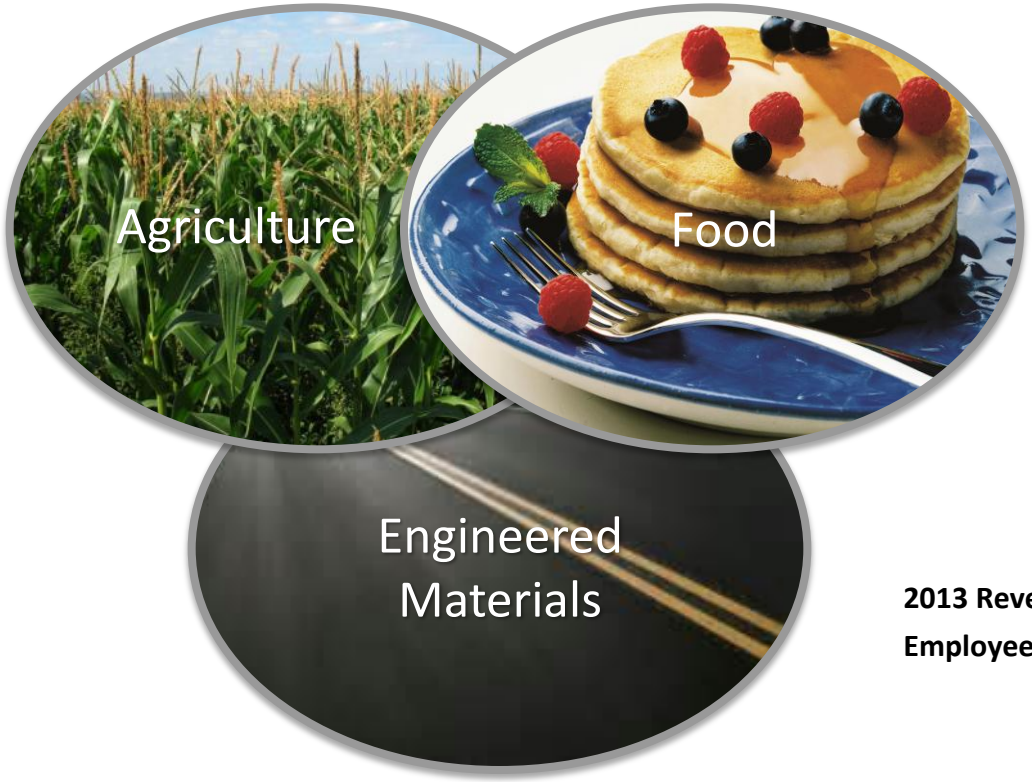
Expertise that Inspires

Texture Modification and Flavor Protection of Whole Grain Products

Lirong Zhou, 06/25/2015, Whole Grains Summit

ICL's Core End-Markets

Our Vision: to be a leading global specialty minerals company, fulfilling humanity's essential needs in agriculture, food & engineered materials



2013 Revenues: **$6.3B**

Employees: **~12,200**

ICL Food Specialties

Expertise that Inspires

Mianjia® Line for Noodle Applications

MIANJIA
For Better Asian Noodles

ICL Food Specialties

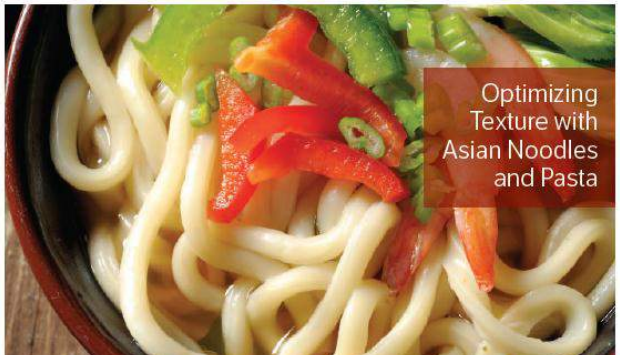


TABLE 1: MIANJIA APPLICATIONS	Product	Use Level
Instant noodle (fried or air dried)	Mianjia 100 Mianjia 310 and 400	0.3-0.7% of flour 0.3-0.7% of flour
Alkaline noodle (Yakisoba, Chow mein, Egg noodle)	Mianjia 300 Mianjia 310	0.5-1.5% of flour 0.3-0.7% of flour
Udon noodle/Salt noodle	Mianjia 400	0.3-0.7% of flour
Noodle surface treatment	Phosphoric Acid Adipic Acid	To desired pH
Calcium fortification, Dough conditioning, Texture modification	Calcium Phosphates (MCP, DCP, TCP)	To desired level, texture

