

The International Symposium 2022 on “Plasma Tech-Driving Sustainable Future” 10-11<sup>th</sup> November 2022

# Non Thermal Plasma and Micro-Nano Bubble Applications for Post-Harvest Fruit and Horticulture in Maintaining Food Security and Safety

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Center for Plasma Research, Universitas Diponegoro



**UNDIP** | UNIVERSITAS  
DIPONEGORO  
becomes an excellent research university

# What is Plasma

- Plasma a fourth state of matter after gas, formed of positive ions, negative ions, electrons, excited molecules and atoms, free radicals.
  - Three state of matter that well kown:
    1. Solid
    2. Liquid
    3. Gas.

PLASMA is the ANOTHER state of metter.



# What is PLASMA?

- “Fourth State” of matter
- Ionized gas at high temperature capable of conducting electrical current
- Lightning is an example from nature





## Delapan Inovasi Paling Top:

# Inspirasi dari Petir

APA HUBUNGAN ANTARA PETIR DAN KESUBURAN LAHAN? "DI DAERAH YANG BANYAK PETIR, BIASANYA TANAHNYA SUBUR." UJAR DR MUHAMMAD NUR DEA, PERISIT JURUSAN FISIKA UNIVERSITAS DIPONEGORO. IA MEMBUAT TEKNOLOGI PLASMA BERUPA GAS YANG TERIONISASI DALAM LUCUTAN LISTRIK, PERSIS PETIR. TEKNOLOGI ITU MEMPERCEPAT PEMBENIHAN BENIH BAKAU SEKALIGUS MENINGKATKAN PRODUKSI TANAMAN.

Des Sutyoso, ahli budidaya pertanian, menjelaskan duduk perkara petir dan kesuburan tanah. Di udara terdapat  $N_2$ , alias nitrogen berkadar 79% dan  $O_2$ , atau oksigen berkadar 20,9%. Keduanya telah bisa berikatan karena



Intensitas petir terbesar di dunia ada di Kotamadya Depok, Provinsi Jawa Barat. Nitrogen dari Depok juga mengalir ke Pasaringgu, Jakarta Selatan, yang dulu sohor sebagai sentra buah-buahan nasional. Cara kerja petir itulah yang mengilhami Muhammad Nur menerapkan teknologi plasma untuk mempercepat pertumbuhan bakau *Rhizophora apiculata*.

### ionisasi nitrogen

Teknologi plasma terdiri dari penyedia tegangan tinggi DC, pembangkit plasma, dan reaktor plasma. Sumber energi untuk pembangkit voltase tinggi berasal dari sumber PLN 220 volt atau baterai 12 volt. Dengan alat itu Nur membuat "petir mini" agar terjadi ionisasi nitrogen. Inti teknologi plasma yang dikembangkan Nur persis teknik *plasma cluster* yang diadopsi industri televisi, kulkas, dan mesin pendingin ruang.

Mereka memanfaatkan gas terionisasi dalam lucutan listrik. Teknologi plasma menyaring udara dan melumpuhkan mikroorganisme di udara dengan sebaran ion positif dan negatif yang

Universitas Diponegoro itu. Lagi pula alat itu dapat digunakan untuk ionisasi benih komoditas lain seperti tomat, cabai, sawi, dan jagung untuk meningkatkan produksi.

Pada pembenihan bakau, teknologi plasma mengurai udara demi membebaskan unsur nitrogen sehingga terjadi ionisasi nitrogen. Nur menembakkan ion nitrogen ke benih bakau selama 10 menit. Ion nitrogen menyusup ke dalam benih. Sutyoso mengatakan tanaman memerlukan unsur nitrogen antara lain untuk perkecambahan dan perkembangan daun. Nur, kelahiran Labuhanruku, Asahan, Provinsi Sumatera Utara, 26 November 1957, mengatakan semakin lama pengionan, kian cepat pertumbuhan tanaman.

Benih-benih bakau hasil radiasi ionisasi nitrogen itu ditanam di Teluk Awur, Jepara, Provinsi Jawa Tengah. Pengionan nitrogen pada benih bakau selama 60 menit, misalnya, mempercepat pertumbuhan 24,13%. Pada fase perkecambahan benih yang dionisasi nitrogen juga lebih cepat. Biasanya benih bakau baru tumbuh setelah 60 hari. Dengan ionisasi nitrogen anggota famili Rhizophoraceae itu tumbuh 28 hari kemudian.

### Multiguna

Bakau memang lambat tumbuh, 4 daun setahun. "Pertumbuhan bakau lambat karena kita belum tahu kebutuhan minimal yang diperlukan bakau," ujar Prof Dr Sukristijono Sukardjo, ahli bakau dari Pusat Penelitian Oseanografi LIPI.

Selain itu persentase tumbuhnya benih yang dibanamkan hanya 20%. "Kadang-kadang hanyut dibawa gelombang," kata Windy Indra Ardiansyah dari Kelompok Studi Mangrove Teluk Awur. Radiasi ion nitrogen terbukti mempercepat pertumbuhan bakau.

Menurut Sukristijono pertumbuhan bakau sangat kompleks. "Banyak faktor yang mempengaruhi. Bakau yang ditanam di lahan berpasir dan berlumpur, pertumbuhannya berbeda," ujarnya. Faktor lain berupa genangan air dan sifat fisika air. Doktor mangrove alumnus Universitas Nijmegen, Belanda, itu mengatakan riset Muhammad Nur perlu dibuktikan di daerah lain.

Teknologi ionisasi nitrogen harapan bagi pemulihan hutan bakau yang sebagian rusak. Menurut data Direktorat Jenderal Rehabilitasi Lahan dan Perhutanan Sosial, luas hutan bakau Indonesia 9.204.840 ha. Lebih dari separuh itu

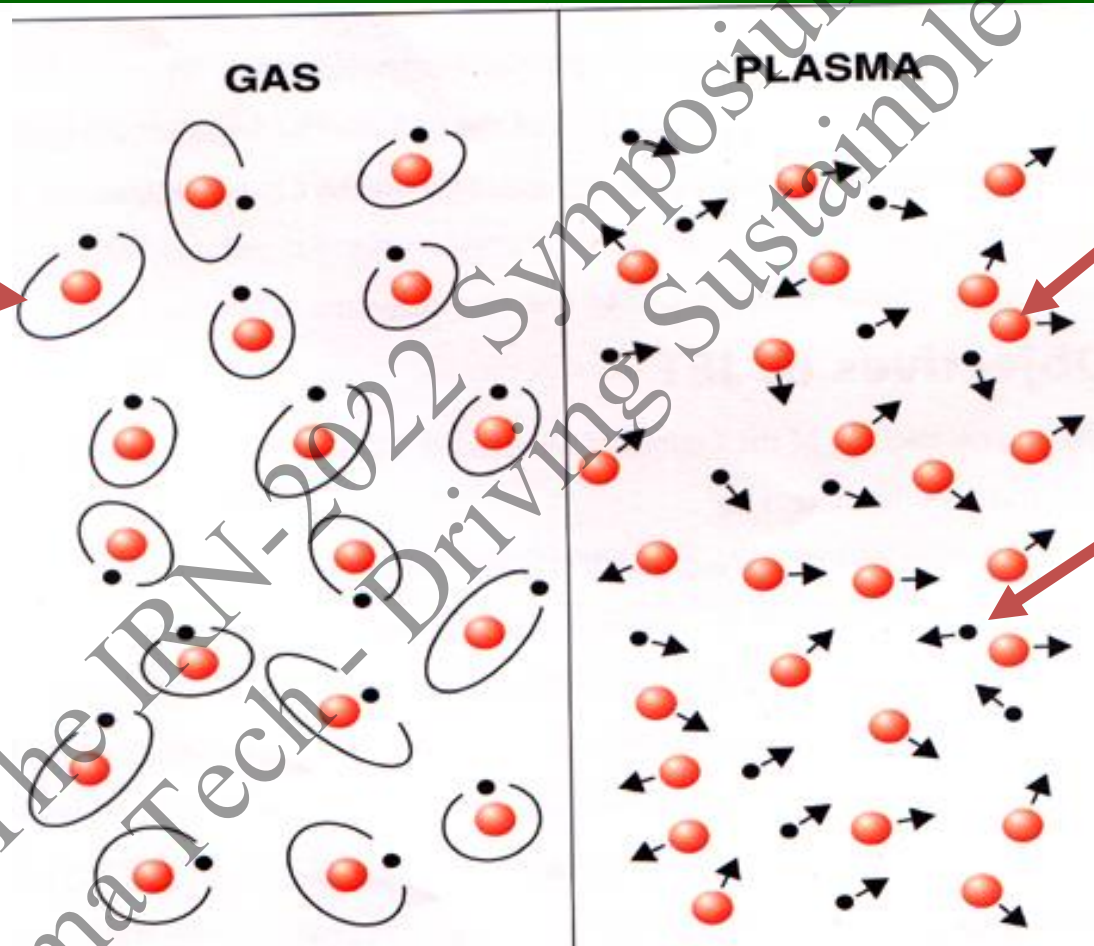




# What is difference between Gas and Plasma?

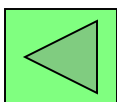
Atoms  
(gas)

Pada hari ketika langit menjadi seperti luluhan perak (PLASMA) (Q. Al Ma'Rij 8)



ION

Electron



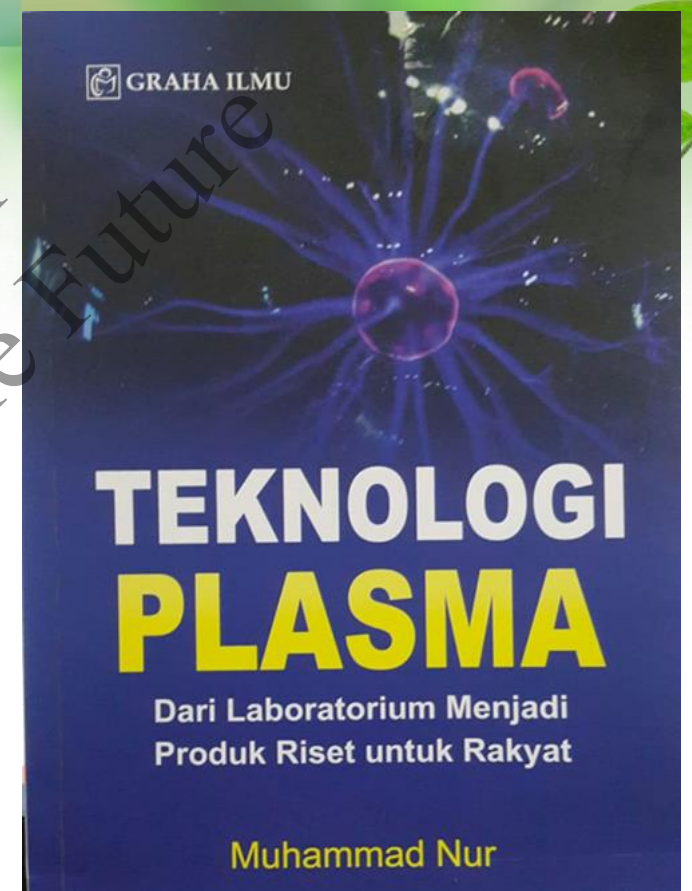
# What is PLASMA?



- “Fourth State” of matter (solid, liquid, gas, **PLASMA**)
- Ionized gas at high temperature capable of conducting electrical current
- Lightning is an example from nature



<http://cpr.undip.ac.id/>



● **Cold Plasma (plasma DBD, CORONA Plasma)**

● Thermal Plasma ( Lightning, Plasma Welding etc.

● Tokamak Plasma (ITER, Nuclear Fusion, Star, Sun)

