2. EUROPEAN HALAL CONGRESS 2024

HALAL HYGIENE and SANITATION

Dr Tharwat Mamdouh Al Bataineh

Name: Dr Tharwat Mamdouh Al Bataineh
Profession: Specialist Food Safety and Halal Regulations
Organization: Ministry of Climate Change and Environment
Phone: +971509585046
E-mail: dr_thrwat@yahoo.com

حلالا طيبا HALALA TAYYIBA

فَكُلُوا مِمَّا رَزَقَكُمُ اللَّهُ حَلَالًا طَيِّبًا
وَاشْكُرُوا نِعْمَتَ اللَّهِ إِنْ كُنْتُمْ إِيَّاهُ
تَعْبُدُونَ

So eat of the lawful and good (pure) food which Allah has provided for you. And be grateful for the Grace of Allah, if it is He

The European Halal Congress aims:

To contribute to a better practical application of halal in everyday life through the presentation and affirmation scientific, professional and practical achievements on halal quality. The purpose of the Congress is to **connect** the academic community, industry (food, pharmaceutical, chemical and others) and state institutions into a single value chain.

Through presentation of knowledge and experience at the Congress, we strive to contribute to the development of halal in Bosnia and Herzegovina, but also in the **world**. Based on the fact that there are a large number of consumers of halal products around the world, efforts will be made to contribute to better cooperation of all actors and participants in the halal value chain. In this regard, halal production needs to increase productivity, improve quality, but also increase efficiency and effectiveness. **The most important goal is to provide interested parties with a quality halal product**.

The Greatest RISK
is
talking NO RISKS at all


التناغم
التعاون
الامتنان
Harmony
Cooperation
Teamwork
Gratitude

INTRODUCTION

- **Food** is not only an essential source of **nourishment** but also a source of **pleasure**, especially when it comes to meat. Meat contains several essential nutrients, including proteins, lipids, vitamins, and minerals (Biesalski, 2005). Several factors can influence meat quality during processing and storage and controlling these factors is important in the meat industry in order to ensure optimal quality and consumer satisfaction.
- Of Ensuring food safety has been and remains a key objective for governments and policymakers, food industry, and researchers worldwide.
- Nevertheless, new challenges may be posed by, inter alia, the **increasing complexity of food supplies, accelerating climate change, intensifying international food trade, new food sources and technologies, circular economy, and sprawling urban agriculture.**

(Food and Agriculture Organization [FAO], 2022).

- The most important aspect of any food safety program's **standard operating procedure** (SOP) and **stringent hazard analysis and critical control point** is rooted in proper hygiene and sanitation practices. For this purpose these two definitions apply:
- 1. Hygiene is defined as the practice of keeping yourself and your surroundings clean, especially in order to prevent illness or the spread of diseases.
- 2. Sanitation is the process of keeping places free from dirt, infection, disease, etc., by removing waste, trash and garbage, by cleaning food production spaces, etc.

Why people chose Halal ?

- **Concentrating on safety, security, and sustainability is part and parcel of the EU's current pathogen management strategy, which has been summarized by May 2020 strategy paper From Farm to fork.**
- **Currently, many efforts have been made to develop more effective halal-authentication detection systems.**

- **Halal is arguably :**
- Healthier,
- Safer for human consumption,
- Superior quality,
- Humane to animals,
- Sustainable,
- Environmental friendly, … Etc.

EUROPEAN HALAL CONGRESS

Intertwining of Halal and Tayyib

- Consumption of halal food among consumers, specifically Muslims, has recently increased globally. The global halal food market has a great potential, and it is growing rapidly across every continent from Asia to the Middle East Africa, Europe, and America.

- Maintaining high standards of hygiene and sanitation is crucial in Halal food production to ensure that the food not only meets religious compliance but is also safe and wholesome for consumption. Halal hygiene and sanitation practices encompass various aspects of food handling, processing, and storing, aligning with the principles of both Halal (lawful) and Tayyib (pure and wholesome).
- This complements the saying of '**halalan tayyiban**' which becomes the objective of Islamic dietary law.

Tayyib & Halal

The Importance of Clean Air

Creating a Productive Atmosphere,

Clean and Safe Spaces, High Quality Product

Clean Indoor Air Should be Mandatory!

- Safety (Tayyib)
- Halal
- Total Value

Food Safety with the line of HALAL …

Wholesomeness

The wholesomeness of the meat has two components :

1) **Meat should be safe to eat**
   - **free from parasites,**
   - **microbiological pathogens and**
   - **hazardous chemicals**