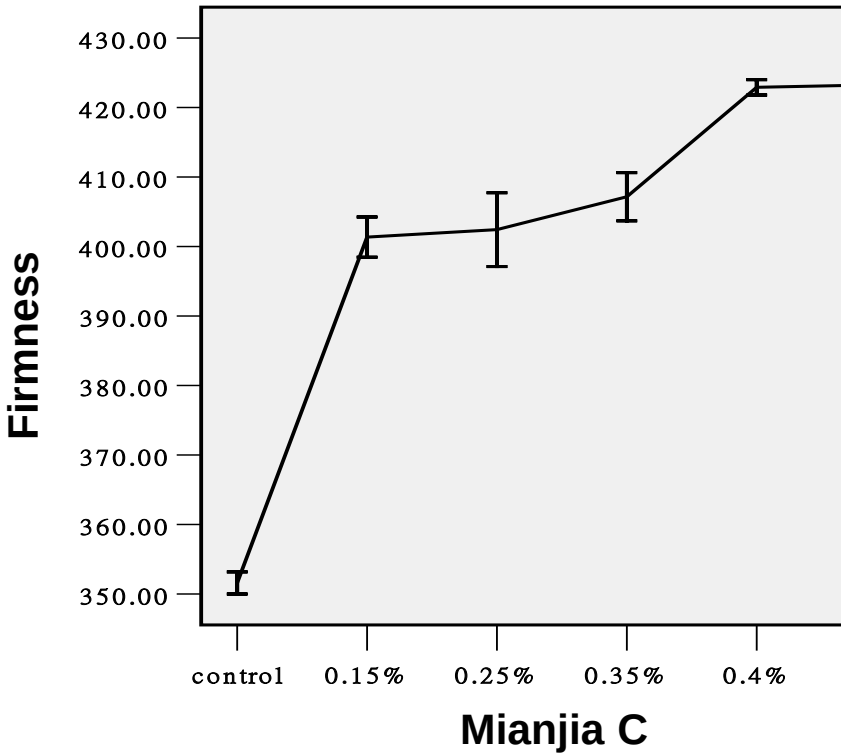
Whole Wheat Noodle /Pasta Challenges

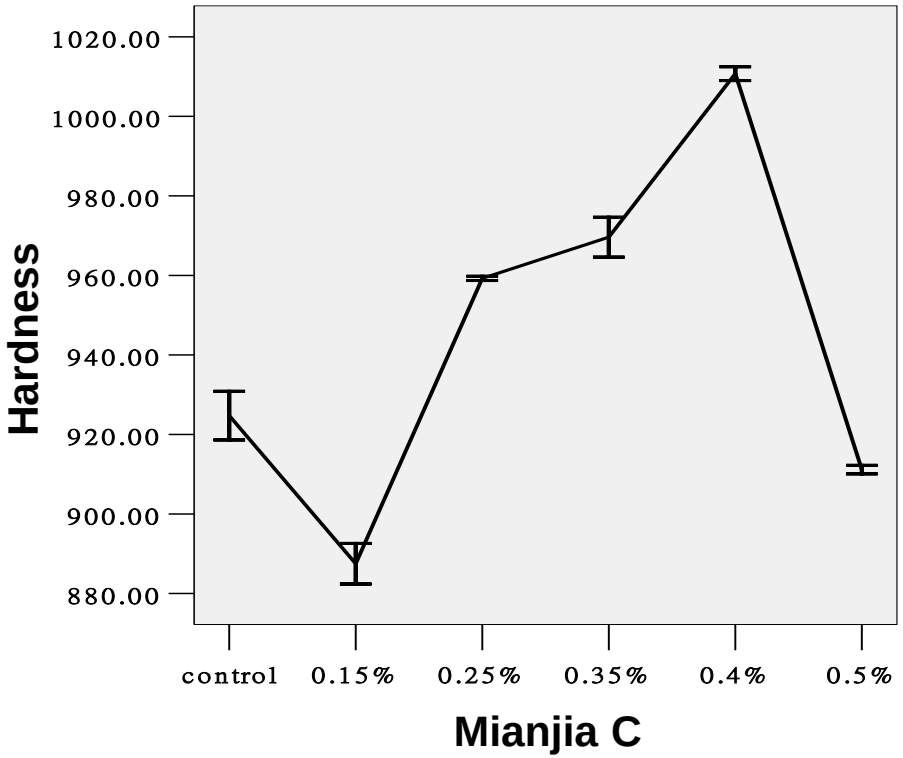
- The addition of wheat bran and germ affects
  - Color
    - Darker, dull color
  - Texture
    - Rough noodle surface, gritty texture, poor gluten formation
  - Stability
    - Shorter shelf life due to high unsaturated fat content

