



Neo-Temper: Validated food safety solution for reducing pathogen load on wheat flour

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AGRI-NEO SHAPES THE FUTURE OF FOOD SAFETY

The Agri-Neo mission is to help safely feed the world by creating food safety technologies that set new standards for a wide range of foods.

Our innovative food safety solutions eliminate microbes including harmful pathogens while maintaining the nutrition and quality that flourishes naturally in food.

Every day at Agri-Neo, our dedicated team of food scientists, researchers, and engineers work together to solve more food safety challenges worldwide.

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Helping Safely Feed the World



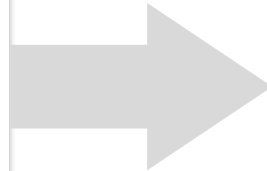
FOOD SAFETY REMAINS A CHALLENGE

- Lots of sources of potential pathogenic contamination from field to final flour products
- Number of flour recalls has been increasing; already two high profile cases in 2023
- Recalls are very costly to the flour milling industry
 - Consumers that are sickened and hospitalized
 - ‘Hard’ costs from recalling products and potential lawsuits
 - Reputational damage from bad press
 - Longer-term loss in consumer confidence with recalled brands
- As a result, there are a growing number of options available to flour millers to mitigate these food safety risks for themselves and their customers

EMERGING TECH SUPPLEMENTS HEAT TREATED FLOUR

Heat Treated Flour

- In response to higher profile product recalls in the 2000s, heat treatment of flour was used as a kill step for pathogens
- Heat-treated flour has only found a 'niche' market since it is:
 - Capital and space intensive for flour millers to integrate into their operations
 - Hard to scale across flour mills
 - Represents a significant added cost to customers who want pathogen/ micro reduction



Emerging Technologies

- Over the past few years, more emerging technologies have come onto the market
- Trying to bridge the gap left by heat-treated flour by being more economical, easier to implement in mills, and scale across mills
- Most are integrated into the tempering stage of the milling process
- Range of different off-the-shelf acids, chlorine-based chemistry, viruses (i.e., phages), and patented organic actives (i.e., Neo-Temper)

WHAT TO LOOK FOR IN A MICROBIAL INTERVENTION

Due Diligence Questions	Key Considerations
Is it validated to control pathogens?	<ul style="list-style-type: none">• Tested on actual pathogens and compatible surrogates• Replicated in lab, pilot, and commercial scale with consistent results• Third-party studies to remove tech provider biases
Is flour functionality intact?	<ul style="list-style-type: none">• Tested to show that impact on flour functionality is negligible
Is it safe to use?	<ul style="list-style-type: none">• Easy to integrate into operations without issues in safety and handling• Tested to show negligible impact on milling equipment (i.e., tempering station, holding bins)
Is it approved by the relevant government authorities and certifying bodies?	<ul style="list-style-type: none">• Approved for use on wheat by U.S. FDA, Health Canada, etc.• Approved by certifying bodies for Organic (i.e., U.S. NOP, CAD COR)
Is it economical?	<ul style="list-style-type: none">• Are the ongoing costs low enough to pass onto the customer and/or absorb the added expense?• Are there any material capital investments required?

WHAT IS NEO-TEMPER?

NEO-TEMPER™

Organic Food Safety Solution for Flour



- Neo-Temper is a patented blend of organic actives that is specifically designed as an intervention for wheat flour to control pathogens and micro
- It is a liquid solution that is combined with water and applied directly onto wheat during tempering
- Achieves lethality within seconds, and then the actives biodegrade completely
- **Validated to provide a 1.5 to ~5-log reduction** of pathogens on a wheat-to-wheat basis (not counting milling effect)
- Provides broad-spectrum control of indicator microorganisms (i.e., total aerobic bacteria, yeast, mold, coliforms)
- Flour functionality and sensory unchanged
- **Approved by U.S. FDA and Health Canada**
- Certified organic to NOP and COR standards



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VALIDATION OVERVIEW



- Determine log kill efficacy at different Neo-Temper rates on STEC *E.coli* cocktail (7 serotypes)
- Conducted compatibility studies to find appropriate surrogate (*E. faecium*, USDA surrogate cocktail)