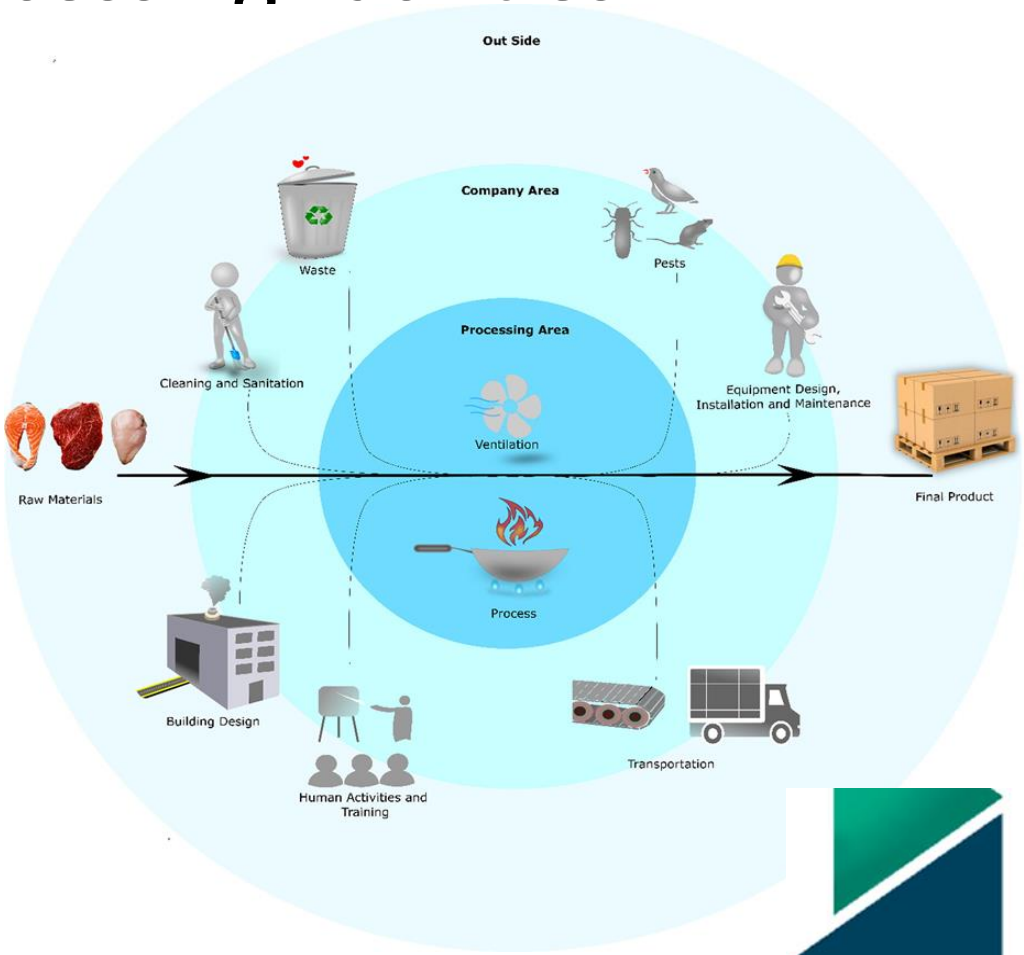
2) **Meat was positively beneficial to consumer's health**
   in contributing minerals, vitamin and protein.

Key objectives for compliance to providing halal food products include:

- 1. Control of cross contamination between halal and non-halal foods but more importantly of impure substances such as bioburden including microbials such as viruses, bacteria, molds and fungi.
- 2. Use Halal certified ingredients, cleaning agents and processing equipment used throughout the food supply chain.
- 3. Avoid the use of chemicals and pesticides.
- 4. Halal slaughtering methods are conducted in a manner prescribed by Islamic law, which includes reciting the name of God at the time of slaughter, ensuring the animal is healthy at the time of the slaughter.
- 5. Properly address any potential of microbial contamination from waste disposal.
- 6. Use of pure, safe water in the processes and packaging.

Food Contaminants and Their Pathways Within Food Processing Facilities

- The Importance of Clean Air
- Creating a Productive Atmosphere,
- Clean and Safe Spaces, High Quality Product



Pure and Healthy

Halal and Tayyib Products are good
for humans and other living things

Halal – The Subject

- Very strict
- Any object or activity that is **permitted**
- Encompasses what is lawful and acceptable for use or consumption.
- Principle of zero tolerance
  - must be 100%
  - no doubt in it

Thayyib – The Process

- Healthy and Quality
  - physical, chemical, biological aspects
- Good and Safe for Consumption
  - food safety
- Clean
  - Good Manufacturing Practices (GMP)

More Than Just Quality - Healthy ● Increased Value

Government regulations and guidance

- There are many common standards and recommendations for sanitary design developed by government and industry organizations. Outside the **United States, laws and regulations** that address sanitary design and cleaning and sanitizing practices include Cleaning and Validation **Guidelines in Canada** (Canada HPFB 2005, Timmerman 2013), Law on Food and Feed and subordinated **regulations in Germany** (Timmerman 2013, USDA FAS 2015), **Regulations and the Machinery Directive in Europe** (CEN 2009, Timmerman 2013), and the **Codex Alimentarius**,

  which provides voluntary international sanitation standards (**FAO** 2003, Timmerman 2013).

- In the U.S., the Department of Agriculture (**USDA**) Food Safety & Inspection Service (**FSIS**; USDA FSIS 2016) provides guidelines for equipment used in meat, poultry, and egg product facilities. The USDA Agricultural Marketing Service (AMS) (USDA AMS 2016) also has an approval process for dairy equipment.

- The Food and Drug Administration (FDA) addresses equipment fabrication and cleanability in its Current Good Manufacturing Practice in Manufacturing, Packaging, and Holding Human Food (cGMPs) (21 CFR Part 110).

- As directed in the Food Safety Modernization Act of 2011, GMP standards will be updated in 2018 through the recent Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Human Foods regulation (21 CFR Part 117).

Halal Regulations

- The halal dietary laws determine which foods are “lawful” or permitted for Muslims. These laws are found in the Quran and in the Sunna, the practice of the Prophet Muhammad, as recorded in the books of Hadith, the Traditions.
- Islamic law is referred to as Shari’ah and has been interpreted by Muslim scholars over the years.
- The basic principles of the Islamic laws remain definite and unaltered. However, their interpretation and application may change according to the time, place, and circumstances. Besides the 2 basic sources of Islamic law, Quran and the Sunna, 2 other sources of jurisprudence are used in determining the permissibility of food, when a contemporary situation not explicitly covered by the first 2 basic sources.
- The first is Ijma, meaning a consensus of legal opinion.
- The second is Qiyas, meaning reasoning by analogy.
- In the latter case, the process of Ijtihad, or exerting oneself fully to derive and answer to the problem, is used.