Pasta Formulation

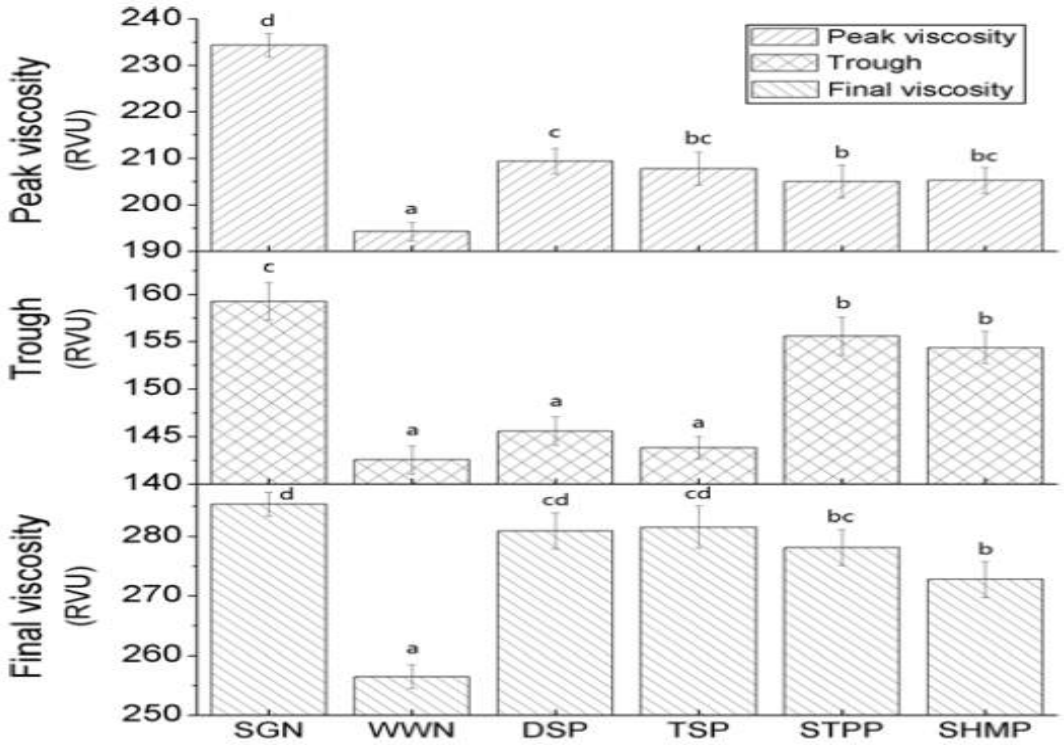
Ingredients	Percentage (%)
Regular	
Semolina	100%
Mianjia®	0.1%~0.6%
Water	28.5%
Whole wheat	
Hard white whole wheat flour	51%
Semolina	49%
Mianjia®	0.1%~0.6%
Egg white	1.5%~2%
Water	32.5%

