



## Dossier on Surface Treatment of Red Meat: Bio-G-Active as an Alternative to High-Pressure Water Treatment

### Executive Summary:

High-pressure water treatment is widely used in India for cleaning red meat (e.g., buffalo, lamb, and mutton), especially for products destined for export to Arabian markets. However, this method carries multiple microbiological and structural risks for the meat, potentially compromising both quality and shelf life. In contrast, Bio-G-Active offers a much more effective surface treatment that not only minimizes microbiological risks but also preserves the structural integrity of the meat.

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## 1. Background on High-Pressure Water Treatment for Red Meat

### 1.1 Method and Purpose

In red meat processing, high-pressure water treatment is frequently employed to remove contaminants and microorganisms from the surface of meat cuts. Pressures of over 6 bar are typically applied to remove surface impurities such as blood, dirt, and microbial loads.

### 1.2 Disadvantages and Risks of High-Pressure Treatment

#### 1. Penetration of Water and Bacteria into Deeper Layers:

When red meat is subjected to high-pressure water treatment, the intense pressure not only forces water into the meat's outer layers but also drives bacteria from the surface into deeper tissue layers. This has significant consequences:

- **Internal Contamination:** Bacteria that might have otherwise remained on the surface can now be pushed deep into the muscle tissue, where they are protected from standard surface sanitation methods. This hidden bacterial presence is particularly problematic for vacuum-packed or frozen meat, as these bacteria can survive the freezing process and then multiply when the meat is thawed.
- **Increased Risk of Spoilage:** The presence of bacteria within the meat tissue accelerates spoilage, reducing the product's shelf life. When the meat is transported or stored for extended periods, the bacterial load increases, leading to potential off-odors, discoloration, and textural changes.
- **Health Risks for Consumers:** Bacteria that are shielded within the tissue can evade typical food safety inspections, increasing the risk of foodborne illness if the meat is not thoroughly cooked. Pathogens such as *Salmonella*, *E. coli*, and *Listeria* can survive inside the tissue and pose serious health risks.

#### 2. Increased Water Retention in Meat Tissue:

High-pressure treatment pushes water into the muscle fibers, leading to increased

water retention within the tissue. This water retention may seem beneficial for maintaining weight, but it has several negative effects:

- **Compromised Meat Texture:** The excess water trapped in the tissue can cause the meat fibers to swell and weaken, negatively impacting the meat's texture. This results in a softer, spongier texture, which may be undesirable in premium cuts where firmness and natural texture are valued.
- **Drip Loss During Thawing:** For vacuum-packaged or frozen products, the retained water leads to high levels of drip loss upon thawing. This excessive fluid loss diminishes the meat's appearance and reduces its weight, resulting in a less appealing product for consumers. This can also lead to economic losses if the meat is sold by weight.

### 3. **Damage to Meat Structure and Reduced Tenderness:**

The intense force applied in high-pressure water treatment can cause mechanical damage to the meat's structure:

- **Fiber Rupture and Structural Weakening:** High pressure may rupture delicate muscle fibers, weakening the meat's natural structural integrity. This can result in a softer, more fragile product that loses its shape more easily. For markets that prioritize texture and appearance, such damage can decrease the meat's value.
- **Loss of Natural Tenderness:** In cases where high-quality red meat is desired, the natural tenderness is a key attribute. High-pressure water treatment can compromise this, resulting in a product that lacks the firmness and mouthfeel preferred by consumers in premium markets.

### 4. **Microbiological Risks and Incomplete Pathogen Reduction:**

While high-pressure water treatment removes visible contaminants, it is often insufficient in significantly reducing microbial loads. Bacteria such as *E. coli*, *Salmonella*, and *Listeria* may remain on the surface or even be driven deeper into the meat, where they are harder to eliminate.

- **Inadequate Sanitization:** Water alone, even under high pressure, does not provide the necessary antimicrobial action to ensure food safety. Without a suitable disinfectant, the treatment may fail to achieve the required microbial reduction, leaving the meat at risk of contamination.
- **Risk of Cross-Contamination:** The water used in high-pressure treatment systems can become a vehicle for spreading bacteria if not properly filtered or sanitized between batches. This raises the potential for cross-contamination, where bacteria from one piece of meat are transferred to others within the processing system.

### 5. **Lack of Lasting Microbial Protection:**

High-pressure water treatment offers no ongoing protection against microbial growth, which can quickly resume once the treatment is complete.

- **Rapid Recontamination:** Without residual antimicrobial effects, any bacteria surviving the initial treatment can quickly multiply. This is especially critical for meat products stored in warm or fluctuating temperatures during transport or distribution.
- **Reduced Shelf Life:** The absence of lasting protection means that treated meat has a shorter shelf life and requires more stringent temperature control to prevent spoilage. For exporters, this can result in increased handling costs and stricter logistical requirements.

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## 2. Differences in Preservation of Red Meat vs. Poultry

Red meat and poultry differ in composition, requiring distinct approaches to treatment and preservation.