Halal food shall be processed, packed and distributed under hygienic condition in premises licensed in accordance with good hygiene practices (GHP), good manufacturing practices (GMP).

Enhance Your **GMP**

Must be proven - scientific approach and properly identify any food safety hazard for all food products

The International HACCP Alliance states, “A food safety program, however, does not just stop with HACCP. To be effective, prerequisite programs such as pest control, traceability & recall, hygiene and sanitation need to be developed and implemented. Additionally, the issue of ensuring that suppliers and distributors also have a food safety program needs to be addressed through development of ingredient specifications and a vendor assurance system.”

Analysis and control of biological, chemical, and physical hazards

- ✓ raw material production
- ✓ procurement and handling
- ✓ to manufacturing, distribution
- ✓ consumption of the finished product

All segments of the food ir

- ✓ growing
- ✓ harvesting
- ✓ processing
- ✓ manufacturing
- ✓ distributing
- ✓ merchandising
- ✓ preparing food for consumption

BE SAFE ....

- The U.S. Food and Drug Administration (FDA) has reported that **cross contamination** and improper cleaning and sanitation are among the **biggest risk factors** contributing to foodborne pathogen contamination, spread, and growth (FDA National Retail Food Team 2009).
- More than 80% of existing cleaning and sanitizing processes in the food industry are not validated and are poorly documented. This finding is likely one of the root causes of food safety recalls and outbreaks (Timmerman 2013).
- **The main goal of good sanitary design is to make it easier to clean and sanitize equipment in order to reduce the potential for contamination by biological, chemical, and physical hazards** (21 Code of Federal Regulations (CFR) Part 117, 3-A 2016, AMI 2014, EHEDG 2004, IFPA 2003, Schmidt 2013).
- Food processors want cleaning and sanitizing to be easy to conduct, in the shortest time possible, and at the lowest cost possible, in terms of expenses related to purchasing chemicals, energy inputs, and labor costs (Fryer et al. 2013).

The Future of Reducing Healthcare Associated Infections is Should be Available!

- Effective tools and methods for early warning and emerging risk identification form a solid basis for achieving food systems that are resilient to food safety risks, a priority for national and international authorities and organizations dealing with food safety, enabling their preparedness for emerging food risk prevention, mitigation, and response .
- In the food production chain, meat safety remains a major industrial challenge presented by the emergence of pathogens with low infectious doses, increased virulence, resistance to antibiotics and cross-contamination or recontamination of foods, food contact surfaces and water (Sofos and Geornaras, 2010). Efficient strategies are required to reduce the microbiological safety risks of meat products in tandem with the goal of shelf-life extension.

The Future of Reducing Healthcare Associated Infections is Now Available!

- In present, consumers demand safe foods which also meet other quality criteria that traditional food preservation methods do not meet, such as convenience, high nutritional and sensorial quality, long shelf life, freshness, additives-free status, environment-friendly processing and low production costs

  (Fernández et al., 2012),

- Heat treatments have been widely used for many years to extend shelf life and enhance food safety and are generally well-accepted by consumers. However, they present certain drawbacks, such as the loss of nutrients and the considerable reduction in the organoleptic quality of some foods

  hey cause.

  (Jayasena et al., 2015).

