BakeSafer™ Application Review

Research & Wheat Flour Risk Reduction

Ardent Mills

Research

Ardent Mills is an active leader in reducing microbial risk in flour.

Ardent Mills processes and sells a wide range of ingredients that are all derived from raw agricultural products. There are several possible pathogens such as *Salmonella*, pathogenic *E. coli* and *Listeria monocytogenes* that can be sourced from the environment where grains or seeds, such as wheat, are grown, harvested and stored. The traditional milling process does not control for pathogens or have a kill step. Flour is intended to be further processed to significantly minimize or prevent the risk of pathogens[5]. This is often accomplished with a lethality step such as baking, cooking, frying, or boiling.

Between 2016 and 2022 there have been more than 15 known pathogen-related flour recalls due to *E. coli* and *Salmonella*. Ardent Mills has intensified research in microbial risk reduction efforts and has three different levels of food safe products to be evaluated as part of each manufacturer's risk assessment and food safety plan - conventional flour, BakeSafer™ (for ready-to-bake/cook applications) and SafeGuard® (for ready-to-eat applications).

Ardent Mills understands that less than 5-log reduction and/or full pasteurization has value in the safety of our products to reduce the food safety risk. Peer reviewed studies have reported pathogen prevalence in wheat as 0.1 to 3%. Subsequent enumeration results indicate very low level of pathogen, 1 to 2 log CFU/g[2]. Previous external research studies conducted in wheat show a wide range of pathogen prevalence up to 12.8% for one study[3,4]. Myoda et al., 2019 conducted a baseline study to determine the prevalence and levels of pathogens in wheat samples. The study indicated a 0.44% prevalence for *E. coli* (0.039 MPN/g) and 1.23% (0.110 MPN/g) prevalence for *Salmonella*.

INTENSIFIED RESEARCH

For the last five years, Ardent Mills has been researching alternatives to reduce microbiological risk in flour. This has resulted in increased activity and collaborations at the industry and university level with universities such as the University of Nebraska, Lincoln, the University of Georgia (UGA), the Kansas State University, the University of California, Davis and the University of Minnesota, as well as collaborating in the USDA NIFA Low-Moisture Food Safety Project led by Michigan State University.

Ardent Mills' team has considered all technologies known to us, even if the chance of success is low. Note that over 15 different technologies and applications have been evaluated and a number of these are still under investigation and research today.

ACTIONS TAKEN – BAKESAFER™ FLOUR

BakeSafer™ flour is Ardent Mills' value-added refined wheat flour safety solution for ready-to-bake (or cook) product applications. BakeSafer™ is designed to reduce food-borne illness risks by reducing pathogens by at least 90% using milling treatment technology and serves the needs of manufacturing environments where the end consumer provides lethality step such as retail flour, baking mixes, frozen doughs and pizzas.

In 2018, with the intent to reduce the microbiological risk in retail flour, Ardent Mills added lactic acid as a processing aid to raw wheat as it is tempered before milling. The system adds food grade lactic acid to the water used for tempering raw wheat. Tempering with water is a standard step in the milling process.

In 2019, Ardent Mills sponsored research at the University of California, Davis to evaluate the specific effectiveness of lactic acid on pathogens, such as *Salmonella* and Shiga-toxin producing *E. coli* (STEC). Results showed a minimum log reduction for *Salmonella* and STEC to be 1 to 2 log CFU/g respectively[1].

After the implementation of lactic acid, Ardent Mills continued research for organic acid alternatives that offer higher pathogenic reduction. Ardent Mills has worked with the manufacturer and supplier of a product that currently used in fruits and vegetables. The product is a combination of peracetic acid and hydrogen peroxide solution. As of October 2021, the product has been granted regulatory approval for use in tempering of wheat by FDA as food contact substance. This product is also approved for organic products under the National Organic Program and is OMRI listed.

A third-party laboratory study in 2020 compared both organic acids, to have a side-by-side comparison of the effectiveness of these acids in wheat kernels. Results showed the peracetic acid and hydrogen peroxide solution to be more effective. Ardent Mills continues to look at the effectiveness and application rate for the best value for our customers.

Ardent Mills has conducted research using a peracetic acid and hydrogen peroxide solution.

Summary of functionality and sensory results

Overall results showed that functionality was not impacted by treatment even at the maximum allowable level. As the treatment is applied to the tempered wheat, it has no effect on milled refined end products.

- Analytical data for both hard and soft wheats showed very little difference from their corresponding untreated controls, even at the maximum allowed treatment concentration.
- Bake results were remarkably similar on all counts, both for bread and cookie applications.
- A sensory survey on the bread showed participants could find no significant difference in taste, appearance, or smell.

Ardent Mills is an active leader in reducing microbial risk in flour as noted above. We now have three different levels of food safe products to be evaluated as part of each manufacturers risk assessment and food safety plan. Safeguard® flour is intended for ready-to-eat applications. BakeSafer™ flour may be appropriate to serve the needs based on manufacturing environment or where the end consumer provides lethality step such as in retail flour, baking mixes, frozen doughs, frozen pizzas, etc. Untreated conventional flour serves the needs for commercially baked items, etc.

Research continues for additonal cost-efficient reduction technologies.

We continue to invest in technologies to find even more effective and efficient processes to provide risk reduced flour at a national scale. Our research investment today is over 5 million dollars in research efforts.

References

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If you have any questions or would like to discuss further, please contact your sales representative.

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