Cooked Whole Wheat Pasta Texture





Modification of Flour Pasting Properties by Phosphates



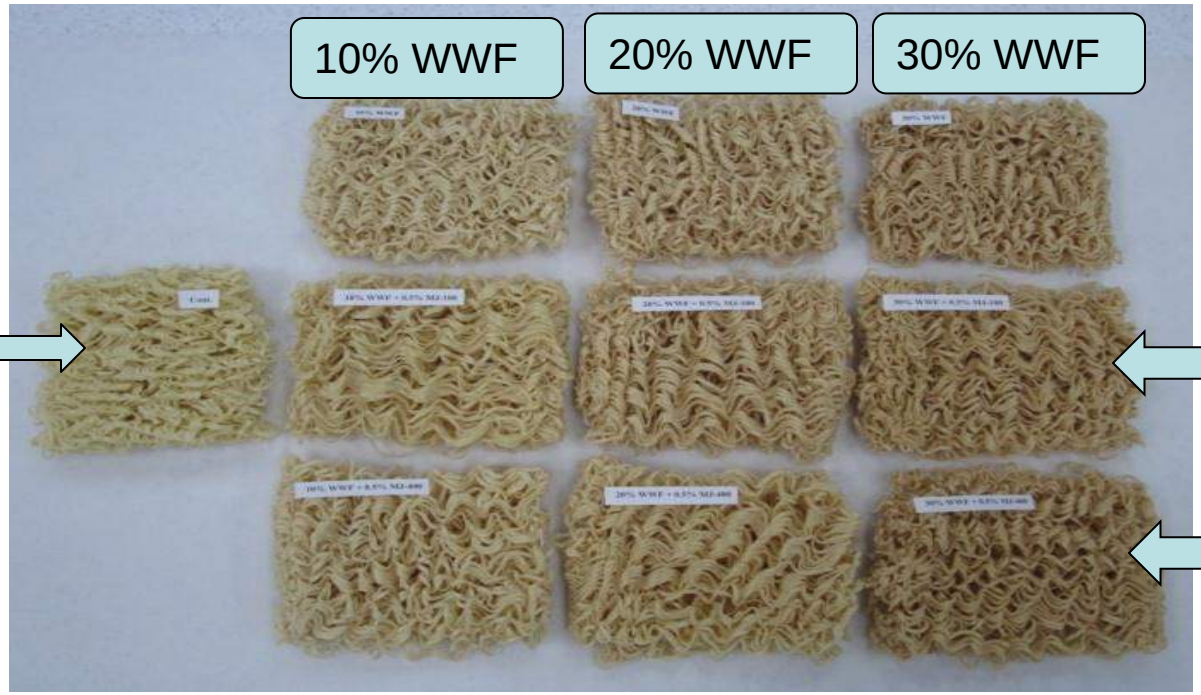
Reference: Niu, M. et al., 2014. Effects of Inorganic Phosphates on the Thermodynamic, Pasting and Asian Noodle-Making Properties of Whole Wheat Flour . Cereal Chem. 91(1):1-7.

Color Improvement in Whole Wheat Noodle with Phosphates

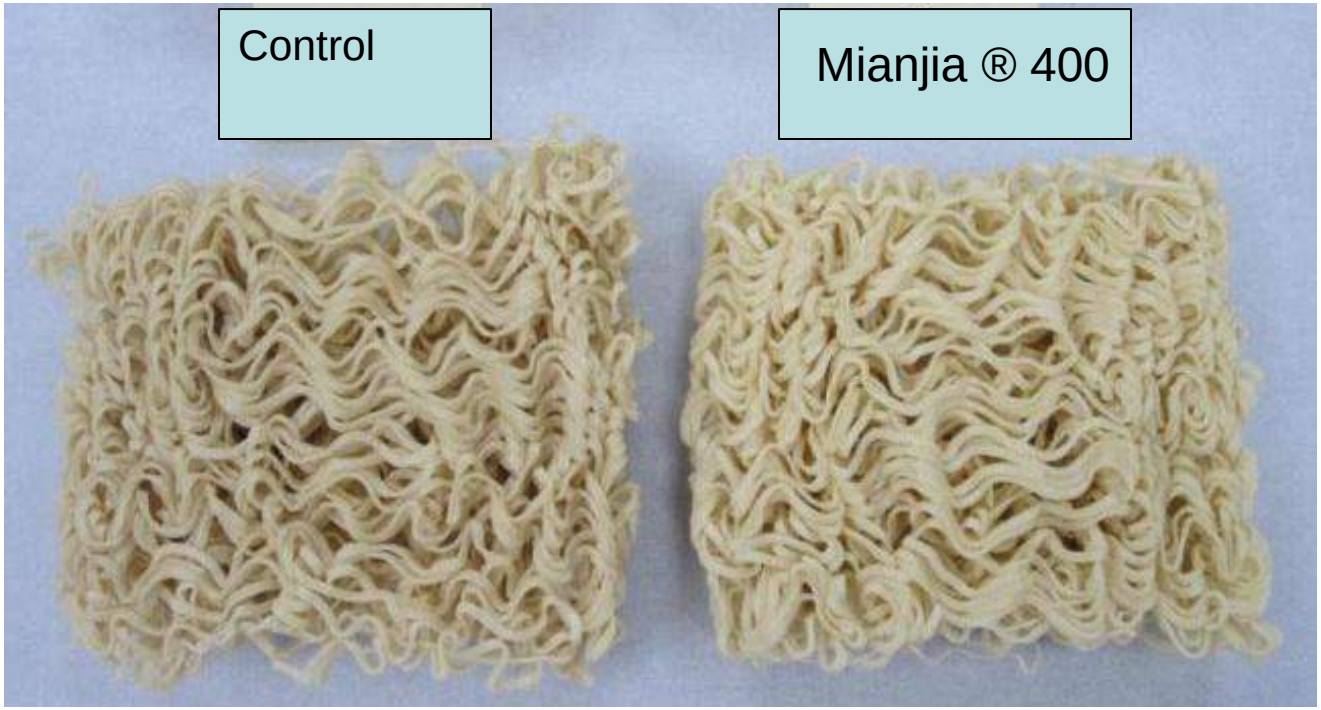
Sample[z]	L^*	a^*	b^*
SGN	85.34 ± 0.23d	0.33 ± 0.01a	11.22 ± 0.12a
WWN	76.51 ± 0.19a	3.31 ± 0.05b	16.50 ± 0.16b
DSP	77.67 ± 0.28bc	3.29 ± 0.08b	16.39 ± 0.17b
TSP	78.58 ± 0.31c	3.13 ± 0.09b	16.05 ± 0.11b
STPP	77.68 ± 0.37bc	3.24 ± 0.07b	16.38 ± 0.18b
SHMP	77.02 ± 0.41ab	3.29 ± 0.06b	16.45 ± 0.21b