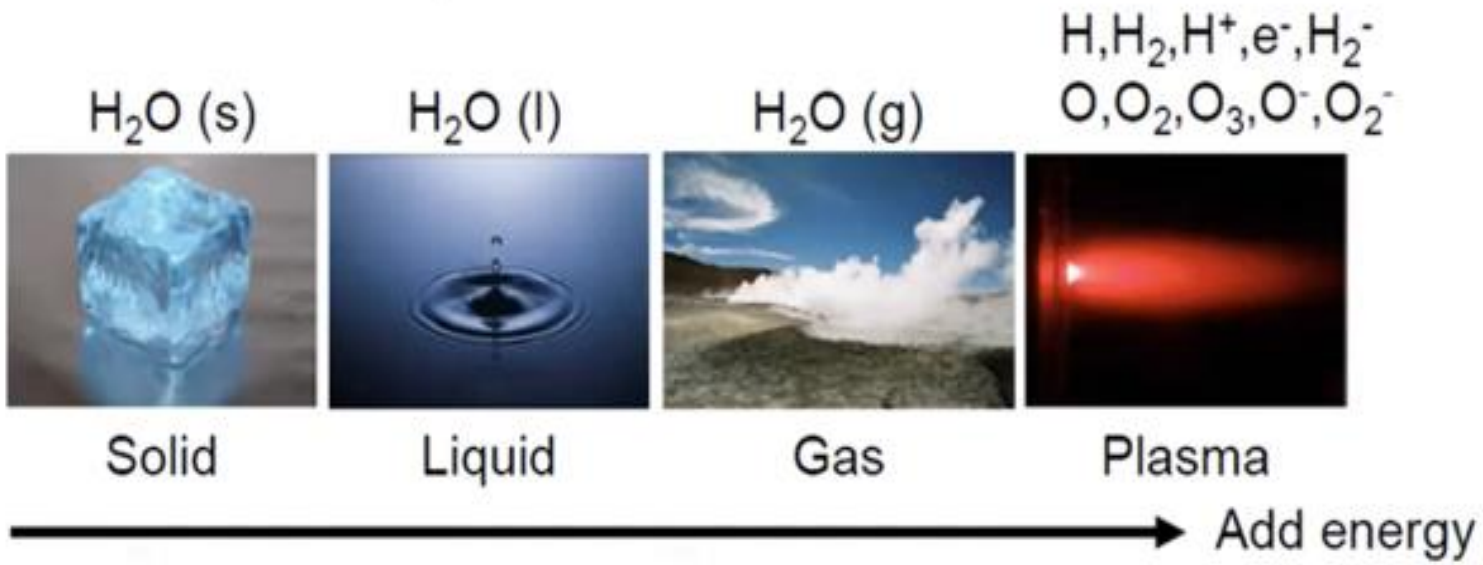
Cold plasma: terminology

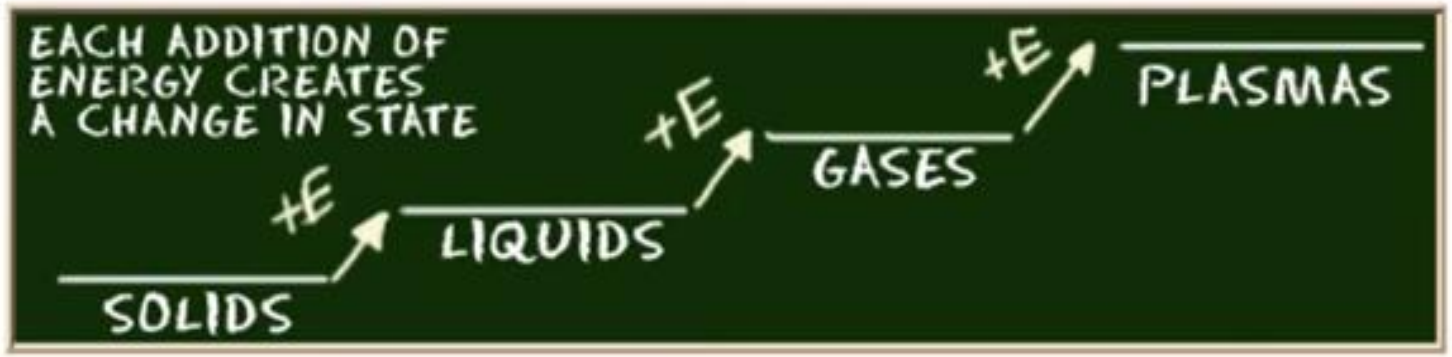
- Terminology: what exactly are we talking about?
  - "Cold", "cool" = operates at or near room temperature (or at least cooler than conventional plasma sources)
  - "Nonthermal" = antimicrobial mode of action other than heat
- As technology evolves, descriptive terminology does also
  - Naming conventions based on technology type vs. plasma type vs. feed gas used vs. application, etc.
  - Similar plasma technologies can have varying names
  - Terms like "cold plasma" can cover a wide variety of technologies, with different functionalities

Non Thermal Plasma

- Plasma are partially or wholly
- ionized gases
- It is the fourth state of the matter
- Form when gases are energized,
- leading to ionization
- Removal of electrons from atoms creates
- a plasma but the electrons also

Plasma the Fourth State





PLASMA is superheated matter- so hot that the electrons are ripped away from the atoms forming an ionized gas…

Cold plasma: overview

- What is a plasma?
  - "Fourth state of matter"
  - Equivalent to highly energetic ionized gas

- Familiar forms of plasma are either hot or inaccessible
  - flames, electric arcs, the sun
  - interstellar gas, insides of some lighting systems

- Cold plasma (also known as nonthermal plasma or cool plasma) uses energetic, partially ionized gases to sanitize foods and food contact surfaces (Niemira, 2012; Pankaj et al., 2018).
- In the past two decades, this technology (or more precisely, this suite of technologies) has garnered increasing research attention internationally (Joshi et al., 2018; Sarangapani et al., 2018). To optimize cold plasma technologies for use in a food processing context, and particularly in the context of fresh fruits and vegetables, collaborative research brings food scientists together with subject matter experts such as electrical engineers and plasma physicists.
- The goal is the production and control of cold plasma discharges for fresh and fresh-cut produce.

(Hori and Niemira, 2017; Misra et al., 2018).

KEY FACTOR ….

- Because cold plasma is waterless and nonthermal, it is of particular interest to processers of fresh fruits and vegetables, which are generally more sensitive to processing treatments (Lacombe et al., 2017).
- **Cold plasma is broadly effective, and because the antimicrobial modes of action rely on ionized gases** rather than chemical sanitizers (Misra et al., 2018), it can be regarded as a chemical-free sanitizing process, which is of interest for organic and “clean label” commodities. The inputs for direct cold plasma treatments are minimal, typically only air and electricity. In these applications, the plasma is created and applied to the commodity, via a plasma jet or dielectric barrier discharge (DBD). The nature and composition of plasma chemistries which interact with the
- commodity surface are dictated by the configuration of the cold plasma equipment, and the particular arrangements of application (Hori and Niemira, 2017; Niemira et al., 2014, 2018). Also, as the modes of action are investigated, pathogen- and isolate-specificity
- in response to cold plasma has been identified as a key factor in overall efficacy

  (Han et al., 2016).