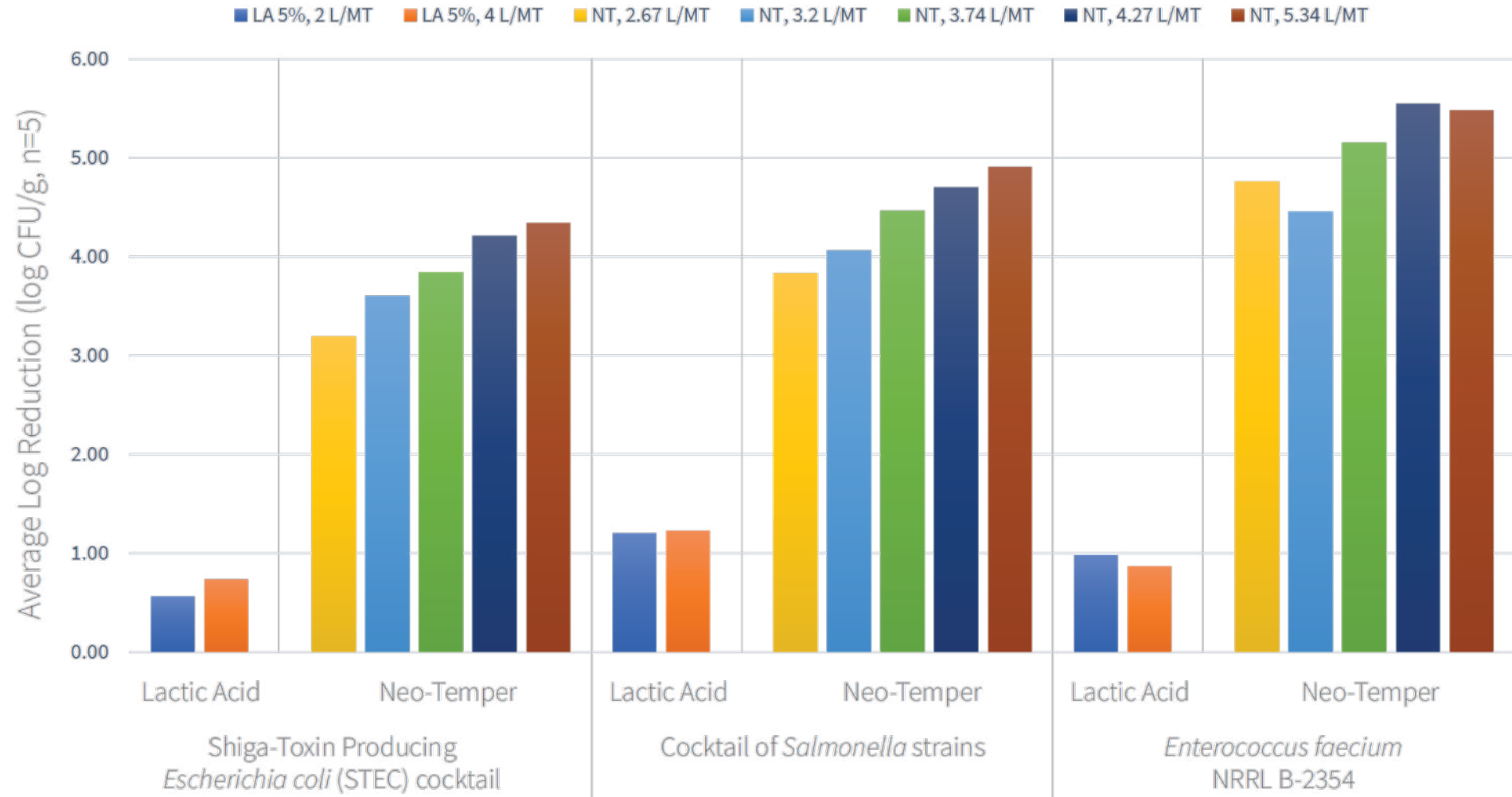


- Confirmed scale-up pathogen control efficacy with surrogate inoculated wheat
- Confirmed no impact on functionality and organoleptic properties of flour post- Neo-Temper kill step