Reference: Niu, M. et al., 2014. Effects of Inorganic Phosphates on the Thermodynamic, Pasting and Asian Noodle-Making Properties of Whole Wheat Flour . Cereal Chem. 91(1):1-7.

Instant Noodle with Whole Wheat Flour



Instant Noodle with Whole Wheat Flour



Cooked Whole Wheat Noodle Texture with Phosphates

Sample	Hardness (g)	Springiness	Cohesiveness	Resilience
SGN	1,859.38 ± 25.67a	0.763 ± 0.018ns	0.451 ± 0.017c	0.136 ± 0.009ns
WWN	2,513.28 ± 30.97c	0.712 ± 0.013	0.393 ± 0.010a	0.123 ± 0.010
DSP	2,308.28 ± 35.45b	0.726 ± 0.010	0.420 ± 0.015abc	0.125 ± 0.011
TSP	2,309.57 ± 26.76b	0.730 ± 0.009	0.413 ± 0.016ab	0.127 ± 0.008
STPP	2,249.54 ± 35.29b	0.741 ± 0.017	0.434 ± 0.008bc	0.127 ± 0.007
SHMP	2,289.02 ± 32.19b	0.736 ± 0.015	0.418 ± 0.018abc	0.126 ± 0.007

Reference: Niu, M. et al., 2014. Effects of Inorganic Phosphates on the Thermodynamic, Pasting and Asian Noodle-Making Properties of Whole Wheat Flour . Cereal Chem. 91(1):1-7.