Cold plasma: overview

- Inputs to the system
  - energy (electricity, microwaves, etc.)
  - carrier gas: air, a pure gas (He, Ar, O_2, N_2, etc.) or a defined gas mixture
- Output
  - self-quenching plasma
  - resolves to UV light, ozone, other reaction products
  - chemical residues are expected to be minimal to non-existent
- Relatively new technology for food processing
  - adaptation from existing applications
  - regulatory status

TAYYIB: Naturally, Continuously
NTP is the Future of Tayyib!

- Uses the air
  - Disinfects
    - *Destroys DNA/RNA rendering inactive, reducing microbial burden*
- No residues
- USDA Organic Registered
  - No chemicals
- **Anywhere there is air**
  - Promotes hygiene and sanitation throughout entire space
  - Not limited to line of sight or distance
  - Surfaces
  - Water
- Packaging
- Healthcare and Senior Care

If the process is not clean – *Thayyib*, the potential of cross contamination these products may not be properly Halal certified

The Science
of Air Disinfection Biosecurity NTP

- Proven safe and effective.
- Ambient air is the raw material
  -Exposed to high-frequency controlled electrical pulses within reaction chamber breaking down at the molecular level.
  -Creates a burst of highly reactive molecules with powerful biocidal properties.
  -Dispersed through the air via the HVAC/air handling system or standalone unit acting as airborne neutralizing agents.
- Destroys microbial DNA/RNA rendering inactive.
- Utilize no consumables.

- **Dissociation:**
- **Chemical reaction in which a molecule or compound breaks into smaller pieces, such as ions, atoms, or radicals.**

Removes Bio-loads Safely Disinfects & Sanitizes Air, Surfaces & Water

Bacteria/biofilms including MRSA, VRSA, C. diff, *E-Coli, Salmonella, TB and Staph*

Fungi/Mold/biofilms including *Candida auris, Aspergillus fumigatus, Aspergillus Niger, Cladosprorium sphaerospermum*

Viruses including: *Sars-Covid, RSV, Norovirus, Influenza, Hepatitus, Rhinovirus*

Reducing VOCs including Formaldehyde, Toluene, Benzene, Acetone, Ethanol and Butanal

Currently being tested for its effectiveness against insects, larvae and eggs

Applications and Application Engineered Solution

Why it is Required?

The Importance of Application Engineering

MDBD Non-Thermal Plasma Species are an “equal opportunity” pathogen killer,

Important because when properly designed it is proven to be effective against most pathogens that impact both people and animal health, food safety, preservation and freshness!

Building metrics are critical to understand to properly design as no two building perform the same due to many variables.

pH Levels of Plasma Activated Water (PAW)

The pH level of PAW can vary depending on several factors, including the type of plasma used, the duration of exposure, and the initial properties of the water. Generally, plasma treatment can lead to slight acidification due to the formation of nitric acid and other acidic components from nitrogen in the air. However, this acidification is typically mild and can stabilize over time.

pH Levels of Plasma Activated Water (PAW)

Maintenance of Proper pH Levels

1. **Stabilization**: After the initial plasma activation, the pH of PAW often stabilizes. The presence of RONS can help buffer the pH, preventing drastic changes.
2. **Adjustability**: The pH of PAW can be adjusted through controlled plasma treatment. By regulating the plasma parameters, it is possible to produce PAW with desired pH levels suitable for specific applications.
3. **Buffering Capacity**: PAW has been found to maintain its pH stability even when diluted or exposed to different environmental conditions, making it a versatile solution.

Applications Benefiting from pH Stability

1. **Agriculture**: In hydroponics and irrigation, maintaining a stable pH is crucial for nutrient availability and plant health. PAW can enhance plant growth and resistance to pathogens while maintaining appropriate pH levels.
2. **Food Safety**: PAW can be used for sanitizing fresh produce and surfaces. Its mild acidity and reactive species help in killing bacteria and other pathogens without the need for harmful chemicals.
3. **Healthcare**: In wound healing and disinfection, PAW's stable pH and antimicrobial properties can promote faster healing and reduce infection risks.

Applications of Non-Thermal Plasma as a Pesticide

1. **Insect Control**:
   - **Direct Exposure**: NTP can be used to directly expose insects to plasma, leading to their immediate inactivation or death. This can be particularly effective against small and soft-bodied insects.
   - **Egg Sterilization**: NTP can disrupt the development of insect eggs, preventing hatching and reducing future pest populations.
2. **Fungal and Bacterial Pathogen Control**:
   - **Surface Sterilization**: NTP can be applied to the surface of plants to eliminate fungal spores and bacterial cells. This helps in preventing diseases caused by pathogens like powdery mildew, downy mildew, and bacterial blight.
   - **Seed Treatment**: Treating seeds with NTP can sterilize them, removing surface-borne pathogens and promoting healthier germination and growth.
3. **Post-Harvest Protection**:
   - **Produce Sterilization**: NTP can be used to treat harvested fruits and vegetables, reducing microbial load and extending shelf life by preventing spoilage caused by fungi and bacteria.