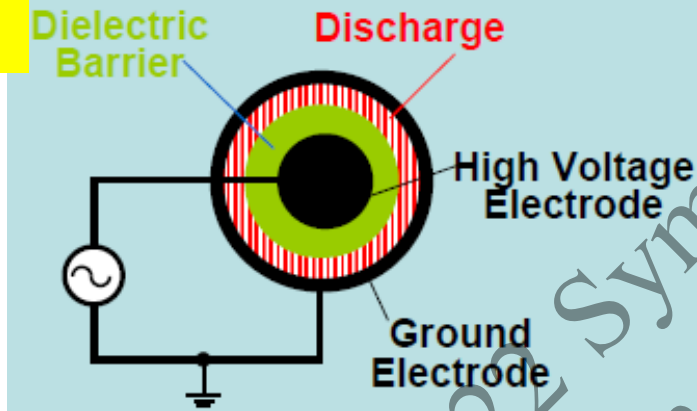




# Single & Double

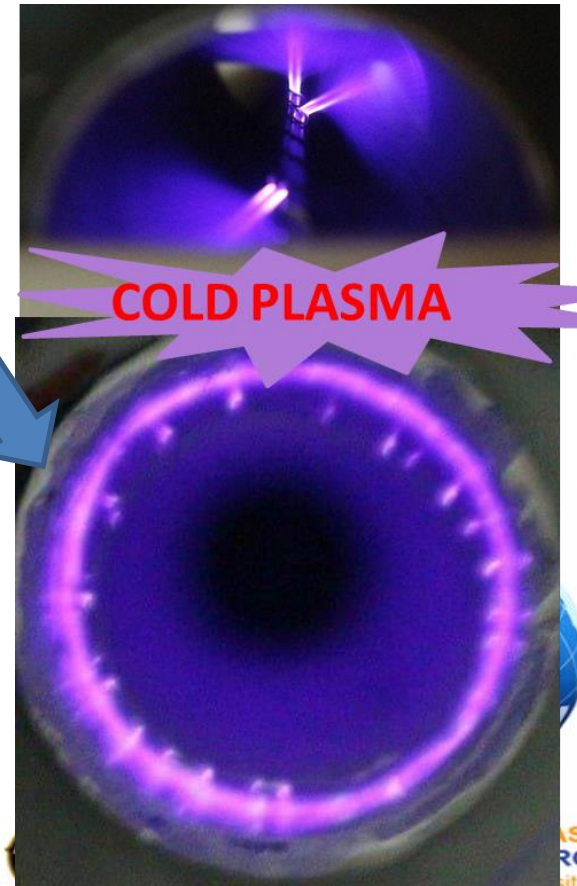
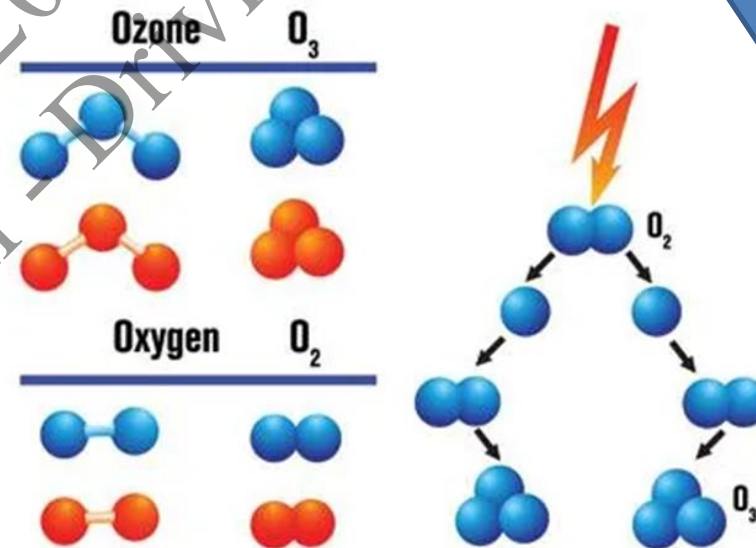
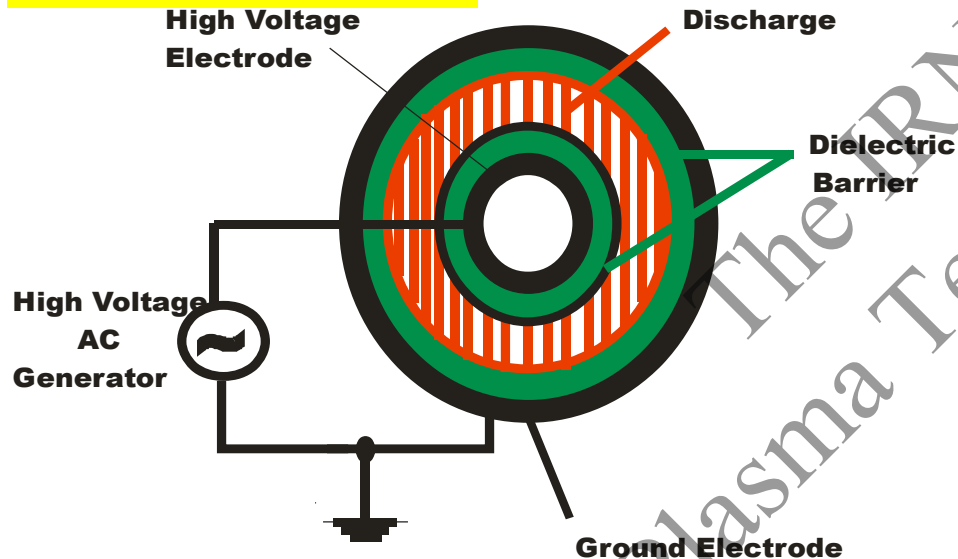
# Dielectric Barrier Discharge Plasma as **Ozone** Generator

## Single DBD Plasma



## Reactor of Ozone Generator

## Double DBD Plasma



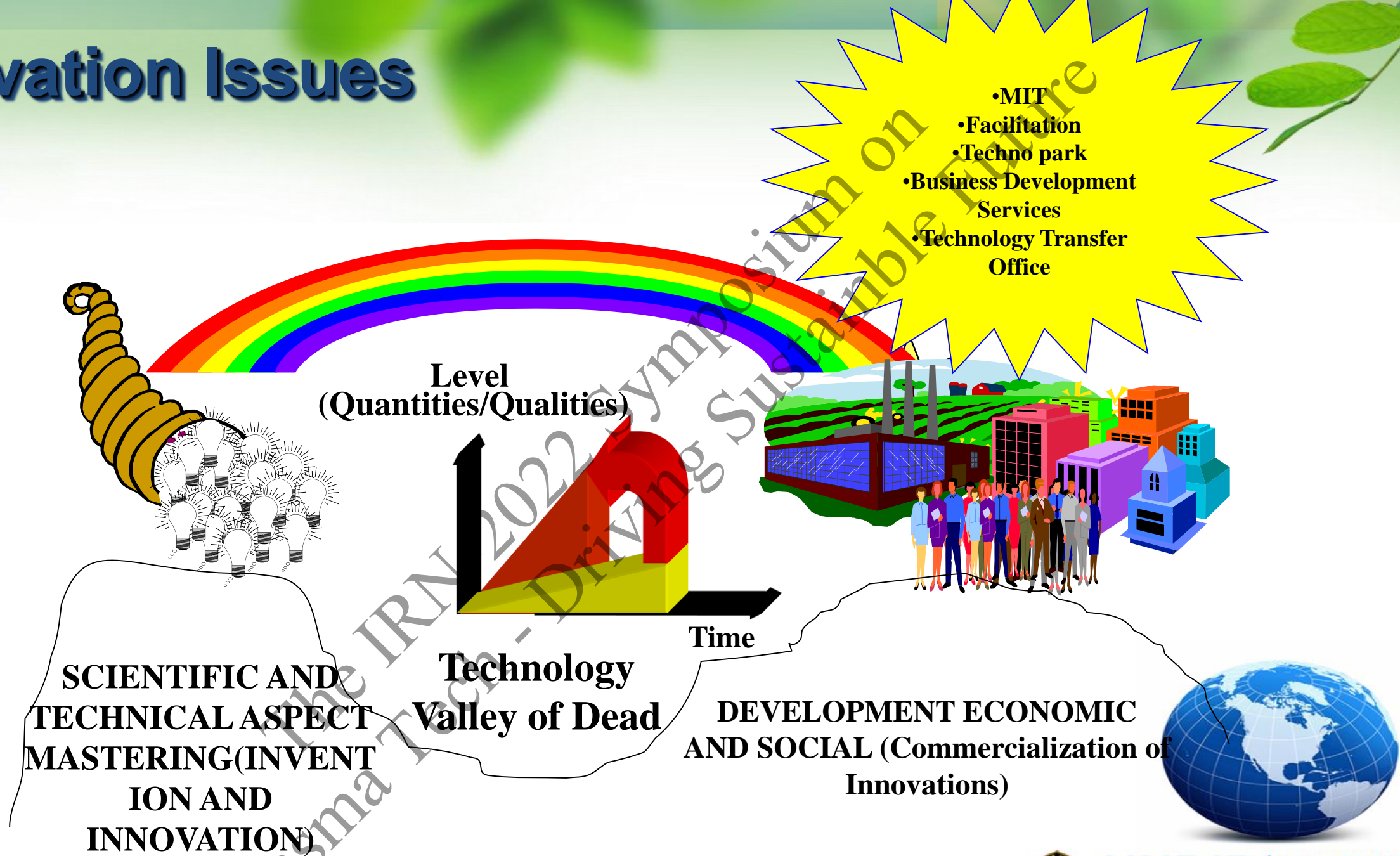
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# Research Science and Technology Plasma in Indonesia

Appiliation /Institution	Research Topics	Research Focus	Leader/Scientist
<b>Center for Plasma Research Diponegoro University</b>  Diponegoro University  Diponegoro University	Corona Discharge Plasma Dielectric Barrier Discharge Plasma Jet Plasma Plasma Radio Frequency Laser Induced Plasma  Catalytic Plasma	<ol style="list-style-type: none"><li><b>1. Plasma Application for Material &amp; Textile</b></li><li><b>2. Plasma Application for Environment and Energy</b></li><li><b>3. Plasma for Agriculture and Food</b></li><li><b>4. Plasma Application for Biology and Medicine</b></li><li><b>5. LIPS, Nanomaterial</b></li><li><b>6. Biodisel and Environment</b></li></ol>	Muhammad Nur  Thohar Yuniati  Wahyu Setiabudi  Istadi
Universitas Sebelas Maret	Arc Discharge Plasma	Nanoparticles and Nanomaterial	Teguh E Saraswati
University of Indonesia	Corona Plasma	Environment and Hydrogen Production	Nelson Laksono
Andalas University	DBD Plasma	Environment	Ariadi Hazmi
Bandung Institute Technology	DC Sputreing Plasma	Material and thin film	M. Djamal
P3TM BATAN Yogyakarta	DC Sputreing Plasma	Material and thin film	Anto Sugiarto
Indonesian Science Institute	Corona Discharge Plasma	Environment	



# Innovation Issues

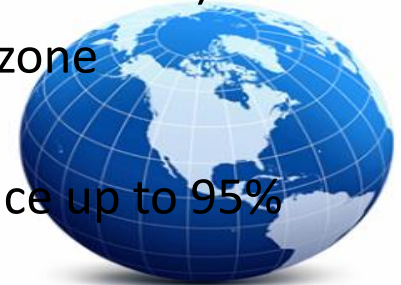


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# Why Ozone Technology for Food is needed in Indonesia

- Food products that spoil quickly are caused by spoilage enzymes that are generated by bacteria and fungi
- Indonesian people are still very attached to the consumption of fresh food (especially chili, onions, legumes, vegetables, fruit fiber)
- Bacteria and Fungi can be reduced by ozone exposure directly or washing by water dissolved ozone
- Ozone exposure in food leaves no residue (FDA America, and various studies of ozonized for food)
- The manufacturing of high-capacity Ozone Generators with air sources has been mastered by domestic experts and is very competitive from the commercial aspect
- Need post-harvest handling on “Volatile Foods”, such as chilies, onions, vegetables that can trigger inflation (inflation in Indonesia on July 2022 was 5.6%, the largest contribution was chili at 1.6%)
- SNI 8759:2019 has been successfully made, as National Standard of the application of ozone technology for the treatment of horticultural products
- Washing with ozone dissolved water can reduce pesticides. In certain products can reduce up to 95%





**SNI 8759:2019 Conceptor for postharvest horticultural product storage using ozone technology - Quality requirements and test methods**

Informasi pendukung terkait perumus standar

[1] Komtek perumus SNI  
Komite Teknis 21-01, Permesinan dan Produk Permesinan

[2] Susunan keanggotaan Komtek perumus SNI

- Ketua : Zakiyudin
- Sekretaris : Andri Tricahyo
- Anggota : Ali A. Rachman  
Bambang Indrakoesoema  
Imran Rasyidhi  
Eddy Trijono  
Hari Sumartono  
Dede Sualmedi  
Frans Yusef Daywin  
Johny Hutapea  
Yalra Yuwana  
Agus Sunara  
Budi Tjahjuchartono

[3] Konseptor rancangan SNI

Muhammad Nur

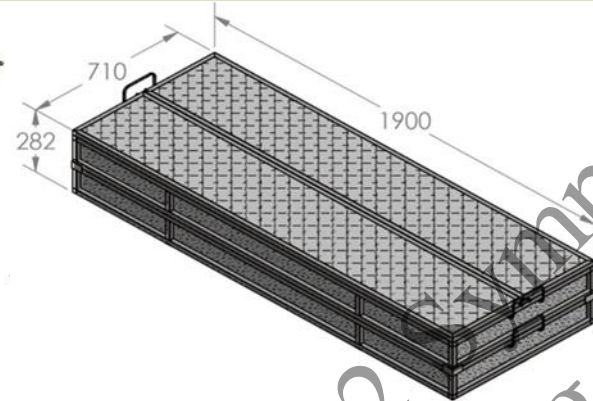
[4] Sekretariat pengelola Komtek perumus SNI

Pusat Standardisasi Industri-  
Badan Penelitian dan Pengembangan Industri - Kementerian Perindustrian



# Concept of SNI 8759:2019

base on Standard Operational Procedures on Center for Plasma Research





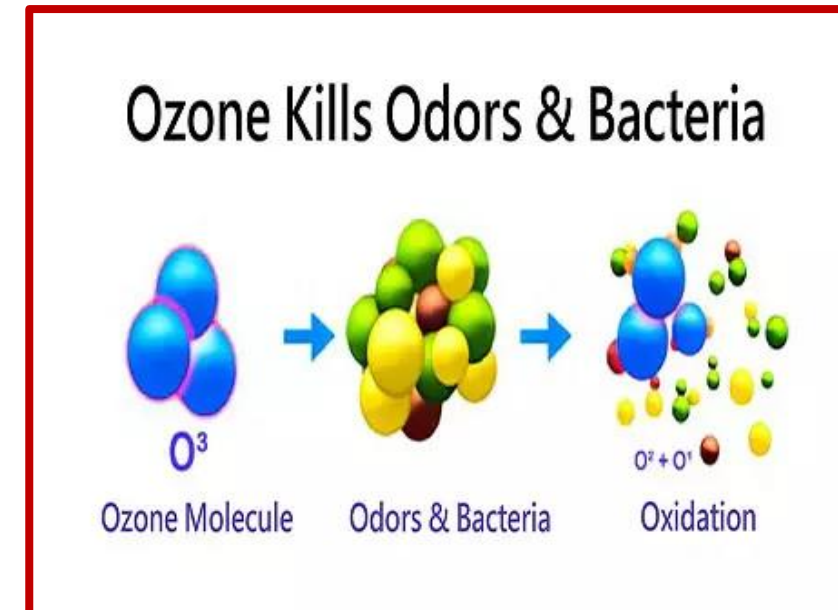
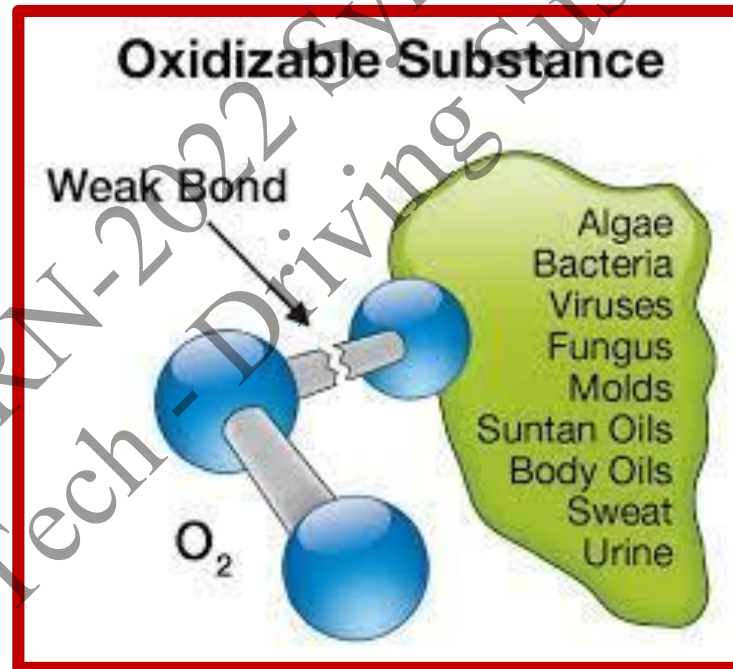
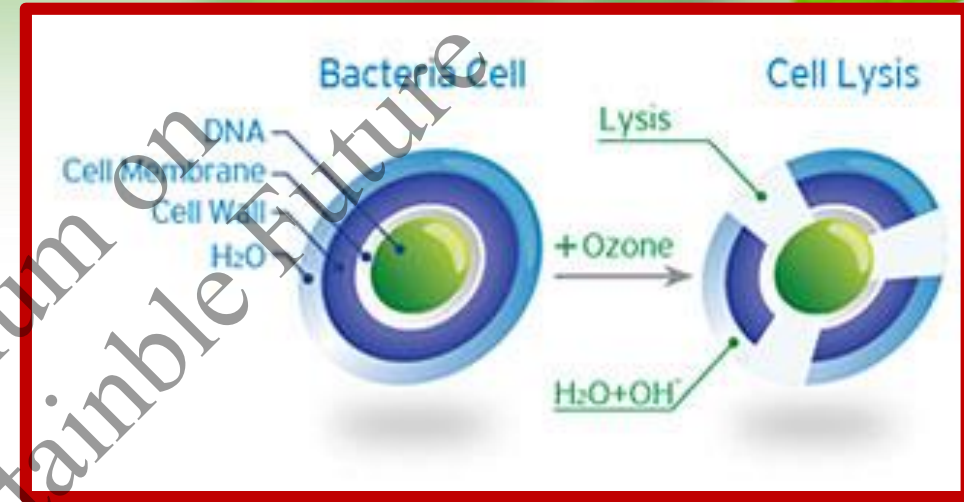
# A SERIES OF PROCESSES USING PLASMA OZONE TECHNOLOGY



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# How Ozone reduce microorganisms?