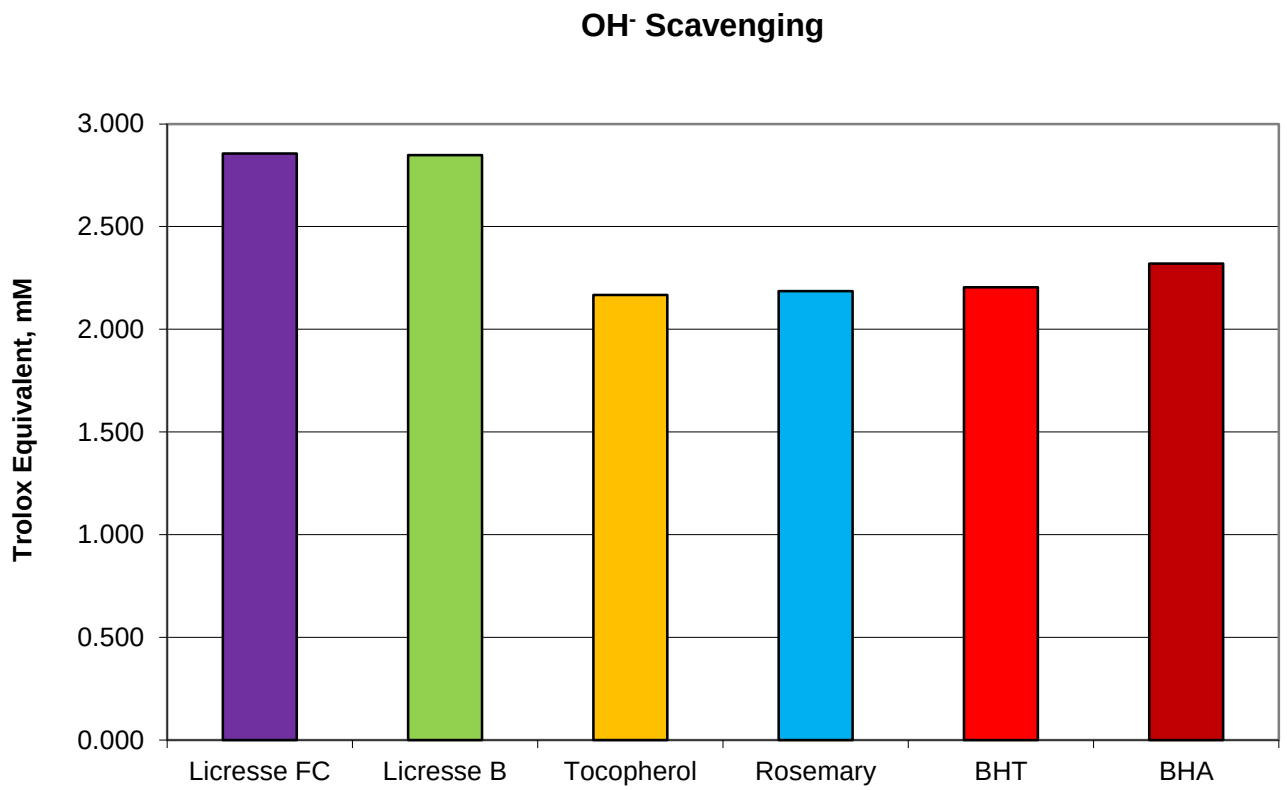
What is Licresse™?

- Licresse™ is a natural food ingredient extracted from the root of the licorice plant (*Glycyrrhiza glabra).*
- It is naturally high in antioxidant phenolic compounds
- Licorice has been used in traditional herbal medicine for thousands of years.
- Licresse™ is minimally processed as described in 21 CFR 184.1408 (a)(1). The root is ground, steeped and filtered. The residue is spray dried.

Licresse™ Regulatory - US

- Regulatory
  - Licresse™ can be labeled as licorice, licorice extract, natural flavoring
  - Affirmed as GRAS and approved under 21 CFR 184.1408
- Licresse™ is a minimally processed extract from the licorice plant
- Licresse™ is Kosher
- BRC, ISO 9001, GMP, HACCP
- Contains no allergens

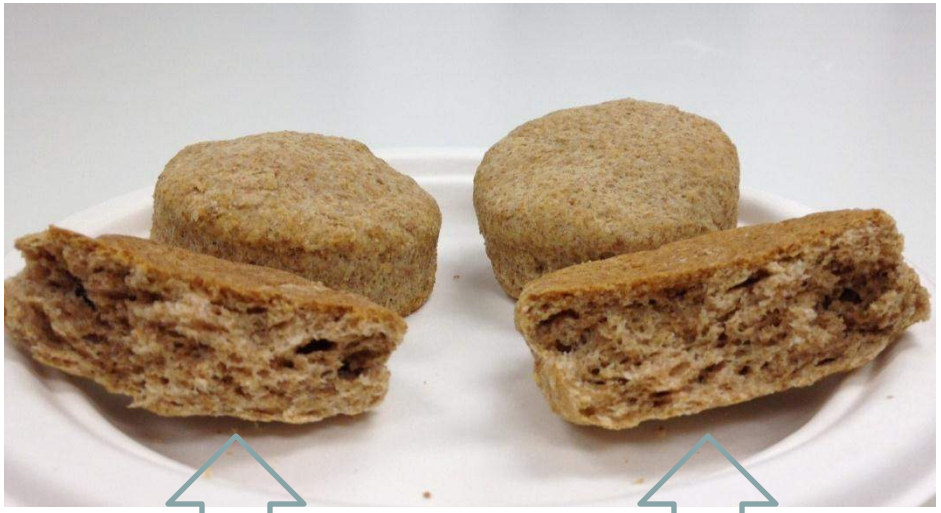
Licresse™ Functionality



(1000 ug/mL for Licresse™ B , 500 ug/mL for others)