- Validate individual flour mills with Neo-Temper to confirm rate(s) of application and associated log kill level(s) in normal commercial operating environment
- Implement food safety program with Neo-Temper based on established critical control parameters from validation results

COMPARING EFFICACY OF NEO-TEMPER AND LACTIC ACID



COMPARING EFFICACY OF NEO-TEMPER AND LACTIC ACID

Solution	STEC Cocktail (Log Reduction, Std. Deviation)		<i>Salmonella</i> Cocktail (Log Reduction, Std. Deviation)		<i>E. faecium</i> (Log Reduction, Std. Deviation)	
	Average	Minimum	Average	Minimum	Average	Minimum
5% Lactic Acid, 2 L/MT	0.56 ±0.10	0.36	1.20 ±0.04	0.93	0.98 ±0.07	0.75
5% Lactic Acid, 4 L/MT	0.73 ±0.07	0.50	1.22 ±0.03	0.96	0.86 ±0.07	0.60
Neo-Temper, 2.67 L/MT	3.19 ±0.08	2.94	3.83 ±0.09	3.52	4.76 ±0.05	4.55
Neo-Temper, 3.20 L/MT	3.60 ±0.06	3.43	4.06 ±0.03	3.80	4.45 ±0.03	4.27
Neo-Temper, 3.74 L/MT	3.84 ±0.11	3.58	4.46 ±0.06	4.18	5.15 ±0.09	4.87
Neo-Temper, 4.27 L/MT	4.21 ±0.03	4.06	4.70 ±0.10	4.35	5.54 ±0.15	5.14
Neo-Temper, 5.34 L/MT	4.34 ±0.03	4.19	4.90 ±0.10	4.59	5.48 ±0.13	5.23

MICHIGAN STATE STUDY (WILL PUBLISHED LATE 2023)



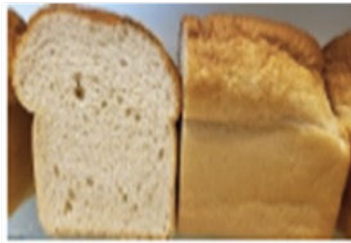
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MICHIGAN STATE UNIVERSITY

- Four different treatment options, including Neo-Temper, were assessed for efficacy against *Salmonella* and *STEC*
- Lower and higher rates of application were used to evaluate range of efficacy for each option
- Neo-Temper provided the highest efficacy for reducing *Salmonella* and *STEC* across all options
- Neo-Temper was also the most effective treatment cost per cwt

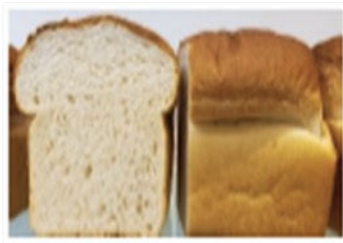
BAKE TEST (INDEPENDENT TEST)

- Functionality assessment comprised of milling extraction (flour yield %), AACC, NIR, Farinograph (constant flour weight), pH, falling number
- No significant impact found on flour quality and/or functionality; organoleptic profile comparable
- Bread Bake Test: Similar scoring between Neo-Temper treated flour and control (bake strength, volume, height, water absorption, mix time, symmetry, etc.)
- Cookie & Pancake Bake Test: Appearance, spread, flavor, aroma, and texture very similar between control and Neo-Temper treated flour

Bread Test (Hard Wheat Flour)



Untreated Control



NEO-TEMPER Treated

Cookie Test (Soft Wheat Flour)



Untreated Control

NEO-TEMPER Treated

Pancake Test (Soft Wheat Flour)



Untreated Control

NEO-TEMPER Treated

TECHNOLOGY APPLICATION



- Retail flour
- Cookie dough (i.e., refrigerated, frozen)
- Dry mixes (cake, cupcake, pie, brownie, muffin, etc.)
- Pasta
- Baking mixes (pancake, bread, cookie, etc.)
- Refrigerated dough (biscuit, bread, roll, bun, pastry, etc.)
- Frozen pizza
- Frozen dough (bread, roll, pastry, etc.)
- Others

QUESTIONS



Q & A

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