Benefits of Non-Thermal Plasma as a Pesticide

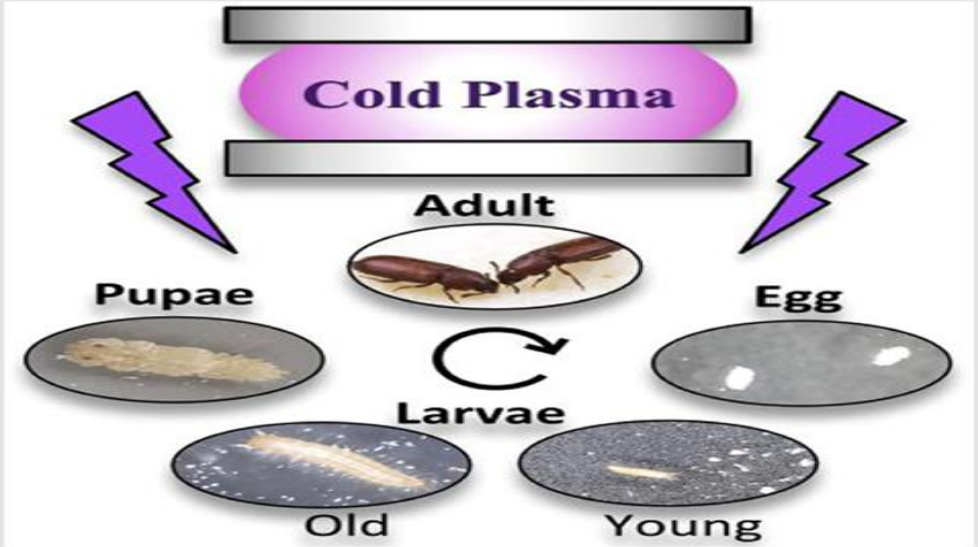
1. **Eco-Friendly**: NTP is an environmentally friendly technology that does not leave harmful residues on crops or in the environment, unlike chemical pesticides.
2. **Reduces Chemical Dependency**: Using NTP can reduce the reliance on chemical pesticides, promoting sustainable agricultural practices and reducing the risk of pesticide resistance.
3. **Broad-Spectrum Efficacy**: NTP is effective against a wide range of pests and pathogens, making it a versatile tool in integrated pest management (IPM) strategies.

Safety for Humans and Animals: NTP treatments are generally safe for humans and animals, reducing health risks associated with pesticide exposure

Insect Control – Organic Uses in Agriculture, Feeds, and Grains

Abstract

The insecticidal properties and mechanisms of high-voltage air-based atmospheric cold plasma using a contained dielectric barrier discharge reactor were investigated against *Tribolium castaneum* as an important bio-contaminant in stored grains spoilage. The mortality of 95.0%–100% for preadult stages can be achieved within seconds of treatment, but longer plasma exposure (5 min) is required to kill adult insects. Cold plasma treatment reduces both the respiration rate and the weight of insects and affects the levels of oxidative stress markers in adult populations. Sufficient toxicity is achievable through plasma process control in air to address the range of insect lifecycle stages that are disease vectors and pose risks for grain stability in storage. Balancing insecticidal activity with grains' quality retention can provide a route to sustainable integrated pest management.



KEYWORDS

cold plasma, insecticidal effect, mortality, oxidative stress, *Tribolium castaneum*

Halal and Tayyib

Applications of Air Disinfection
Biosecurity
NTP Technology in the
Food Industry, Agriculture and
Medicine

Environmental reduction of TPC and MOLD SPORES in Sopraval Poultry Operation

Sopraval
Poultry Processing Plant

2007

SCOPE/ CUSTOMER SITE

Animal health: **Sopraval Poultry Production Plants.**
https://www.sopraval.cl/
Conducted at plant by customer production team.

OBJECTIVE

In plant verification of Oxyion/PathogenFocus Technology in poultry hatching parlors by counting airborne microorganisms.

MATERIALS AND METHODS

Monthly sampling via plate sedimentation. Pre-test January, installation (April), in treatment (May, June, Jul, Aug.) **discontinued in July then resumed in-treatment in August** through November.

Determinations: Total plate (TPC) and mold counts in the environment

Oxyion /PathogenFocus technology installed in hatcheries in April

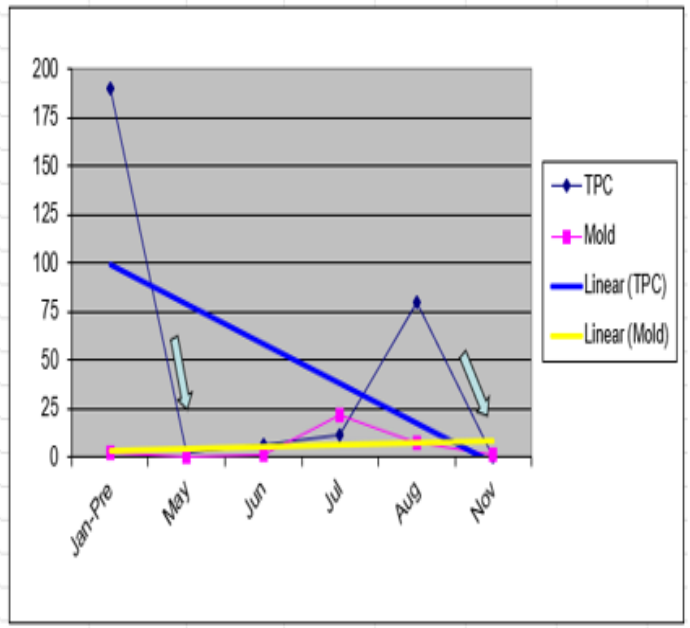
Count of environmental microorganisms

Comparison before and in-treatment samples.

RESULTS

PATHOGENFOCUS

TPC and mold counts (CFU/plate) counts in hatch rooms Oxyion/PathogenFocus Technology.