Licresse™ in Whole Wheat Biscuit

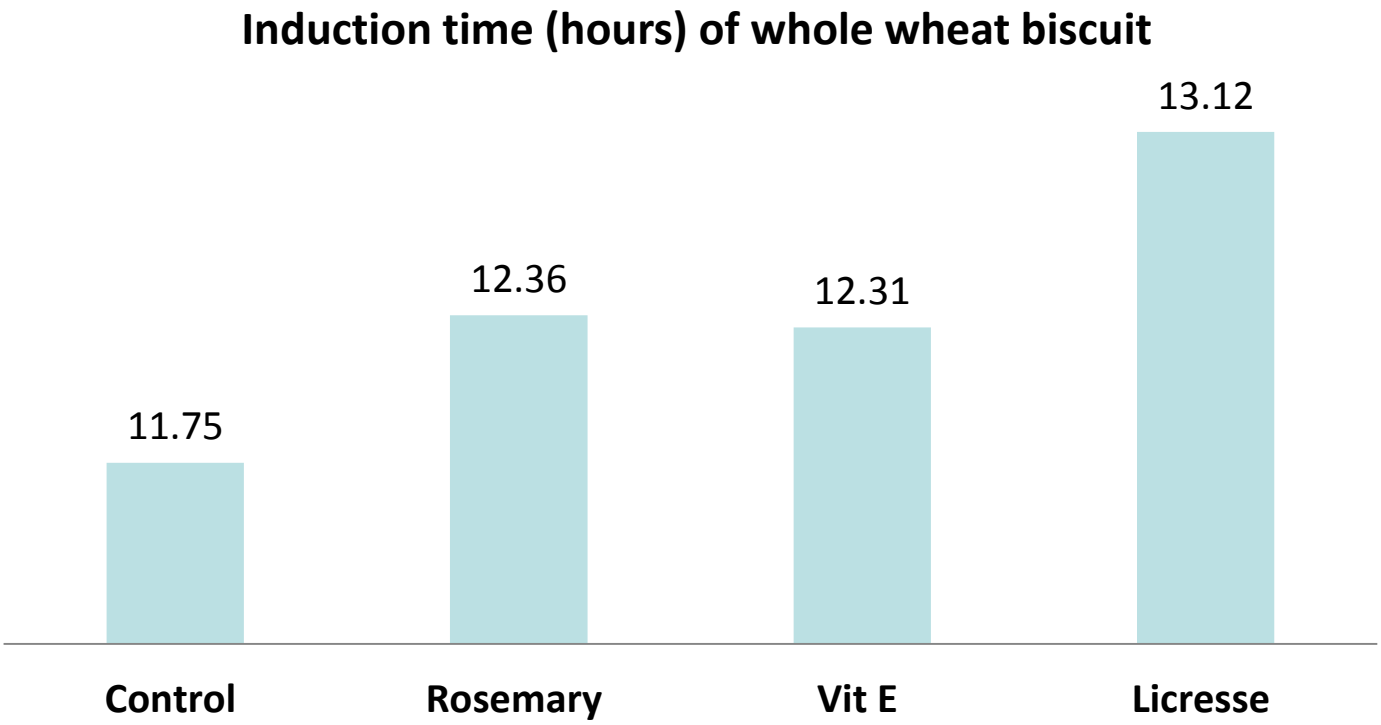
	Bakers %
Whole wheat flour	100
Shortening	25
NFDM	7
Sugar	3
Salt	2
Soda	3
Stabil-9	3.23
Water	65



Licresse™ in Whole Wheat Biscuit

Oxidation Stability by Rancimat™

(Treatment added at 1000 ppm of dry biscuit mix, test run @110 ^{o}C)



Licresse™ in Whole Wheat Bread

Licresse™ for Seed Stability