



# Study the effect of plasma on some aquatic microorganisms

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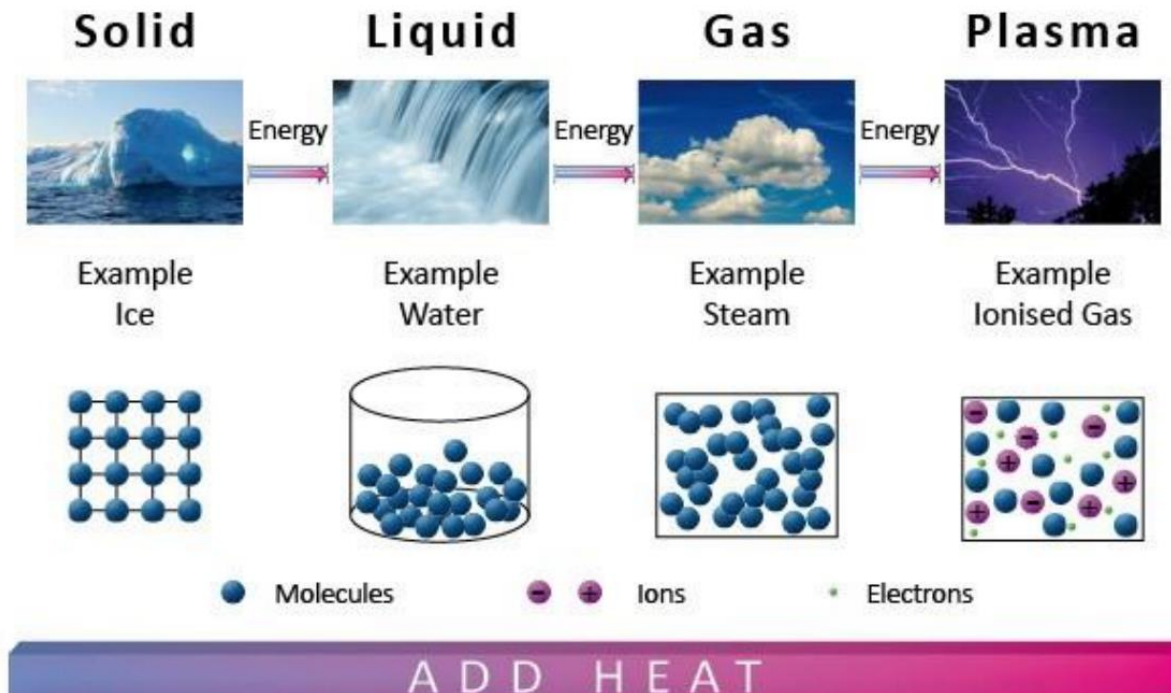
Prof.Dr. Eithar El-Mohsnawy

# Outline

- Plasma Definition
- Plasma Generation
- Low Temperature Plasma Advantage
- Application
- Motivation
- summary

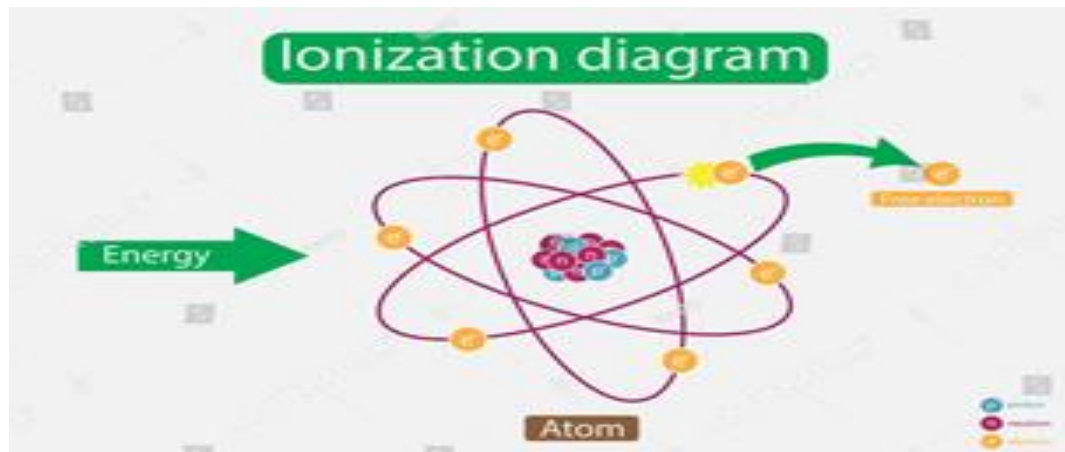
# Plasma Definition

- Plasma: is a State of matter which is Ionized, Quasineutral and exhibits Collective Behavior.