Free Radicals

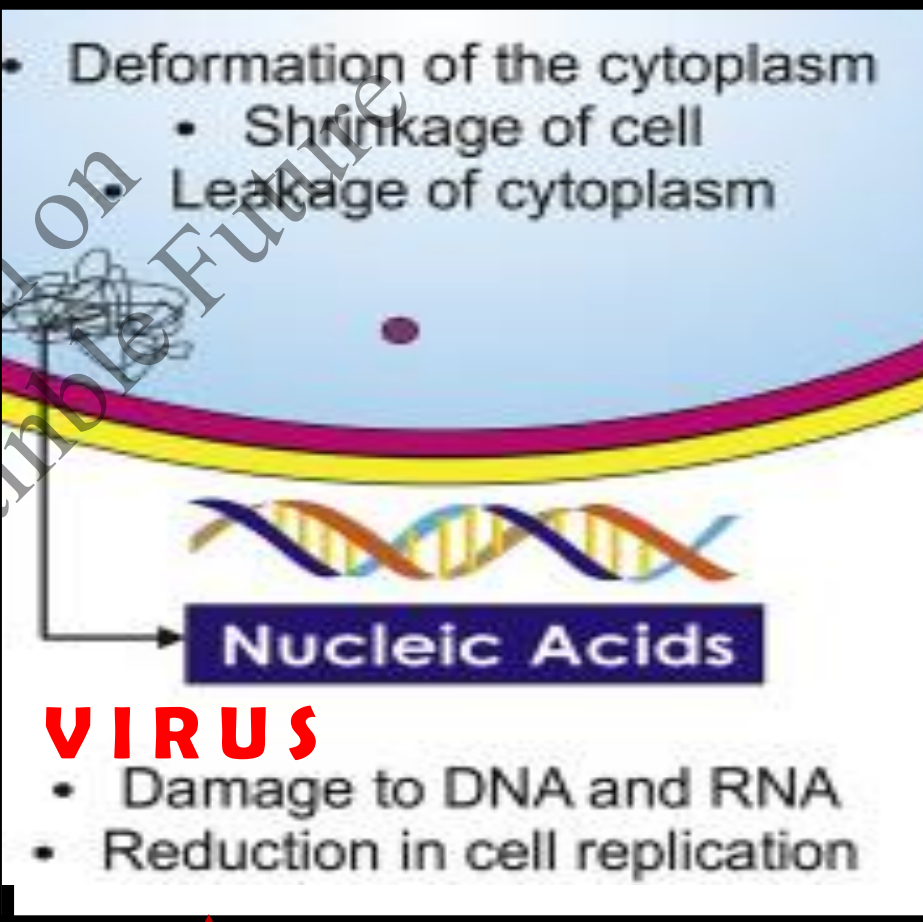
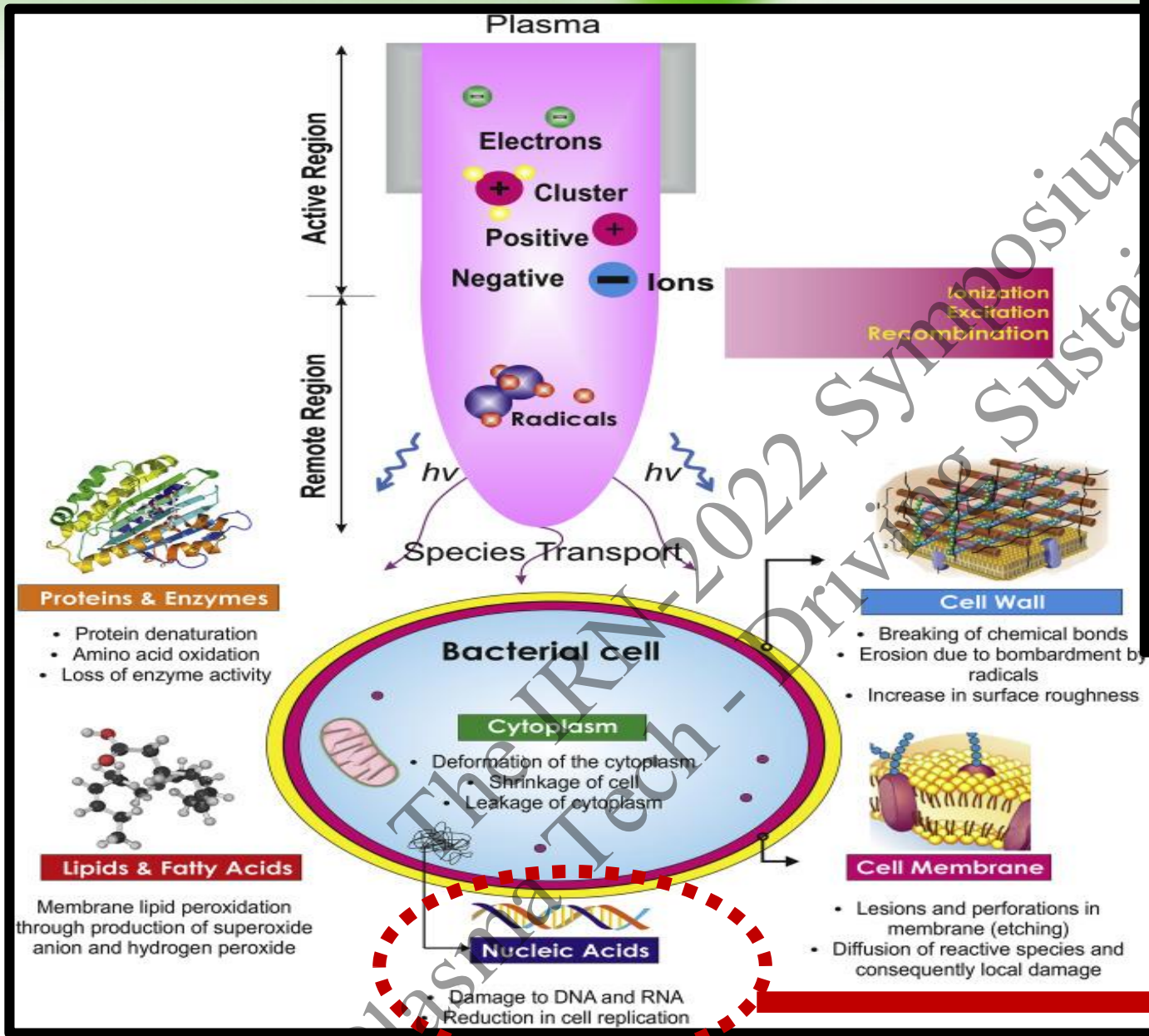




# Mechanism of ozone on preservation of horticultural products ozone

- Action on Rees, 2016; (Lara, Belge, & Goulao, 2014)  
Stimulates the formation of cuticle
- → reduces membrane damage, reduces skin rupture, reduces water evaporation  
Fatty acid (oleic acid) + O<sub>3</sub>
- → activation of lipoxygenas
- → utin (monomer of the cuticle)





A schematic of the action of cold plasma on bacterial cell structures (N.N.Misra and CheorunJo, [Trends in Food Science & Technology Volume 64](#), June 2017, Pages 74-86)



**Success Story**

**“Mutiara Organik” Cooperation Horticultures Production, at Village Ngablak, District Magelang, Central Java**

**Sebelum 2017**

Poktan Organik Hortikultura

**2017**  
“Mutiara Organik” Cooperation Horticultures Production started use Ozone Technology

**Total sales 1.7 billions/year**



**2018- 2021**

“Mutiara Organik” Cooperation Horticultures Production after used Ozone Technology

**Total sales 8-10 billions/year**

Broccoli as Premium Products has been exported to Singapore



**Ozone Plasma Technology Horticulture System at the Chili Farming Center, Lubuk Cuik Village, Lima Puluh Subdistrict, Batu Bara Regency, North Sumatra, December 2020**

**Application in the “BERKAH ABADI JAYA” Cooperation, District BATU BARA, North Sumatra Province**

1. Ozone generator,
2. Ozone dissolving System
3. Drain Rack
4. Micro bubble generator
5. Cool Room dedicated Ozone





# IMPLEMENTATION OF ABADI ABADI JAYA COOPERATIVES IN BATU BARARA DISTRICT

FARMERS APPLY 6 OF 7 STANDARD

## A SERIES OF PROCESSES USING PLASMA OZONE TECHNOLOGY



Application of treatment on chili harvest management

- A. picking chili in the field
- B. Transport
- C. Weighing
- D. washing with ozone dissolved water
- E. Drain
- F. Storage in the cool room



A



B



D

## Pembelian dan Awal Penyimpanan (9 -20 June 2021)

No	Pengeluaran	Jumlah (kg)	Harga per kg	Harga total
1	Pembelian Cabai I (9-10 Juni)	626	Rp10.000	Rp 6.260.000
2	Pembelian Cabai II (20 Juni)	209	Rp10.500	Rp 2.194.500
	<b>Total Cabai</b>	<b>835</b>		<b>Rp 8.454.500</b>



E



F

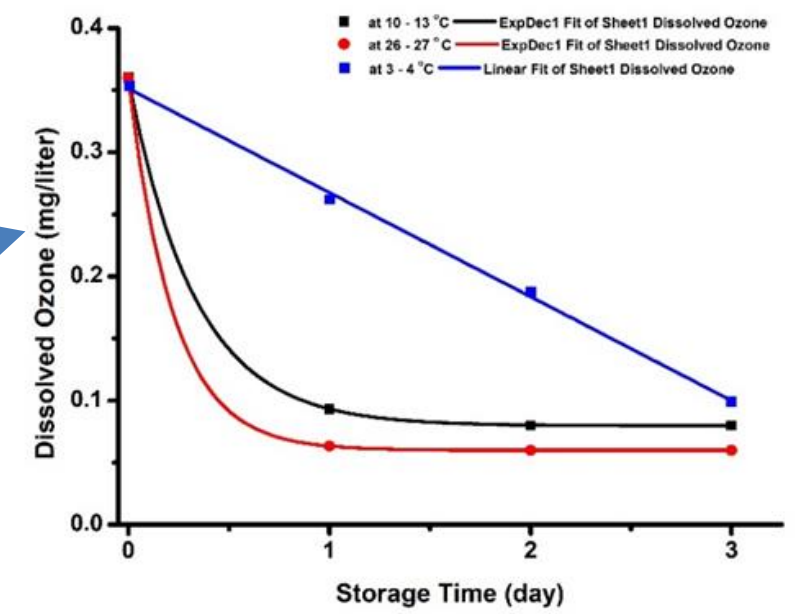
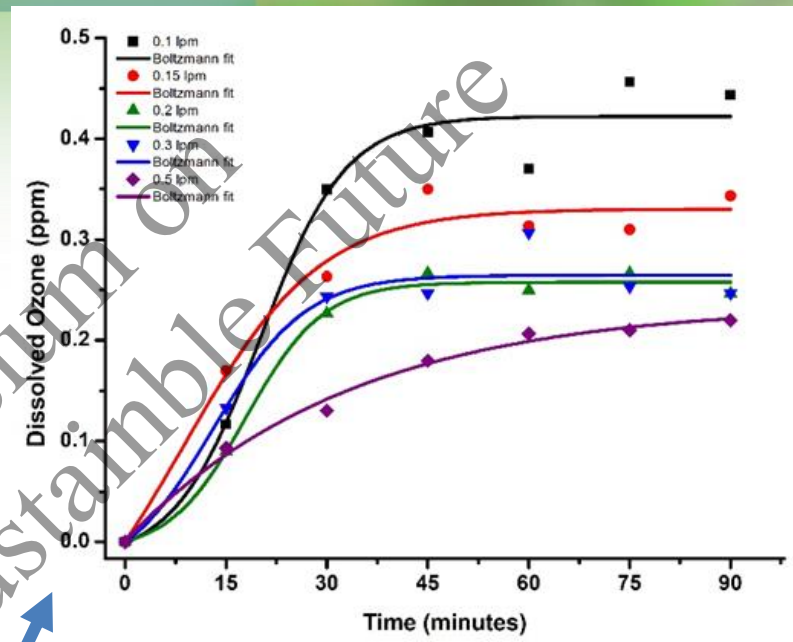
**Application of Ozone Dissolved Water from Nano-Micro Bubble Ozone and centrifuge machine for Horticultural Products in Ensuring Food Safety**

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# Prototype Testing



Measurement of dissolved ozone concentration



Ozone  
Dissolved  
Water  
Sample and  
Treatment  
from Nano-  
Micro  
Bubble  
Ozone

Product	Control	wash with water	wash with ozonized, water 5 minutes	wash with ozonized, water 10 minutes	wash with ozonized, water 15 minutes
Tomato					
spinach					
Carrot					
Broccoli					

