

INNOVATIVE TECHNOLOGIES IN MEAT PRODUCT MANUFACTURING AND THEIR IMPACT ON QUALITY, SAFETY, AND SHELF LIFE

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<https://doi.org/10.5281/zenodo.18786934>

Summary. The meat processing industry is undergoing rapid transformation due to the introduction of innovative technologies aimed at improving product quality, ensuring food safety, and extending shelf life. Traditional meat production methods are no longer sufficient to meet modern consumer demands for high-quality, safe, and nutritionally balanced products. This article analyzes the role of advanced processing technologies such as vacuum packaging, modified atmosphere packaging (MAP), biotechnology, low-temperature processing, and fermentation techniques in meat product manufacturing. Special attention is given to their effects on physicochemical properties, microbiological safety, sensory characteristics, and storage stability. The study highlights the importance of integrating innovation with international quality management systems to enhance competitiveness and sustainability in the meat industry.

Key Words: Meat processing, innovative technologies, food safety, shelf life, vacuum packaging, modified atmosphere packaging, biotechnology, quality control.

Annotatsiya. Go'shtni qayta ishlash sanoati mahsulot sifatini yaxshilash, oziq-ovqat xavfsizligini ta'minlash va saqlash muddatini uzaytirishga qaratilgan innovatsion texnologiyalarning joriy etilishi natijasida jadal rivojlanmoqda. An'anaviy go'sht ishlab chiqarish usullari zamonaviy iste'molchilarning yuqori sifatli, xavfsiz va ozuqaviy jihatdan muvozanatlangan mahsulotlarga bo'lgan talablarini to'liq qondira olmayapti. Ushbu maqolada go'sht mahsulotlarini ishlab chiqarishda vakuumli qadoqlash, modifikatsiyalangan gaz muhitida qadoqlash (MAP), biotexnologiya, past haroratli ishlov berish va fermentatsiya texnologiyalari kabi ilg'or usullarning o'rni tahlil qilinadi. Shuningdek, ularning go'shtning fizik-kimyoviy xususiyatlari, mikrobiologik xavfsizligi, sensor (ta'm, hid, rang) ko'rsatkichlari hamda saqlash barqarorligiga ta'siriga alohida e'tibor qaratiladi. Tadqiqot natijalari innovatsion texnologiyalarni xalqaro sifat menejmenti tizimlari bilan uyg'unlashtirish go'sht sanoatida raqobatbardoshlik va barqaror rivojlanishni ta'minlashda muhim ahamiyatga ega ekanini ko'rsatadi.

Kalit so'zlar: Go'shtni qayta ishlash, innovatsion texnologiyalar, oziq-ovqat xavfsizligi, saqlash muddati, vakuumli qadoqlash, modifikatsiyalangan gaz muhitida qadoqlash, biotexnologiya, sifat nazorati.

Аннотация. Традиционные методы производства мясной продукции уже не способны в полной мере удовлетворять современные потребительские требования к высококачественным, безопасным и сбалансированным по питательной ценности продуктам. В данной статье анализируется роль передовых технологий переработки, таких как вакуумная упаковка, упаковка в модифицированной газовой среде (MAP), биотехнологии, низкотемпературная обработка и ферментационные методы, в производстве мясной продукции.

Особое внимание уделяется их влиянию на физико-химические свойства, микробиологическую безопасность, органолептические характеристики и стабильность при хранении. В исследовании подчеркивается важность интеграции инновационных технологий с международными системами управления качеством для повышения конкурентоспособности и устойчивого развития мясной промышленности.

Ключевая слова: *Переработка мяса, инновационные технологии, пищевая безопасность, срок хранения, вакуумная упаковка, упаковка в модифицированной газовой среде, биотехнология, контроль качества.*

Meat and meat products are essential components of the human diet due to their high biological value, rich protein content, and essential amino acids. However, meat is also a highly perishable raw material that is vulnerable to microbial contamination, oxidation, and quality deterioration. Therefore, ensuring product safety and extending shelf life while maintaining nutritional and sensory quality is one of the major challenges in meat product manufacturing.

In recent years, innovative technologies have become a key driving force in the modernization of the meat industry. These technologies not only improve processing efficiency but also contribute to higher product quality, better safety assurance, and compliance with international food standards.

Innovative Technologies in Meat Product Manufacturing

One of the most widely applied innovations in meat processing is vacuum packaging. By removing oxygen from the package, vacuum packaging significantly slows down oxidative reactions and microbial growth. This method helps preserve the natural color, flavor, and texture of meat products while extending their shelf life.

Another advanced technique is Modified Atmosphere Packaging (MAP), which involves replacing air inside the package with a controlled mixture of gases such as carbon dioxide, nitrogen, and oxygen. MAP effectively inhibits the growth of spoilage microorganisms and pathogenic bacteria, making it particularly suitable for fresh and processed meat products.

Biotechnological methods are also gaining importance in meat processing. The use of starter cultures, enzymes, and beneficial microorganisms improves fermentation processes, enhances flavor development, and increases product safety. Fermented meat products produced using controlled biotechnology exhibit stable quality and improved microbiological safety.

Low-temperature processing technologies, including chilling and freezing, play a crucial role in maintaining meat quality. Rapid chilling reduces moisture loss and microbial activity, while modern freezing techniques help preserve nutritional value and structural integrity during long-term storage.

Impact on Quality and Safety

Proper application of advanced processing methods results in improved texture, juiciness, and overall sensory acceptability.

From a safety perspective, these technologies significantly reduce the risk of contamination by pathogenic microorganisms. When combined with quality management systems such as HACCP and ISO standards, innovative technologies ensure full control over critical processing stages, enhancing consumer trust and regulatory compliance.

Shelf Life Extension and Economic Benefits

Shelf life extension is one of the most important advantages of innovative meat processing technologies. Longer shelf life reduces product losses, minimizes waste, and increases economic efficiency for producers. Additionally, it allows meat products to be transported over longer distances, facilitating access to international markets.

Future Prospects

The future of meat product manufacturing lies in the integration of innovation, sustainability, and consumer-oriented approaches. Emerging technologies such as intelligent packaging, natural preservatives, and digital monitoring systems are expected to further enhance quality and safety standards in the meat industry.

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