- **Muscle Structure and Fat Content:**

While poultry meat contains mainly fast-twitch muscle fibers with low intramuscular fat, red meat from animals like cattle, buffalo, lamb, or pork is rich in slow-twitch fibers with significant intramuscular fat (marbling). This higher marbling provides a natural barrier to oxidation, improving meat shelf life by preserving moisture and quality.

- **Myoglobin Content:**

The high myoglobin content in red meat necessitates special care to prevent discoloration or greying. Myoglobin gives red meat its color but can oxidize and cause undesirable color changes. Any surface treatment should account for this aspect to maintain the natural red hue of the meat.

Red meat is generally more susceptible to oxidative processes than poultry, making the choice of surface sanitizer critical. Originally developed for poultry, Bio-G-Active has demonstrated its effectiveness in red meat applications as well, supporting microbiological quality without adverse effects on color or texture.

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## 3. Bio-G-Active as a Safe and Effective Alternative to High-Pressure Water Treatment

Bio-G-Active was initially formulated for poultry treatment but has proven highly effective on red meat as well. Bio-G-Active has demonstrated notable improvements in quality in applications on lamb in Australia, as well as pork in Poland and Hungary. This blend of natural acids and phosphates is biodegradable and residue-free. Unlike high-pressure water, Bio-G-Active not only ensures effective surface cleaning but also improves microbiological quality and extends shelf life.

### 3.1 Mechanism of Bio-G-Active

- **Superior Antimicrobial Effectiveness:**

Bio-G-Active demonstrates significantly higher efficacy against microorganisms compared to chlorine and other cleaning methods. Its blend of natural acids and phosphates delivers potent disinfection, substantially reducing bacterial and pathogenic loads.

- **Residue-Free Application:**

Bio-G-Active is applied as the final step in processing, leaving no detectable residues on the meat. Its ingredients are fully utilized, so no declaration as an additive is necessary.

- **Preservation of Meat Structure:**

Unlike high-pressure water treatment, Bio-G-Active does not disrupt the natural

muscle fibers of the meat, preserving its texture and quality. This benefit is especially valuable for high-quality export markets.

### 3.2 Detailed Advantages of Bio-G-Active

1. **Long-Lasting Microbial Protection:**

While water offers no ongoing antimicrobial effect, Bio-G-Active provides sustained microbial protection on the meat surface. It inhibits bacterial and microbial growth over time, greatly extending the meat's shelf life.

2. **Protection of Meat Structure:**

Bio-G-Active is applied without high pressure, maintaining the integrity of the meat tissue and preserving the natural tenderness and juiciness of the meat. High-pressure water, in contrast, can damage delicate fibers and increase drip loss.

3. **Improved Shelf Life and Reduced Oxidative Processes:**

The natural acids and antioxidants in Bio-G-Active slow oxidation processes responsible for color change and quality degradation in red meat. Unlike high-pressure water, which can promote oxygen exposure, Bio-G-Active protects the surface, extending freshness.

4. **Environmental and Safety Benefits:**

Bio-G-Active contains no toxic substances and produces no harmful byproducts. Unlike chlorine-based sanitizers, Bio-G-Active does not form dangerous byproducts like chloramines or trihalomethanes, making it a safer choice for meat processing and the environment.

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## 4. Application Recommendations and Compliance of Bio-G-Active with Indian Standards

### 4.1 Recommended Application Method

Given the challenges of high-pressure water treatment, we recommend using Bio-G-Active as a post-slaughter surface treatment. Reducing water pressure to 3–6 bar combined with Bio-G-Active would:

- improve product microbiological safety,
- preserve meat structure, and
- extend shelf life.

### 4.2 Compliance of Bio-G-Active with FSSAI Regulations

According to a legal review by the Indian law firm *Anand and Anand*, Bio-G-Active complies with the *Food Safety and Standards Authority of India (FSSAI)* regulations for sanitizers and is approved for surface treatment of meat. As Bio-G-Active leaves no residues, there is no requirement to declare its use as an additive, allowing the product to retain its “fresh” classification.

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## 5. Conclusion

High-pressure water treatment of red meat introduces multiple microbiological and structural risks. This method not only drives water and bacteria into the tissue, reducing quality and shelf life, but also leaves microbial residues that can pose health concerns for consumers.

In contrast, Bio-G-Active offers the following advantages:

- **Superior Antimicrobial Efficacy Without Chemical Residues:**  
Bio-G-Active is more effective than water and provides significantly higher antimicrobial efficacy compared to chlorine.
- **Preservation of Meat Structure and Improved Shelf Life:**  
Applying Bio-G-Active maintains the natural tenderness and juiciness of the meat, extending shelf life through inhibition of microbial and oxidative processes.
- **Environmental and Health-Friendly:**  
Bio-G-Active leaves no toxic residues or harmful byproducts, making it a safe and eco-friendly alternative.

**In summary, introducing Bio-G-Active in red meat processing in India could decisively improve product quality while minimizing microbiological risks.**

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