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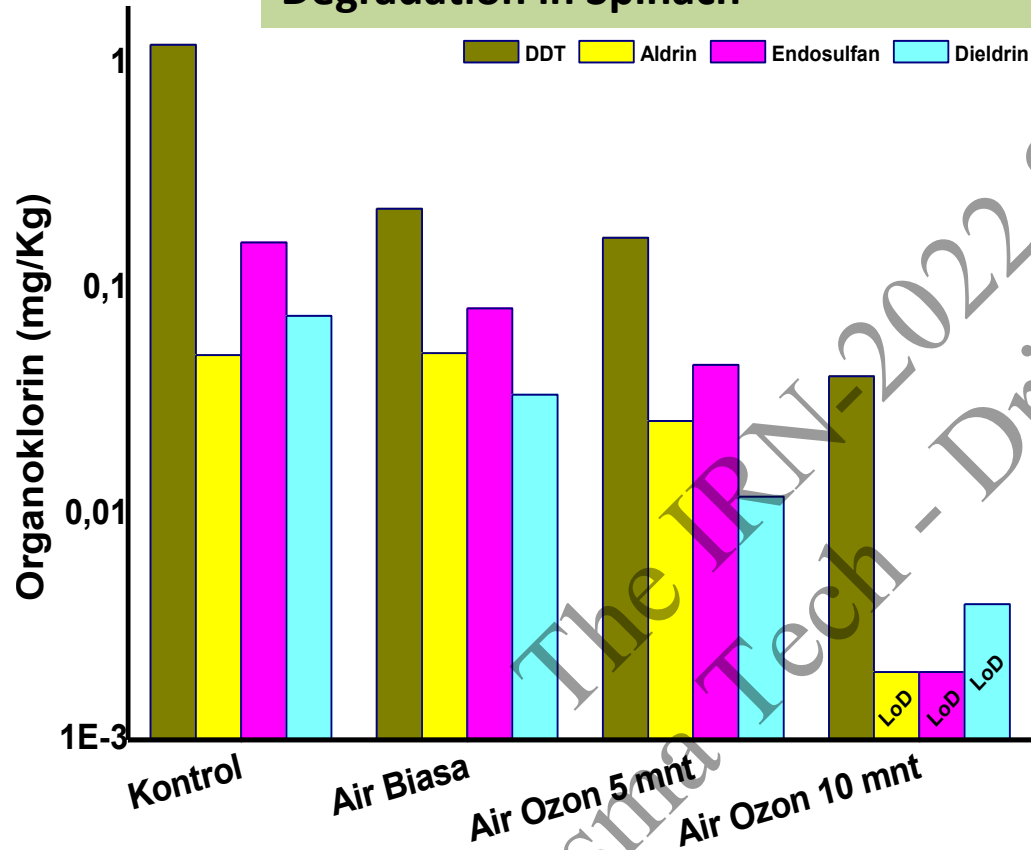


# Treatment Result of Ozone Dissolved Water from Nano-Micro Bubble Ozone in Spinach

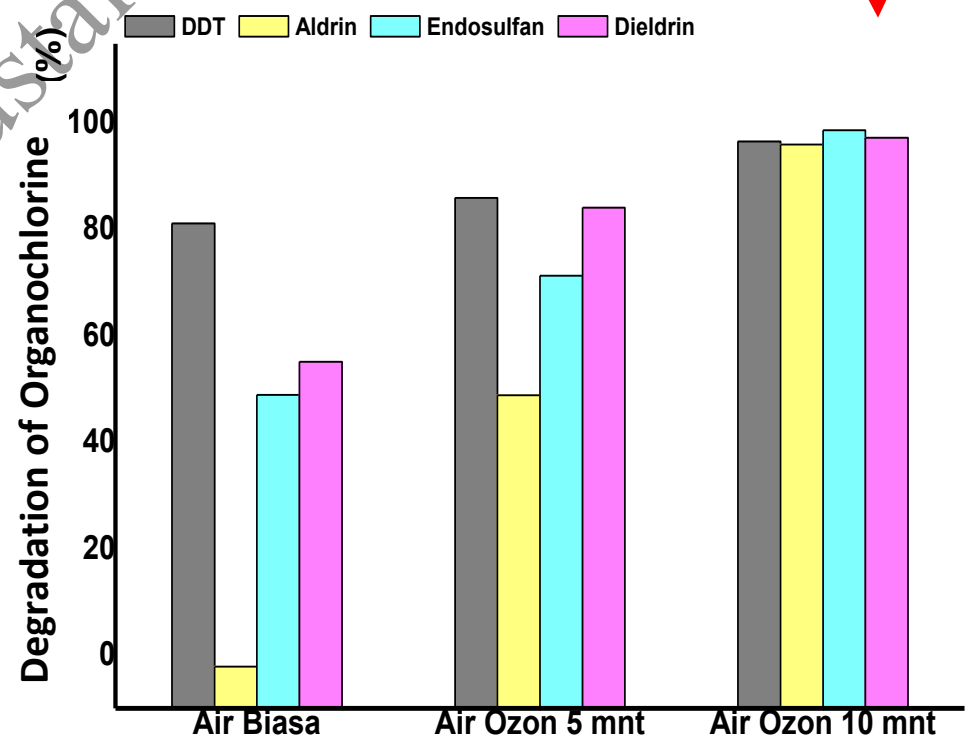


Over than 95

Organochlorine-based Pesticide Degradation in Spinach



Percentage of Degradation of Organochlorine-based Pesticides in Spinach

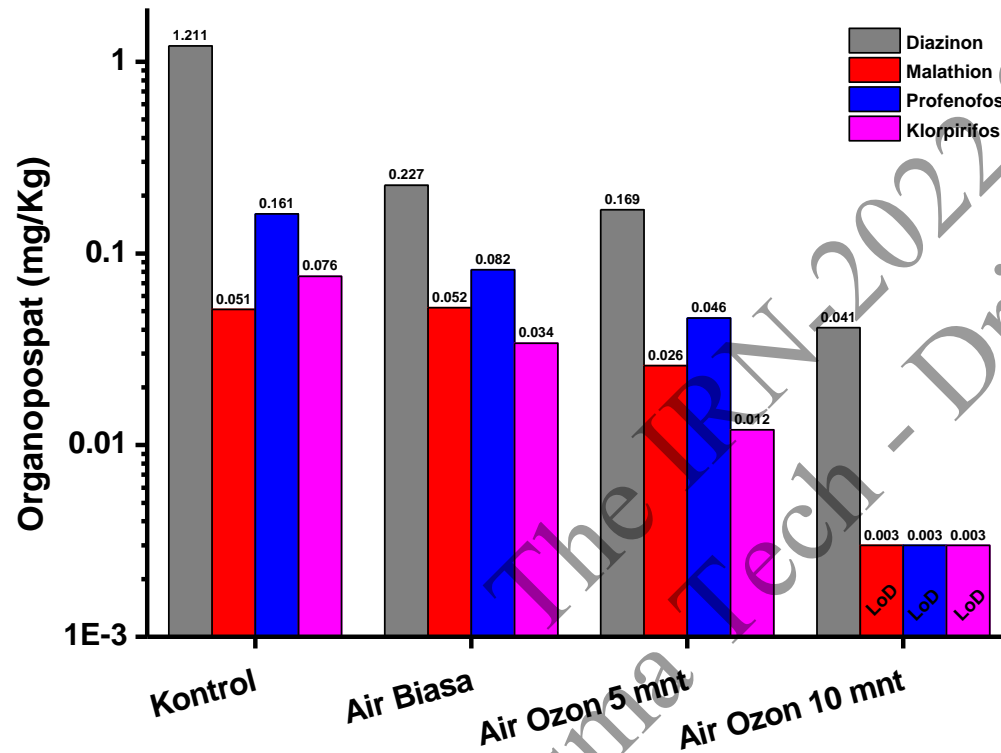


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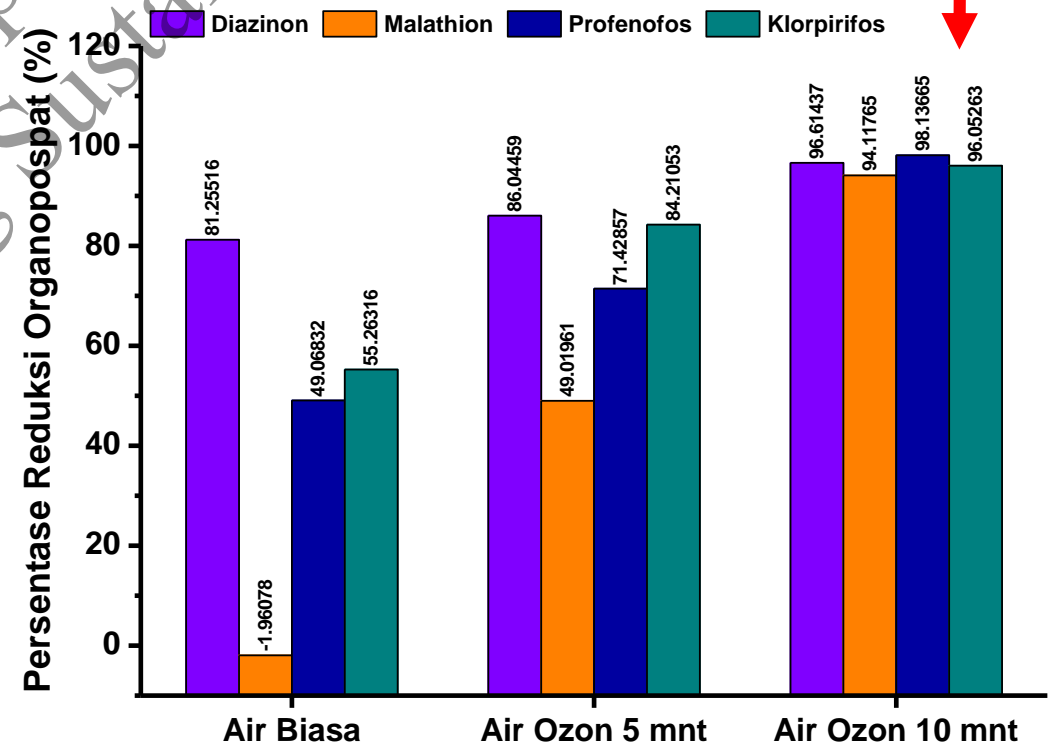
# Treatment Result of Ozone Dissolved Water from Nano-Micro Bubble Ozone in Spinach

Over Than 90 %

Organophosphate-based Pesticides Degradation in Spinach



Percentage of Degradation of Organophosphate-based Pesticides in Spinach



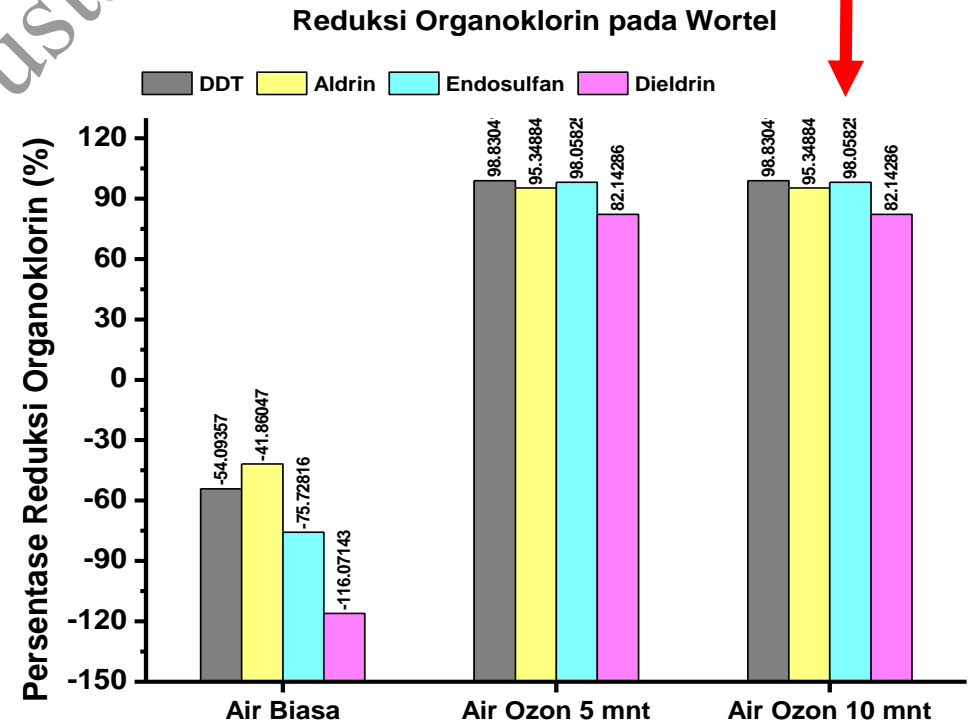
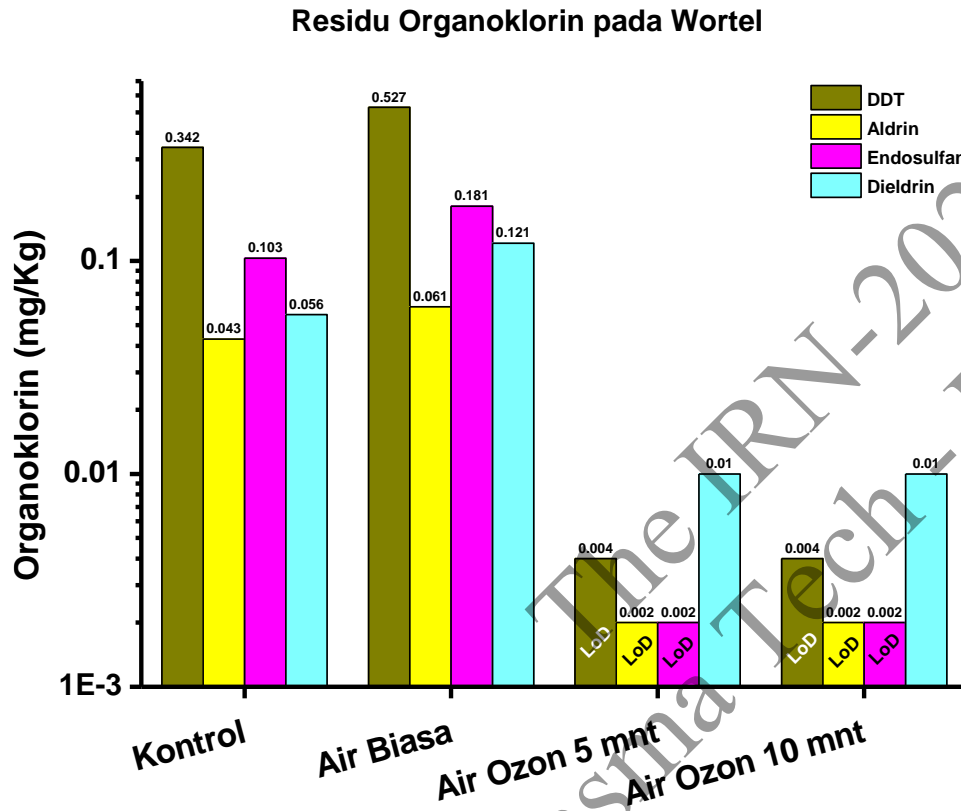


