Comprehensive Analysis of the Mechanisms of Action of Bio-G-Active in Poultry Processing

Introduction

Bio-G-Active represents an innovative solution to combat microbial contaminations on poultry carcasses. This report provides an in-depth scientific analysis of the biochemical and microbial mechanisms underlying Bio-G-Active, highlighting its advantages over conventional disinfection methods such as chlorine treatment. Supplementary test results are presented to support the described effects.

Scientific Foundations of Bio-G-Active's Effectiveness

Bio-G-Active implements a strategically developed, multi-stage method to reduce microbial loads through direct and indirect antimicrobial activities. This methodology is based on the latest findings in microbiology and food technology.

Phase 1: Selective Modulation of Microflora
The first phase of the Bio-G-Active treatment begins with the application of a specially formulated solution on poultry carcasses. This solution is rich in prebiotic carbohydrates, particularly monosaccharides, which selectively promote the growth of probiotic or non-pathogenic microorganisms. This selective promotion is crucial as it shifts the ecological balance of the microflora towards organisms that acidify the environment on the carcass surface through their metabolic activity.

Test Results on pH Effects on Skin and Muscle:

Treatment Group	pH Value (Skin)	pH Value (Muscle)
Control (Water)	6.65 (Day 1) → 6.48 (Day 8)	5.94 (Day 1) → 6.02 (Day 8)
Bio-G-Active	5.13 (Day 1) → 6.66 (Day 8)	5.88 (Day 1) → 6.08 (Day 8)
Chlorine (20 ppm)	6.94 (Day 1) → 6.27 (Day 8)	6.85 (Day 1) → 6.16 (Day 8)
Trisodium Phosphate (12%)	9.22 (Day 1) → 6.79 (Day 8)	5.77 (Day 1) → 6.01 (Day 8)

The test results show that Bio-G-Active induces a significant initial pH reduction, which stabilizes over time. In the muscle, the pH remains relatively constant, indicating that the effect is primarily localized on the surface.

Phase 2: Biochemical Acidification and Inhibition of Pathogenic Microorganisms
During bacterial fermentation on the meat surface, in addition to lactic acid, propionic acid and acetic acid are also produced, contributing to an enhanced antimicrobial effect. While lactic acid primarily inhibits bacterial growth through pH reduction, propionic acid and acetic acid further disrupt bacterial cell membranes, allowing Bio-G-Active to remain effective even at pH levels above 5.5.

Moreover, microbial activity leads to the formation of bioactive metabolites, such as diacetyl and bacteriocins. These compounds specifically destabilize the cell structures of pathogenic microorganisms by increasing membrane permeability and disrupting essential cellular processes. Gram-positive bacteria such as Listeria and Clostridia are particularly sensitive to these peptides, resulting in a targeted suppression of their growth.

Another crucial aspect of Bio-G-Active is its antioxidative effect. Certain fermentation-derived components act as chelating agents, which bind iron ions. Iron is an essential cofactor for many pathogenic bacteria, as it plays a key role in enzymatic processes. By reducing iron availability, Bio-G-Active inhibits the growth of iron-dependent microbes. Simultaneously, this chelation process helps stabilize meat color, as it slows down the iron-catalyzed oxidation of myoglobin. This effect improves the visual quality and freshness of the meat throughout its shelf life.

Additionally, improvements in visual properties were observed through color measurements (Lab system):

Parameter	Difference (Bio-G-Active - Control)
L (Brightness)	Fluctuating (+0.28 Day 2, -0.69 Day 10)
a (Red Value)	Decreasing (-1.16 Day 4, -2.45 Day 8)
b (Yellow Value)	Decreasing (-1.15 Day 4, -2.78 Day 8)

The data suggest that Bio-G-Active inhibits oxidative processes, leading to improved color stability and freshness of the poultry.

Additional Effects of Lactic Acid

The combination of directly added lactic acid and the lactic acid produced through the fermentation of monosaccharides enables both immediate and sustained effects. The immediate reduction in pH level by the added lactic acid rapidly creates an unfavorable environment for pathogenic microorganisms, while the long-term acidification through fermentative lactic acid maintains and enhances the antimicrobial effect over an extended period.