Data shared by customer

"Pre-test was carried out in January, resulting in the presence of Aspergillus sp. and Penicillium sp. This was contrasted with the in-treatment sampling that was carried out in the same areas mentioned, with the equipment already working, as can be seen where no presence of mold spores was found within May"

Significant reduction of Aspergillus and Penicillium to non-detectable levels in poultry operation.

CONCLUSIONS

It was evidenced that Oxyion/PathogenFocus Technology achieved a continuous and permanent purification in hatching rooms, minimizing microorganism increases, managing to maintain environmental conditions that prevent the spread of diseases in birds.

Poultry Processing Operation Area Reduction

Customer site
L&T Testing

SCOPE/ CUSTOMER SITE

Poultry processing rooms. **Samples taken at customer plant subcontracted to L&T for analysis**

OBJECTIVE

Compare total microorganism counts in different process areas of processing company where Oxyion/PathogenFocus Technology is being applied. In plant verification.

MATERIALS AND METHODS

Environmental sampling by impact on plate determination: Total counts.
Sampled areas: Cut areas, ground meat, packing, processing, back store, access.

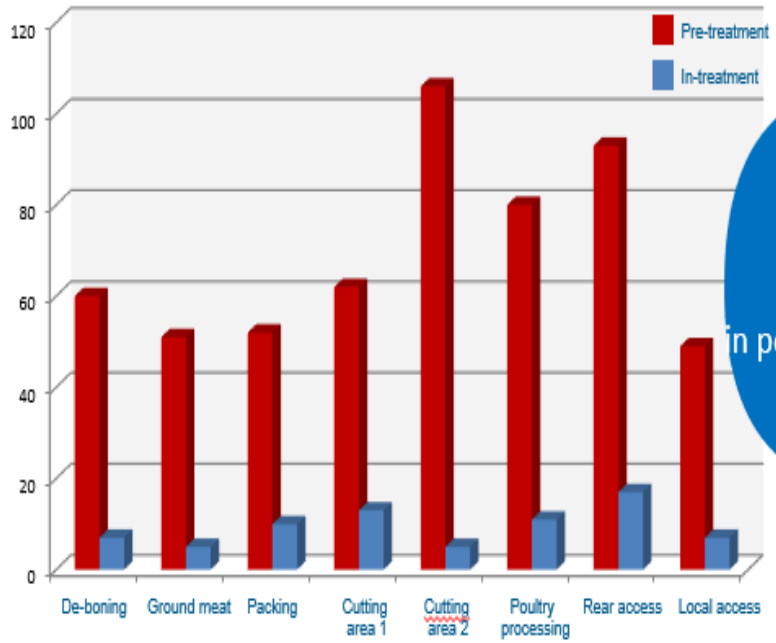
Exposure to Oxyion®/PathogenFocus Technology measured
21 days in treatment (before and after)

Counting of microorganisms in air by plate impact methodology.

Data analysis

RESULTS

FURTHER PROCESSING POULTRY AREAS (BEFORE-IN TREATMENT)



▸ Over +90% pathogen reduction in 21 days of treatment in poultry processing operation.

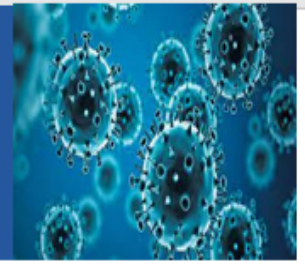
CONCLUSIONS

- Over 90% control of environmental microbiological contamination industrial poultry processing plant (TPC: bacteria, molds and yeasts).
- Supplemental unpleasant **odor control** within the treated areas

Elimination of H1N1 Influenza: Study for Influenza A Virus (includes Avian Flu)

U de Chile. Department of Preventive Medicine, Faculty of Veterinary and Livestock Sciences.

2021



SCOPE/Veterinary and Livestock Sciences Lab

Food Processing Rooms, Environmental Biosecurity in Public and Work Spaces, Health Facilities, Animal Health, Production Areas, Materials and Transport.

OBJECTIVE

To determine the efficacy of Oxyion®/PathogenFocus Technology in eliminating the **Influenza A (includes Avian or Bird Flu)** using H1N1 virus to show effectiveness.

MATERIALS AND METHODS

Cultivation of Influenza H1N1.
100 ml inocula, indoor viral cultures, sterile petri dish.

Exposure to Oxyion/PathogenFocus Technology :
30 min

Determination of Cytopathic Effect
MDCK cell line.

RESULTS

PATHOGENFOCUS

Viricidal efficacy of Oxyion/PathogenFocus Technology against INFLUENZA A H1N1.

Virus	Test	Viral title TCID50	Viral title reduction %
Influenza H1N1	Control 1	3.E+00	control
	Test 1	1.E+05	99.993%
	Control 2	3.E+00	control
	Test 2	3.E+04	99.994%
Influenza reduction average after exposure to Oxyion/PathogenFocus			99.994%

INFLUENZA A Viruses eliminated with a 99.994% EFFICIENCY within 30 minutes.

CONCLUSIONS

Oxyion/PathogenFocus Technology showed virucidal efficacy >99.99% at 30 minutes, demonstrating that it is capable of eliminating the Influenza A H1N1 virus.

FINAL CONCLUSION

Study developed to evaluate the shelf life on fruits and vegetables, after the application of 72 hours of OXYION, in retail settings, measuring parameters of mold and dehydration.