# Hasil Perlakuan Air terlarut Ozon dari GNMBO pada **Wartel**

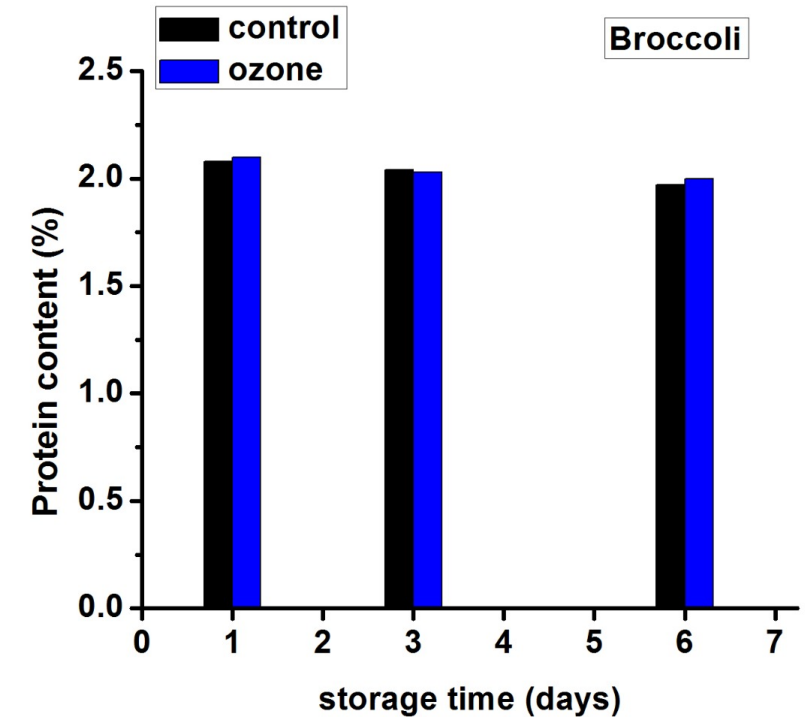
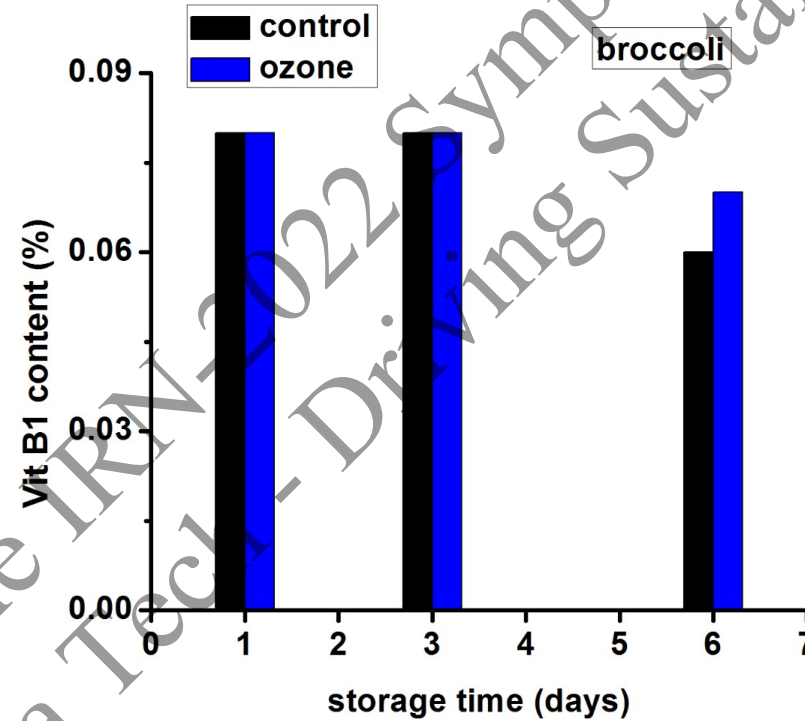
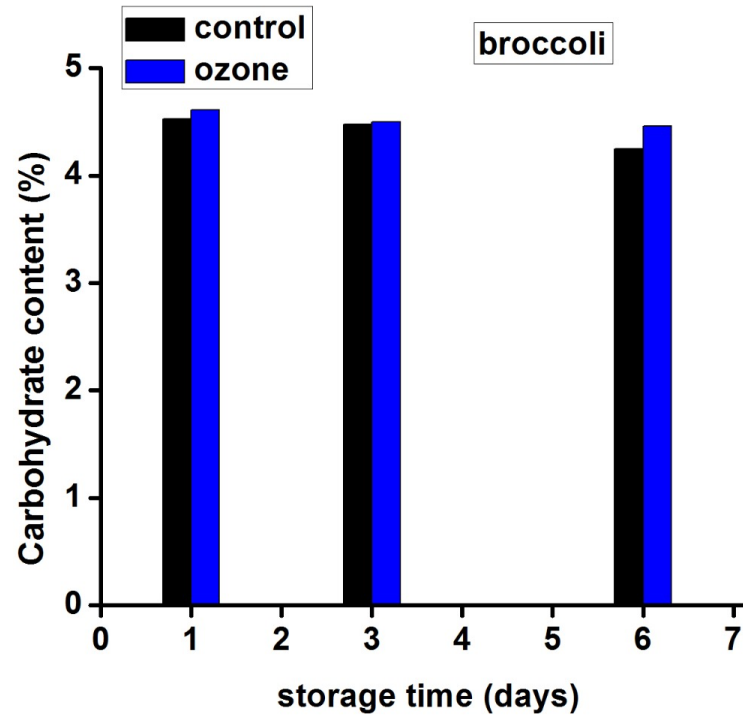
Pengurangan Pertisida berbasis Organoklorin pada **Wartel**

Persentase Degradasi/Reduksi/Pengurangan Organoklorin pada **Wartel**

**Diatas 90 %**

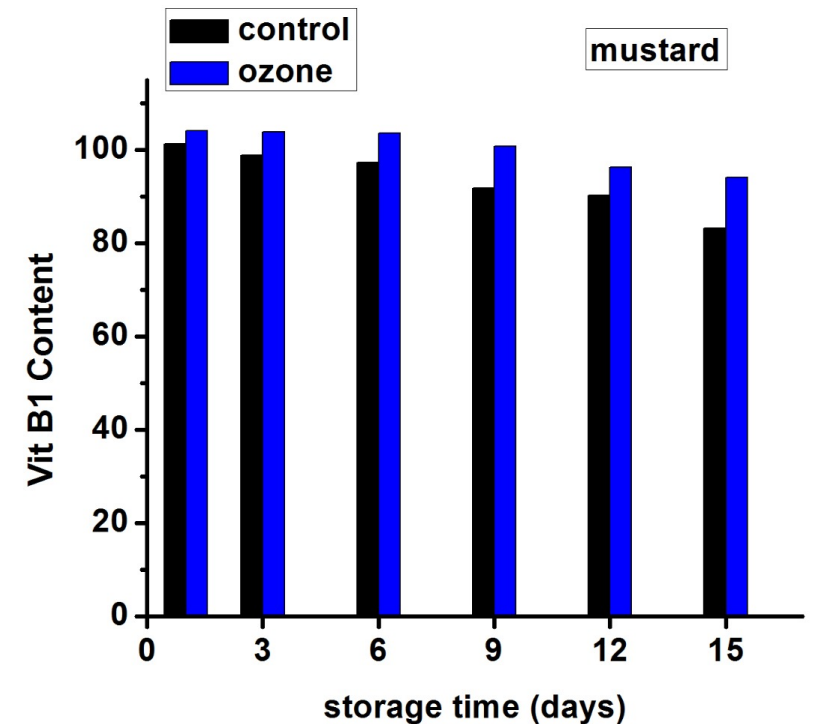
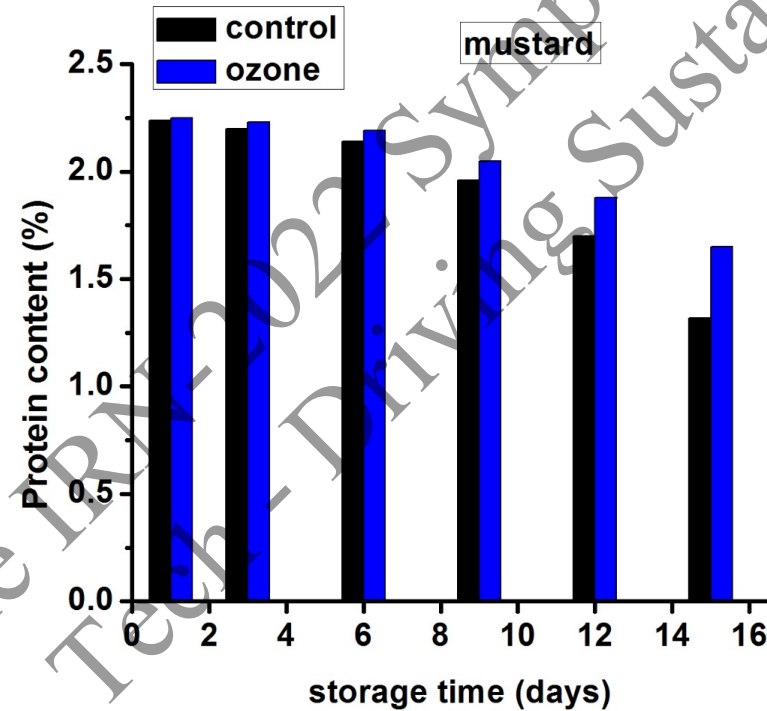
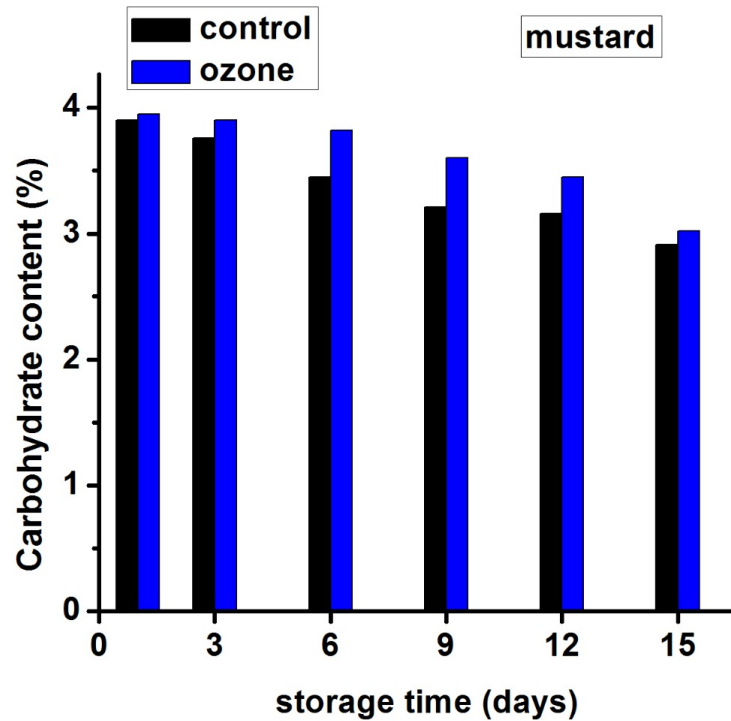