Detailed Mechanisms of Action: Monosaccharides and Metabolic Activation

Monosaccharides in Bio-G-Active play a crucial role in reactivating dormant or 'persister' bacterial cells, which are characterized by reduced metabolic activity and increased resistance to antimicrobial agents. By absorbing these sugars, dormant cells initiate metabolic processes to derive energy, inadvertently reactivating their cellular functions. This reactivation is pivotal as it transitions the bacteria from a state of dormancy to active growth, making them more vulnerable to the antimicrobial components of Bio-G-Active.

Phase 3: Complete Biological Degradation and Assurance of Residue-Free Completion

Following its active antimicrobial phase, Bio-G-Active undergoes complete biological degradation. The components of its formulation are specifically chosen to break down entirely under normal environmental conditions into harmless substances. The degradation process results in:

- **Water (H_2O):** A natural by-product that leaves no residues.
- **Carbon dioxide (CO_2):** Produced during the conversion of organic components and released into the atmosphere without causing environmental harm.
- **Salts and minerals:** Minimal concentrations of natural salts remain, which are non-toxic and environmentally safe.

This degradation process ensures that no chemical residues remain on the surface of the meat, meeting the highest standards of food safety and consumer protection. The complete biodegradability of Bio-G-Active establishes it as a sustainable and safe choice for the food industry, posing no risks to humans, animals, or the environment.

Sensory and Visual Enhancements through Biochemical Interactions in the Bio-G-Active Formulation

The formulation of Bio-G-Active employs synergistic biochemical mechanisms that not only ensure microbiological safety but also significantly enhance the taste, color, and texture of treated poultry meat. These effects are achieved through a targeted combination of organic acids, antioxidant compounds, and specific carbohydrate-based components that become active postmortem.

- **Carbohydrate-based substances**: These facilitate enzymatic glycogenolysis by promoting the natural breakdown of muscle glycogen. This stimulates the formation of lactic acid, leading to a reduction in pH and the relaxation of protein structures. The result is improved tenderness and intensified flavor.
- **Phosphate compounds**: These help preserve the water-binding capacity, keeping the meat juicy while preventing oxidative damage to proteins and lipids. They also stabilize natural color pigments, particularly myoglobin, enhancing the visual appeal of the meat.
- **Organic acids (lactic acid, citric acid)**: The targeted use of these acids creates a stable, mildly acidic environment that reduces oxidative stress and enhances color and flavor stability. Their effect extends beyond the direct inhibition of pathogens, positively influencing the biochemical processes of the meat.
- **Ascorbic acid (Vitamin C)**: As a potent antioxidant, ascorbic acid prevents the oxidation of myoglobin into metmyoglobin, which is responsible for undesirable gray discoloration. This ensures a vibrant, fresh appearance over an extended period.

The carefully designed composition of Bio-G-Active interacts on a molecular level with the postmortem biochemical processes of poultry meat. The activation of these processes results in improved sensory quality, characterized by heightened freshness, enhanced color, and a juicier texture. This positions Bio-G-Active not only as a microbiologically effective treatment but also as a solution that clearly surpasses traditional methods through its additional sensory advantages.

Comparison with Chlorine Treatments

Chlorine, although effective in killing microorganisms, is associated with several disadvantages, including the formation of potentially toxic by-products and impairment of sensory qualities of the meat. Chlorine can also promote the development of chlorine-resistant microorganisms, posing a long-term risk to food safety. Bio-G-Active avoids these risks with its natural, biodegradable approach and offers an environmentally friendly alternative that simultaneously enhances food safety and product quality.

Conclusion

The implementation of Bio-G-Active in poultry processing represents a significant innovation based on profound biochemical and microbiological principles. By effectively controlling microbial growth through physiological processes, Bio-G-Active sets new standards in the food industry and offers an advanced solution that is both effective and in line with the requirements for modern food safety and sustainability.

BGA Dictum GmbH
Mommsenstraße 7
10629 Berlin / Germany
+49 (0)30 8442891
post@bga-dictum.com
www.bga-dictum.com