→ **A CONSIDERABLE DECREASE IN MOLD WAS ACHIEVED IN PRACTICALLY ALL VARIETIES DURING THE TIME THAT THE VERIFICATION LASTED, IN ADDITION TO A REDUCTION IN DEHYDRATION, WHICH INCREASES THE CONDITION AND APPEAL OF THE PRODUCTS TO THE FINAL CONSUMER.**

THE USE OF THE OXYION TECHNOLOGY SIGNIFICANTLY REDUCED SPOILAGE AND SHRINK OF PERISHABLE PRODUCTS.

Pilot Program Objectives

Demonstrate the effectiveness of Non Thermal Plasma NTP (PathogenFocus's) air and surface sanitization technology in multiple working environments through third-party lab analyses.

- Baseline Measurement

  Within a working building environment, measure and identify the bio-loading that exists in multiple buildings that each have code compliant HVAC systems.

  Lab cultivation and analyses of surface swabs and air samples taken from building before treatment.

  Multiple locations indoor and out (air samples only outside).

  Deliver third party scientist results for baseline measurements.

- Treat The Space

  Introduce NTP Technology (PathogenFocus equipment) to the building and allow it to treat the space(s) for 6-8 weeks.

  No changes in HVAC operation or cleaning practices during this treatment period.

  Building to be used as normal during this period as well.

- Demonstrate Technology Impact

  Successfully demonstrate the effectiveness of the air and surface sanitizing technology by repeating the lab process and comparing the "in-treatment" lab measurements against the original baseline measurements.

PF ADB Promotes Halal & Tayyib

Quote from ISLAMIC SERVICES OF AMERICA

- GMP require indoor air quality to be moderately clean and rated as safe!
- The use of your product, PathogenFocus ADB NTP will protect halal product because of its Tayyib aspect
- Rendering the product to be Halal & Tayyib
- The system will add value to their halal program where your product will block any undesirable participle in air that may affect their product

Yassine Tebbal
Quality Assurance Director
ISA
ISLAMIC SERVICES OF AMERICA
Your Guide to the Global Halal Market ®
www.isahalal.com
O: 319.362.0480
ytebbal@isahalal.com
isa@isahalal.com

The Future of Reducing Healthcare Associated Infections is Now Available!

- Falsify DNA result - where it is always false negative or wrong species detection and … so this system will help to provide system and accurate result without any shobha- means no bacteria in air that falsify the reading.
- NTP technology is good to be use in abattoirs regarding animal welfares - animal will not suffer
- Some studies for this technology that show before and after filtration - all findings will harm our food chain.
- This is why this technology will add value to halal product - clean air will help production and packing process - most industry use vacuum system - imagine clean environment and well sealed packing - shelf life will extend automatically- no preservatives needed…
- Also this technology can be used indoor household where it will stop mold growth and …. Fresh air will help breading system inspiratory and expiratory (shaheek and zaffeer)…
- Why people are allergic to many substances in the air especially during spring time …

Conclusion

- There are numerous methods to preserve foods, as we know.
- Among them, COLD PLASMA (CP)
- Non-Thermal Plasma Reduces Microbial Contamination

  while Enhancing Hygiene, Sanitation
- CP has been explored to enhance the shelf life of foods by inactivating spoilage microorganisms and enzymes,

  enhancing food dehydration, and improving the packaging materials

  for better food preservation.

Conclusion

- Cold plasma is an effective, water-free, chemical-free, contact-free antimicrobial processing technique
- Parameter space is extensive in devices for generation of non-thermal plasma
- Demonstrated efficacy against a wide range of human pathogens, contaminating/outbreak/spoilage-associated microorganisms
- Examined as a method to control coronaviruses
- Effective against planktonic and biofilm phenotypes

- **Future Considerations**?
  - Synergy with conventional agents/processes
  - Integration with existing processes and equipment
  - Scalability
  - Regulation

The Future of Cold Plasma

- Although recent results are promising, continued research and development efforts are needed for cold plasma to

move toward commercialization.

Some key areas include determination of modes of action; optimization of gas mixtures to balance power consumption, antimicrobial efficacy, and feed gas cost; and improving speed, efficacy, and compatibility with existing food handling and packaging systems. Parallel research tracks will see the development of cold plasma systems intended to sanitize packaging materials and in areas where sanitizer-resistant pathogen biofilms

form, such as food contact surfaces, drains, and conveyor belts. With these

developments on the horizon, cold plasma is positioned to be a flexible,

effective sanitizing process for the food processing industry in the near future.

The Future of Cold Plasma

- Filtration system - filter air from khabithe (harmful bacteria) to make the air clean and Tayyib - now many countries they add clean air part of GMPs - as you know mold is dangerous in our health - so the system will prevent bacteria growth –
- Even food processing became a requirement
- From Halal - it will help Tayyib aspect with killing bacteria in the air - extend shelf life and more…
- Air is not clean,, so during the packaging process- even product is halal how about when it is packed and stored!!

Recommendation

*There is a continuing need for effective antimicrobial processes suitable for application to fresh and fresh-cut fruits, vegetables, meat and other food products, It is anticipated that **cold plasma**, in all its many forms, will be a **cornerstone technology i**n that effort. As it matures, it will prove to be one of the most important technologies of the last several decades to arise for application to these commodities. The rapidly expanding body of cold plasma research, academic and industrial, is on pace to support a sea change in how fresh produce is cleaned and preserved in the coming decades.

*Think about a challenging situation concerning how to ensure proper hygiene and sanitation in your facilities. Whether it be in air, surface or water NTP offers a potential solution.

*Treating the air also impacts surfaces that the air contacts. For water NTP can offer stability p maintenance as well as maintenance reducing microbials and biofilms

MANY THANKS and REGARDS