# Proximate Values in Broccoli

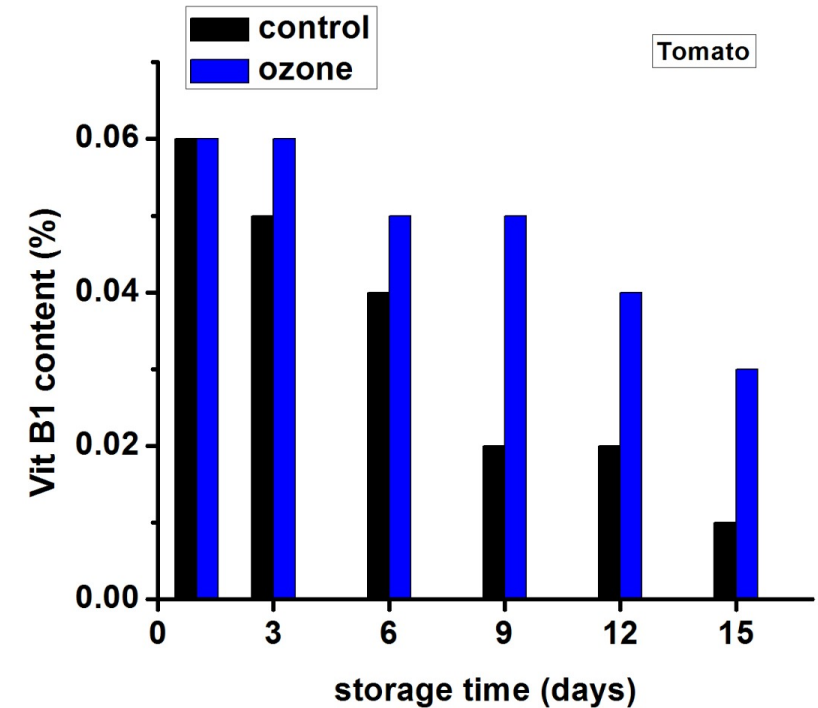
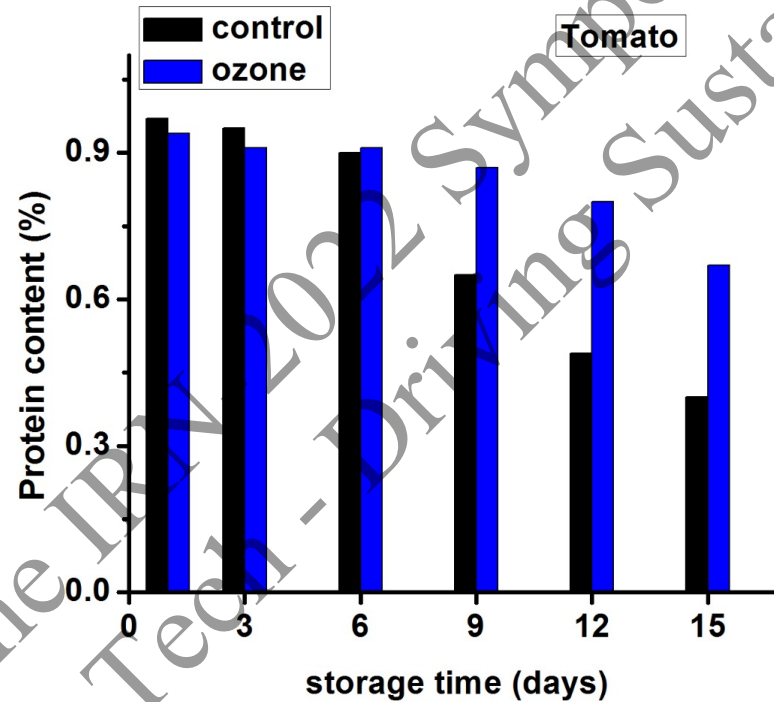
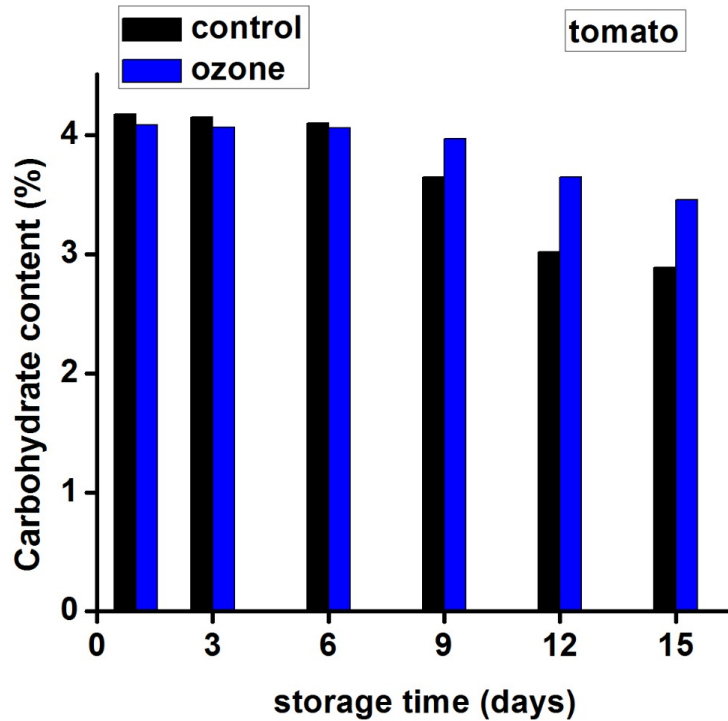




# Proximate Values in Mustard

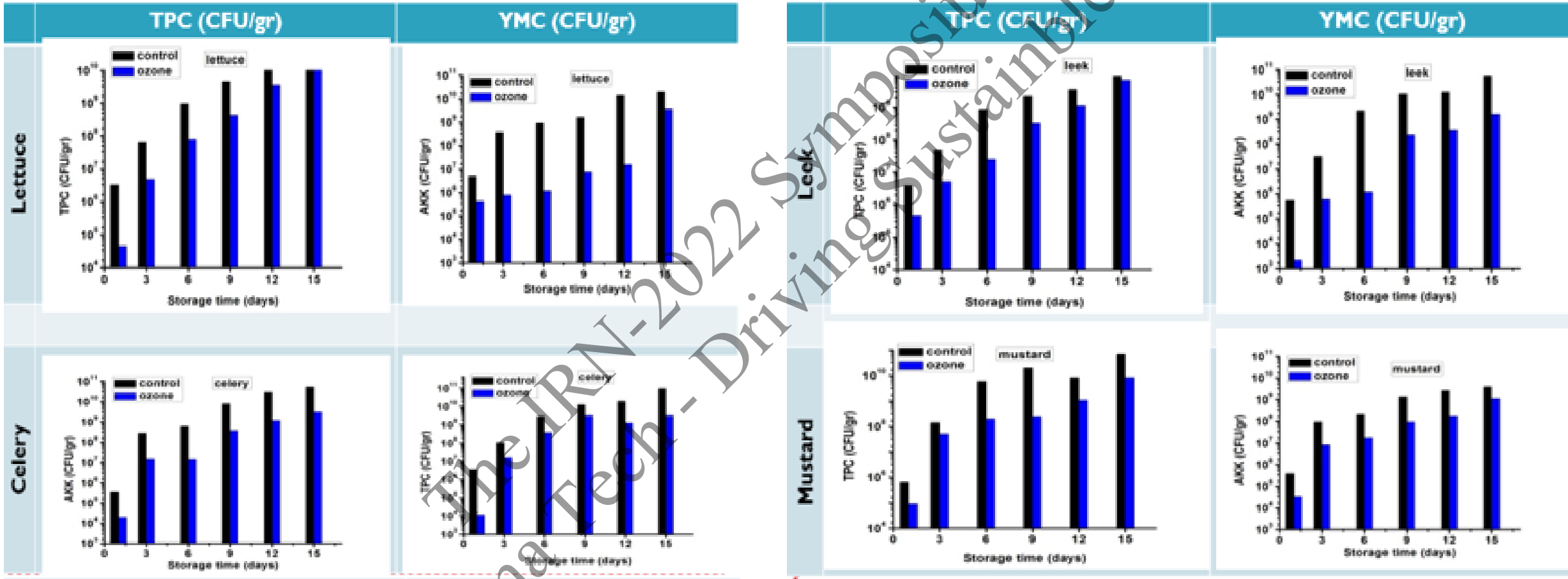


# Proximate Values in Tomato





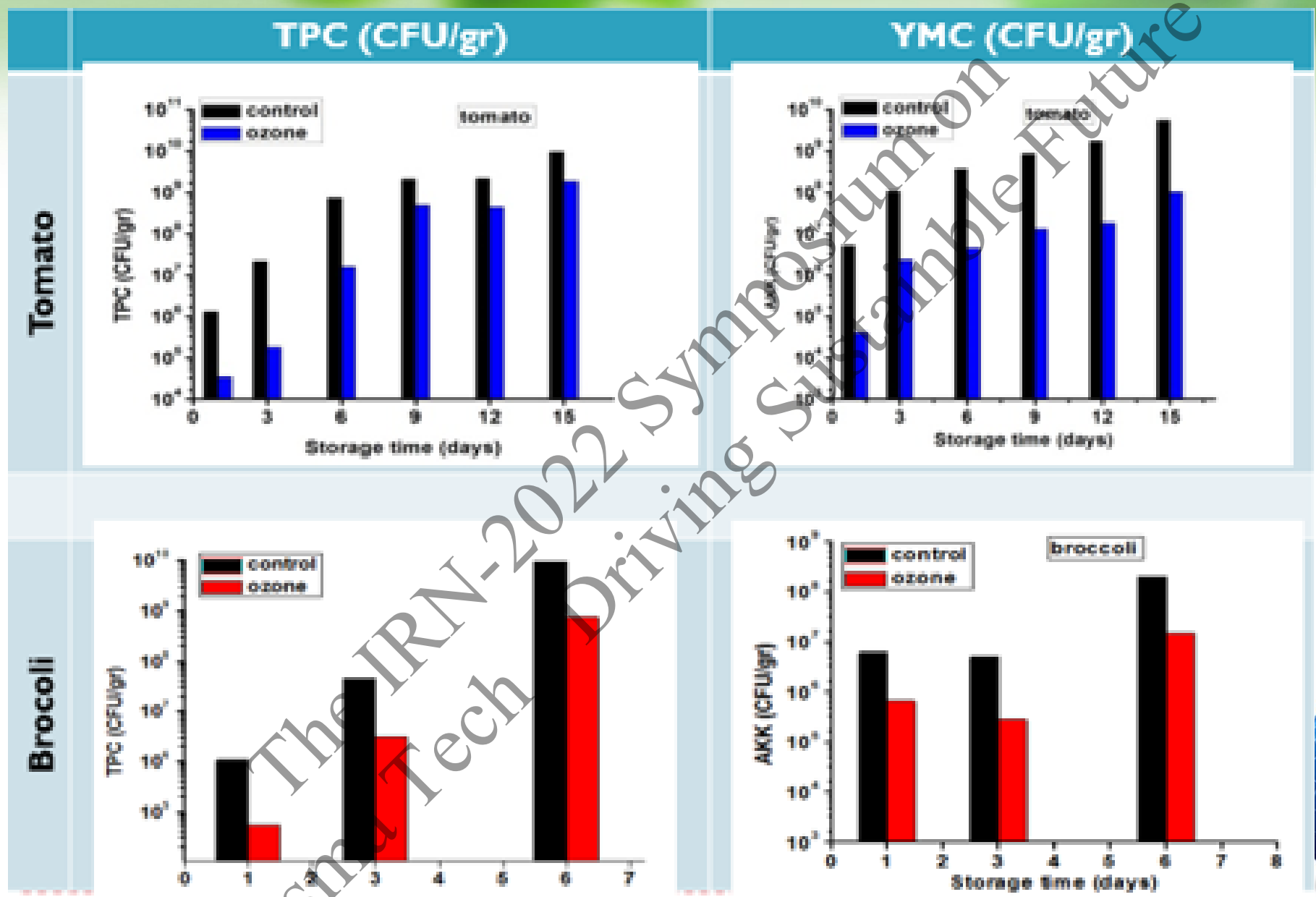
# Total microbial test results



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Symposium on



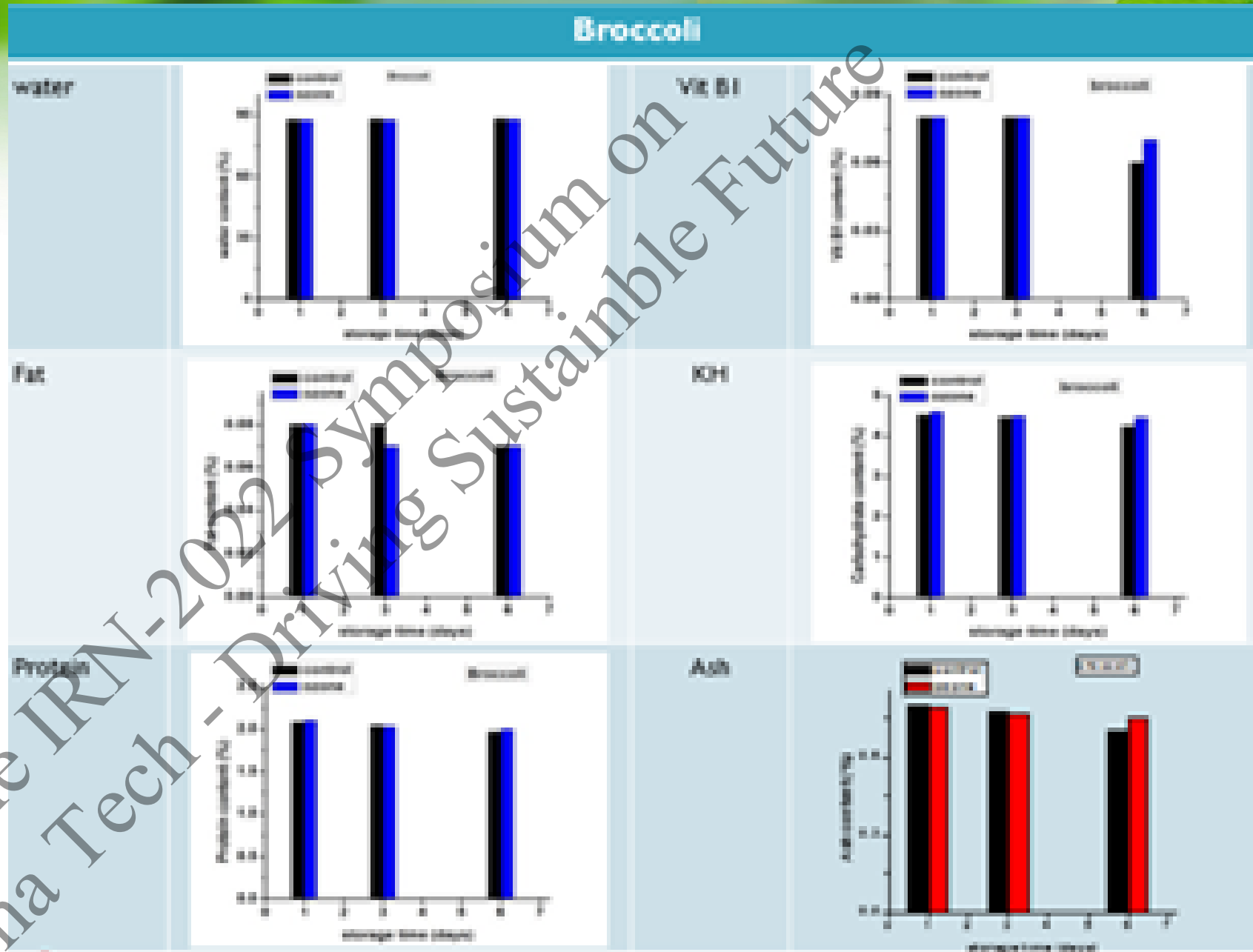


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# Nutritional content

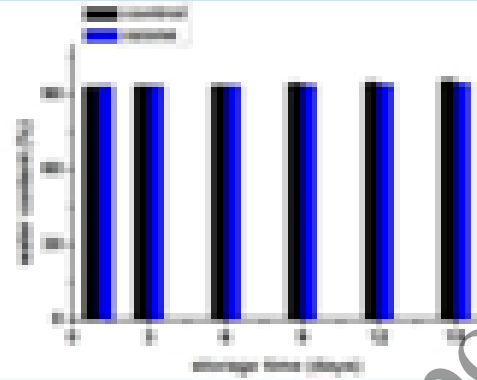


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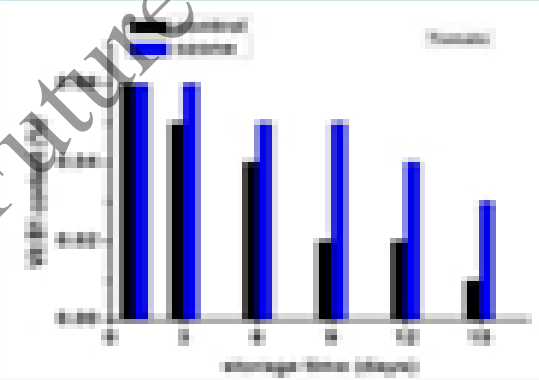


# Tomato

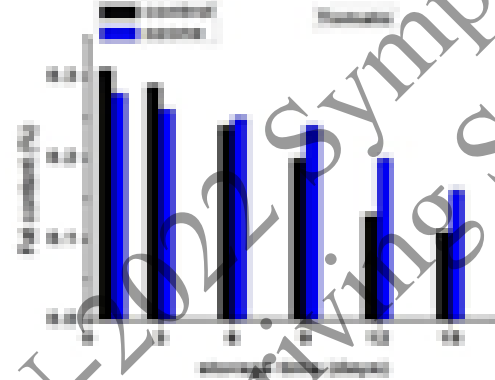
Water



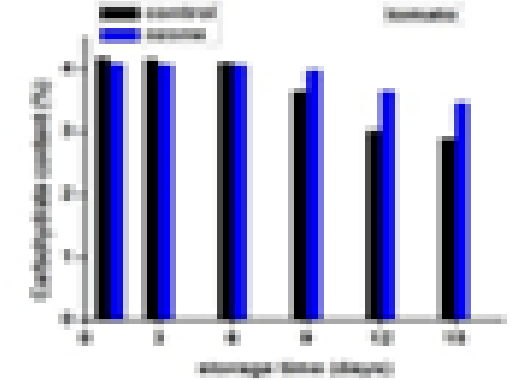
VaBI



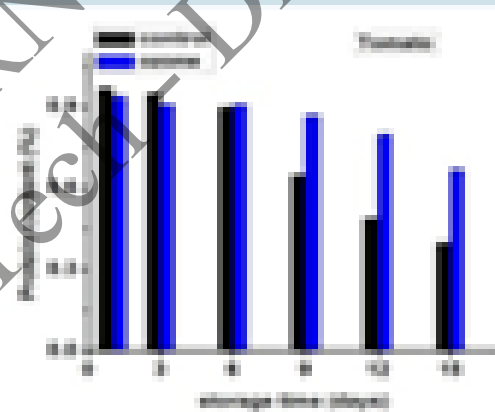
Fat



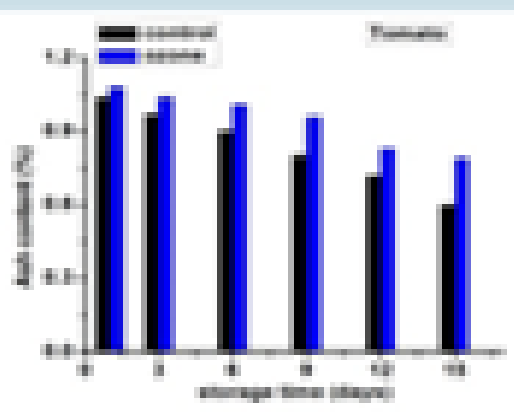
RH



Protein



Ash



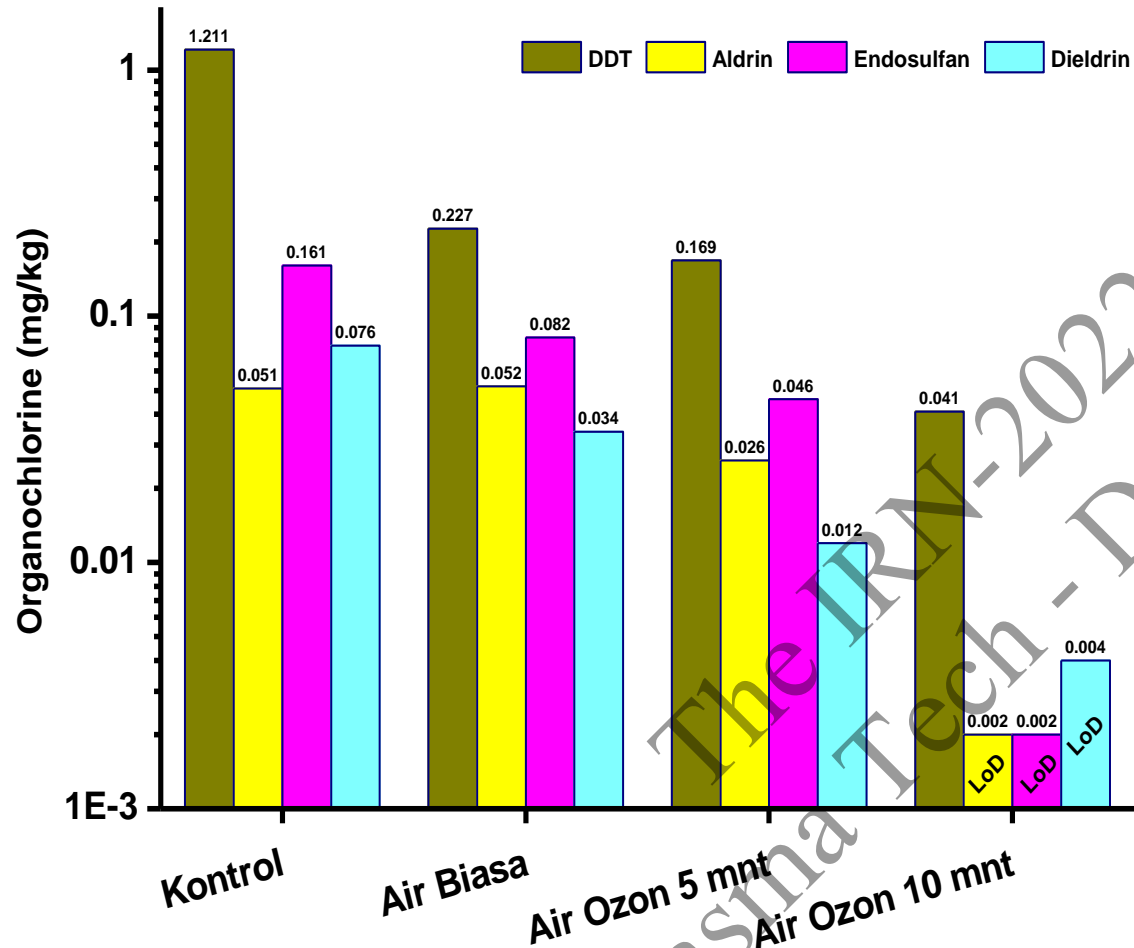
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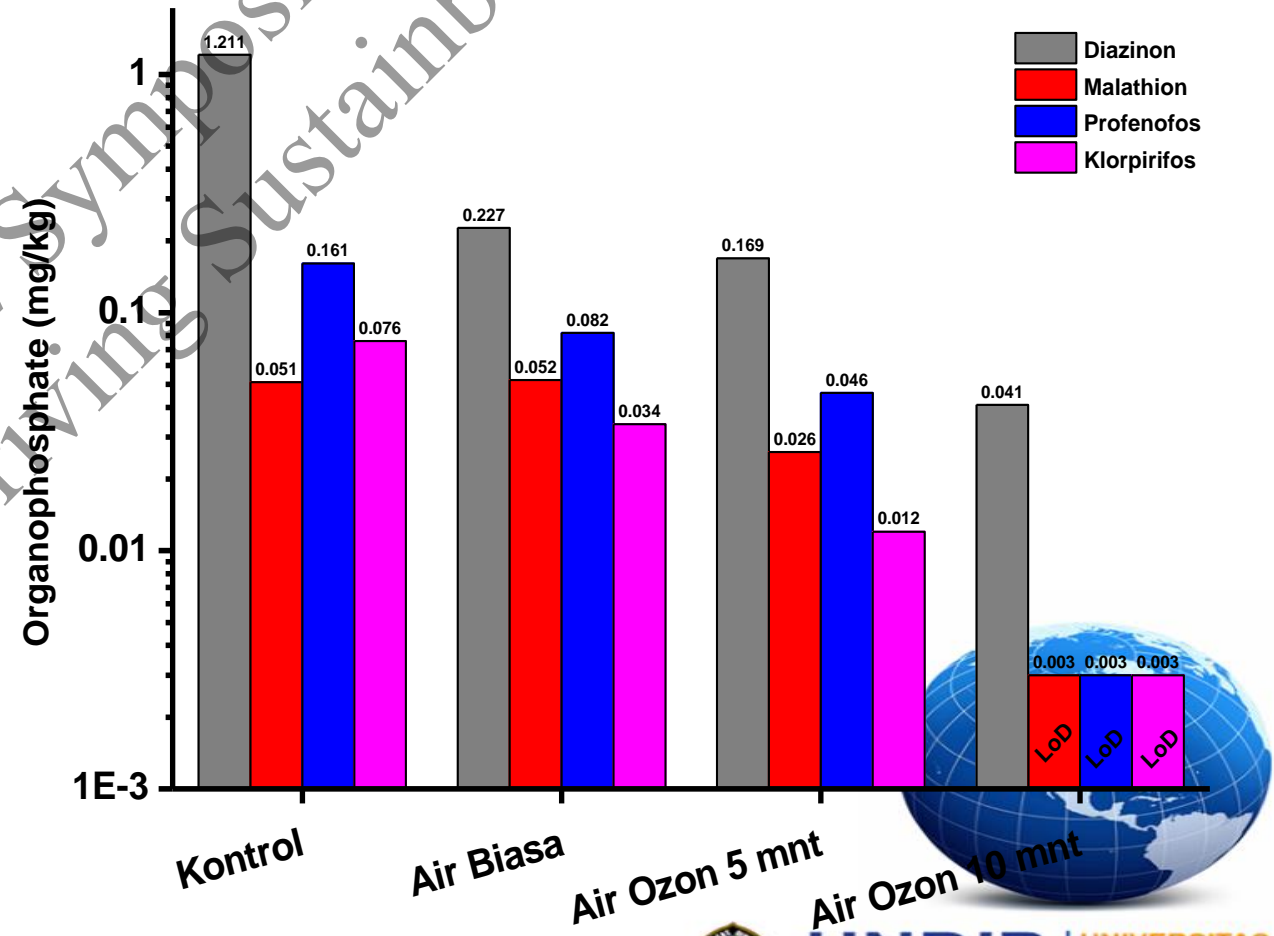


# Pesticide Reduction in spinach

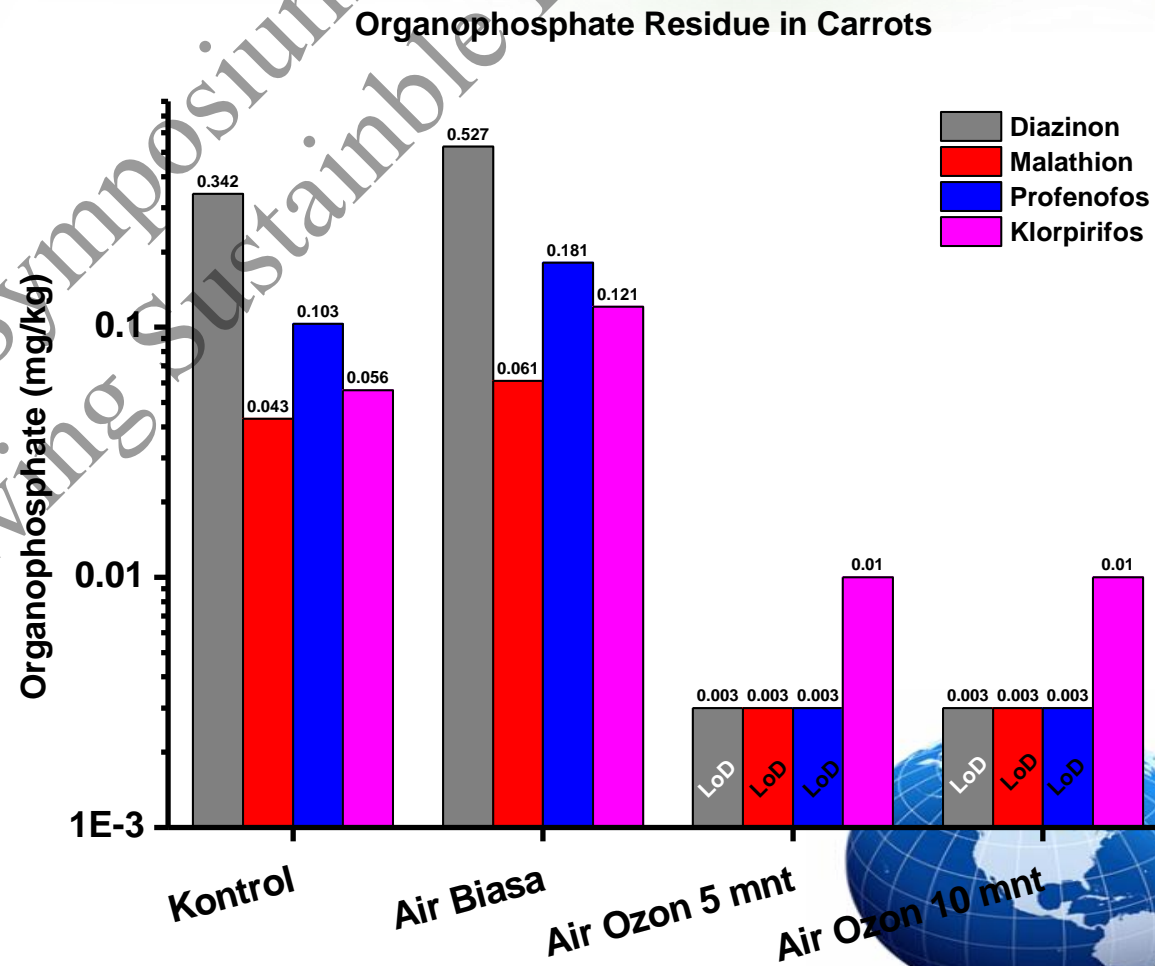
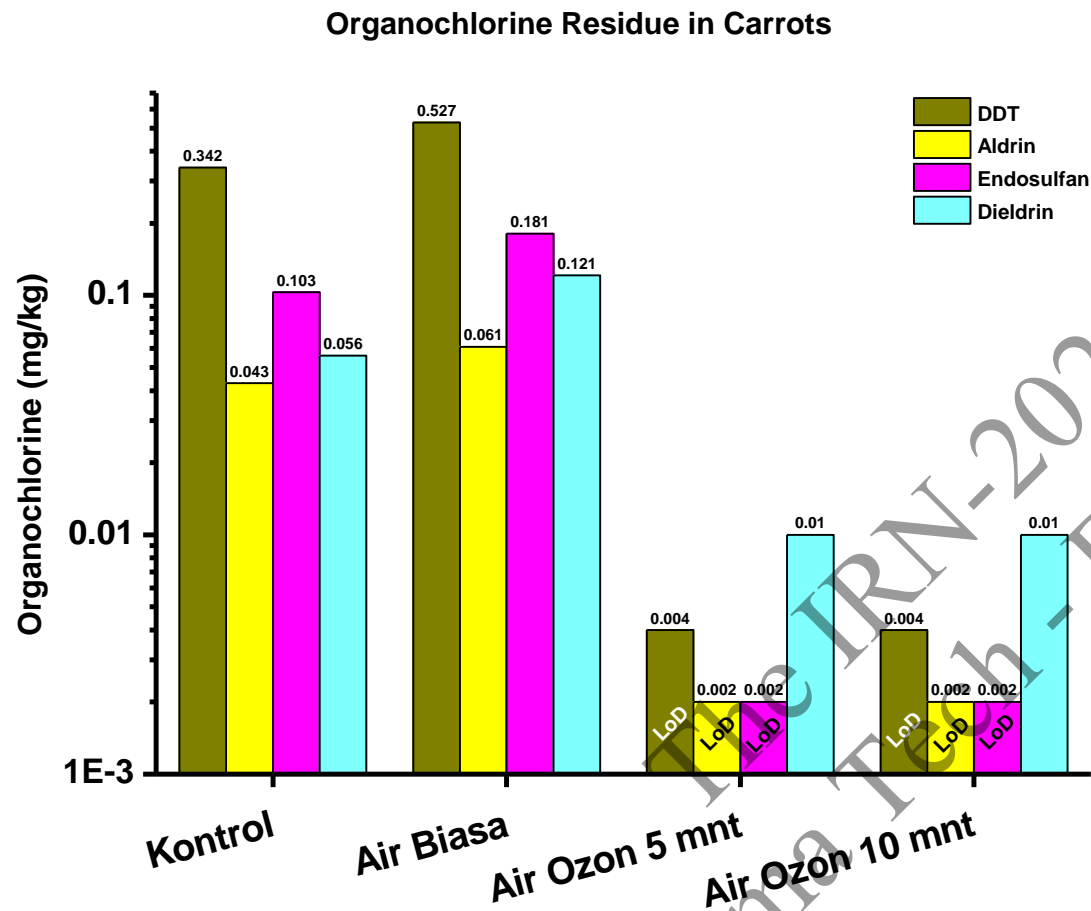
## Organochlorine Residue in Spinach



## Organophosphate Residue in Spinach



# Pesticide Reduction in carrots

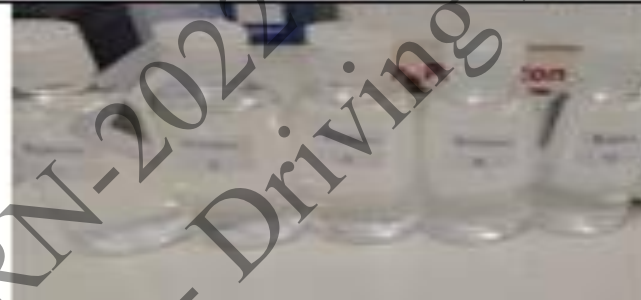




### Dokumentasi Pengujian Prototipe Final



### Dokumentasi Pengujian Fisis GMINBO



### Dokumentasi Pengujian Balingtan



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# Documentation and Media Publication for Ozone Plasma Activities for Horticulture







The IRN 2020 Symposium on  
Plasma Tech - Dr. A. K. Mishra  
Sustainable Future



# PERBANDINGAN SAWI DI HARI KE 9



TANPA OZON

DENGAN OZON





Not Ozone Treatment

Ozone Treatment

Disimpan dalam storage suhu 7-10 derajat selama 8 hari, perlakuan sayur di ozon dan tidak diozon. Lokasi Gapoktan Mutiara Desa Ngablak, kab. Magelang, Jawa Tengah

Ozone Treatment

Not Ozone Treatment



4 days



Plasma Tech. 2022 Symposium on Sustainable Future





day 0

Dragonfruit  
ozon-washed  
cold  
day 0



10 days

Dragon fruit  
Washed- ozon  
cold- ozon  
day-10



5 days

Dragon Fruit  
Ozone - Washed  
cold  
day-5



15 days

Dragon Fruit  
ozon-washed  
cold  
day-15





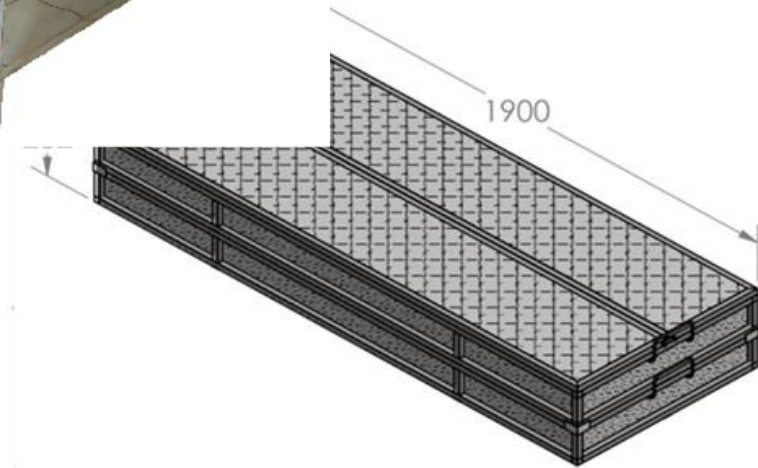
# Pineapple exported to Singapore after ozone treatment

2011, 22 Okt 2019 - 12:03 WIB

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Agricultural Research and Development Agency (Balitbangtan), especially the Postharvest Center (2018)

Balai besar pasca panen mengambil peran cukup penting dalam rangka ekspor perdana ini. Selain memberikan rekomendasi teknologi, Balai besar Pasca panen ikut serta dalam melengkapi peralatan yang diperlukan oleh suatu unit penanganan segar buah (PHO), seperti penyediaan alat pembersih nanas (blast air compressor), meja-meja persiapan dan sortasi, bak pencucian dan ozon generator. Dengan fasilitas PHO yang cukup memadai diharapkan dapat memenuhi kualifikasi yang diinginkan oleh negara tujuan



## Agricultural Research and Development Agency (Balitbangtan), especially the Postharvest Center (2018)

@bbLitbangPascapanenPertanian · Government  
ization



Balai Besar Pascapanen Pertanian

March 8, 2019 · 🌐

Teknologi Pascapanen Memperpanjang Masa Simpan Buah Nanas

BB Pascapanen telah menghasilkan teknologi untuk memperpanjang umur simpan buah nanas dan pisang melalui teknologi ozonisasi. Perendaman buah nanas dalam ozon dengan konsentrasi 3 ppm selama 10 menit mampu mempertahankan umur simpan nanas selama 26 hari pada suhu 20°C.







**Asian scientists visited Horticultures Center with Ozone implementation in Ngablak Magelang**

## Ozone can preserve vegetables

### D'Ozone Mampu Awetkan Sayuran

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MAGELANG, KRjogja.com - Inovasi bidang pertanian, berhasil dilakukan Dr Muhammad Nur. Pria se baya yang sehari-hari menjadi pengajar di Universitas Diponegoro Fakultas Sains dan Matematika menemukan alat yang mampu mengawetkan sayuran paska panen.

Melalui teknologi yang kemudian ia beri nama Mesin D'Ozone yang diproduksi PT Dipo Technology mampu membuat aneka sayuran paska panen menjadi tahan lebih lama. "Sayuran yang telah di menggunakan teknologi ini, terbukti mampu tahan lebih lama dibanding yang tidak diperl menggunakan teknologi ini," katanya dihadapan perwakilan 14 negara peserta Program Workshop o Crops.

Adapun teknis menggunakan alat ini, dimulai saat sayuran dipanen kemudian dicuci menggunakan a sudah di ozoni menggunakan Mesin D'Ozone. Selanjutnya, sayuran dimasukkan dalam storage (alma telah dialiri ozon). Sayuran di dalam storage ini, kemudian akan dibersihkan dari mikroorganisme.

"Sayuran paska panen, musuh utamanya adalah mikroorganisme. Jadi agar tahan lama, sayuran dibersihkan dari mikroorganisme tersebut. Salah satunya dengan di cuci dan diletakkan dalam s dengan suhu 7 hingga 10 derajat celcius," jelasnya, didampingi Direktur PT Dipo Technology, Azwar. (





**INVOLVEMENT OF PLASMA OZONE PRODUCTS IN ASEAN COOPERATION PROJECT: Reduction of Post-Harvest Losses (PHL) for Agricultural Produces and Products, 2018**

**Prov. Sumut , Kabupaten Deli Serdang, 25 November 2018**

Harian Analisa  
Rabu, 28 November 2018



**Diponegoro University provides agricultural product storage technology for farmers**

**ASEAN Berupaya Tekan Kehilangan Pasca Panen di Bawah 30%**

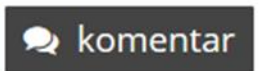
**ASEAN Member States Seeks to Reduce of Post-harvest Food Losses below 30%**

Editor : M. Achsan Atjo  
Translator : Dhelia Gani

PUBLISHED: Rabu, 25 Juli 2018 , 01:48:00 WIB

41

SHARES



Kabid Kerjasama dan Pendayagunaan Hasil Penelitian - BB Pasca Panen, Ev Savitri Iriani (depan ke-3 kanan) dan Regional Expert the ASEAN PHL-Project, Prof Dr Eriyatno (batik biru) Foto: B2B/Mac



Prosesi penyerahan teknologi penyimpanan hasil pertanian kepada Gapoktan, Minggu (25/11) (jw/csp)

ANALISADAILY.COM



Prov. Jambi, Kabupaten  
Kerinci 5 Februari 2019



## Peduli Akan Nasib Masyarakat Kerinci, SAH Bawa Mesin Pengawet Sayuran D'ozone Bagi Petani Kayu Aro



SAH saat menyerahkan Mesin Pengawet Sayuran D'ozone Bagi Petani Kayu Aro

Prov. Kaltim Kabupaten  
Penajam Paser Utara, 20 Februari 2019



## Petani PPU Dapat Bantuan Teknologi Generator Plasma, Hetifah: Bisa Tingkatkan Kesejahteraan Petani



Kementerian Ristekdikti bekerjasama dengan Universitas Diponegoro menyerahkan seperangkat teknologi generator Plasma D'ozone kepada kelompok tani di PPU.



# D'Ozone (Trademark) for Onion Farmers

D'Ozone application for onion and garlic nursery



Onion House  
at West Sulawesi



Onion House  
at North Sumatra

**APPRECIATION CENTRAL  
BANK INDONESIA  
Poliwali, West Sulawesi ,  
2017**



**APPRECIATION CENTRAL  
BANK INDONESIA  
at North Sumatra  
, 2016**



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# D'Ozone (Trademark) for Onion Farmers

## D'Ozone application for onion and garlic nursery



## APPRECIATION CENTRAL BANK INDONESIA at Mamuju, 2019



## APPRECIATION CENTRAL BANK INDONESIA at GORONTALO, 2020



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The Agrozone brand is registered with the Ministry of Law and Human Rights for commodities after ozone treatment

Status

(TM) Didaftar

Detail

NOMOR PENGUMUMAN  
BRM1917A

TANGGAL PENGUMUMAN  
2019-04-01

NOMOR PERMOHONAN  
DID2019014838

TANGGAL PENERIMAAN  
2019-03-22

TANGGAL DIMULAI PELINDUNGAN  
2019-03-22

TANGGAL BERSUHUR PELINDUNGAN  
2029-03-22



Publikasi

Publikasi A

Translasi

Merupakan suatu penamaan + kelas

Kelas Nice

KODE KELAS

JANGKA WAKTU / JASA

Prioritas

NOMOR

KEWARGANEGARAAN

Pemilik

NAMA

ALAMAT

KEWARGANEGARAAN

Dr. Muhammad Nur

Bumi Wanamukti B-4/18, RT 010 RW 004, Sambiroto, Tembalang, Kota Semarang, Jawa Tengah, 50276

ID

Konsultan

NAMA

ALAMAT

KEWARGANEGARAAN





# PT. Dipo Technology as Industrial Partner has licences agreement with Diponegoro University

Google  x 🔍

Semua Maps Video Gambar Belanja Lainnya Setelan Alat SafeSearch aktif

Sekitar 1.380 hasil (0,46 detik)

Mungkin maksud Anda adalah: **dipo technology**

[www.dipotechnology.com](http://www.dipotechnology.com)

## Dipo Technology - Dipo Technology

Welcome to **dipotechnology.com**. PT. **Dipo Technology** adalah perusahaan manufaktur yang memproduksi produk-produk berbasis Teknologi Plasma.

Anda telah mengunjungi halaman ini berkali-kali. Kunjungan terakhir: 24/02/21

### Tentang Kami

Tentang Kami. PT. DIPO TECHNOLOGY menghasilkan ...

### D'Ozone

D'Ozone. D'Ozone. PT. DIPO TECHNOLOGY bekerjasama ...

### Azwar Awanta, Author at Dipo ...

Penulis: Azwar Awanta ... Dipo Technology untuk ...

### Produk


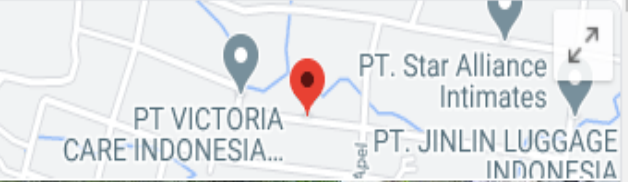

Cari untuk: Pos-pos Terbaru. SAYUR HIGIENIS, SOM ...

### Kontak Kami

Kontak Kami. Address ...

### Zeta Green

Produk Zeta Green. Zeta Green ...



Lihat foto

Lihat ke luar


## PT Dipo Technology

Situs web Rute Simpan Telepon

4,3 ★★★★★ 6 ulasan Google

Kantor Perusahaan

**Alamat:** Jl. Kw. Industri Candi Blok 10A No. 3, Ngaliyan, Kec. Ngaliyan, Kota Semarang, Jawa Tengah 50181

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# Thank you

Dialogue with the President of the  
Republic of Indonesia October 2017



APPRECIATION AS A PLASMA  
TECHNOLOGY INNOVATOR IN INDONESIA



Adibrata Award 2018  
BEST INNOVATOR 2 NATIONAL