# Plasma Definition: Ionization

- Ionization: is the process by which an atom or a molecule acquires a negative or positive charge by gaining or losing electrons.



- The degree of ionization (the Saha equation):

$$r = \frac{N_e}{N_i + N_a} \approx 2.4 \times 10^{21} e^{-\frac{\Phi}{k_B T}}$$

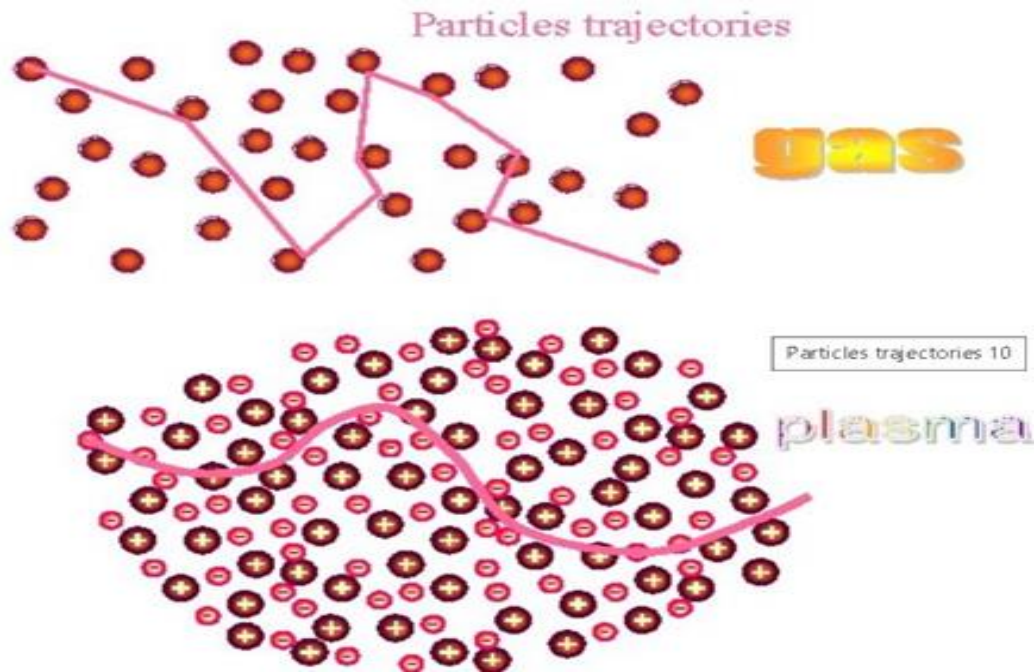
# Plasma Definition: Quasineutral

- Quasineutral: nearly equal number of oppositely charged particles.



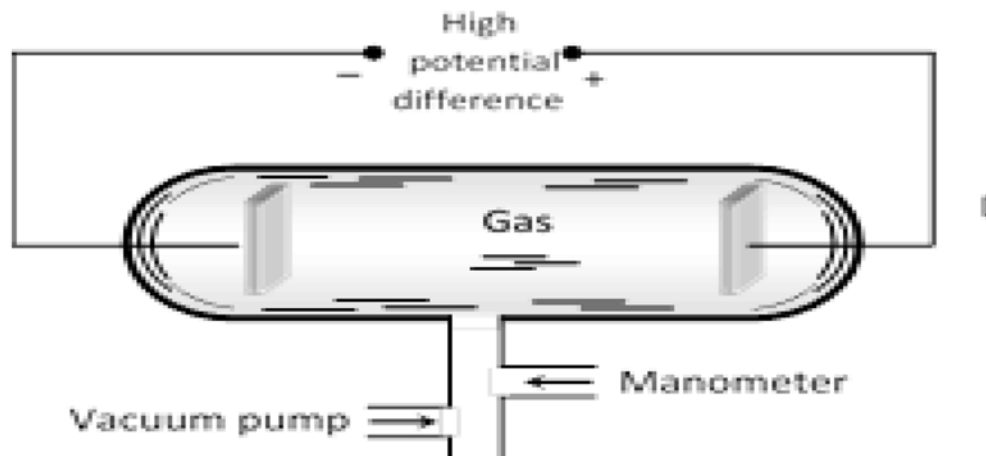
# Plasma Definition : Collective behavior

- Collective behavior in a plasma is a situation where a plasma responds to external forces as a single entity.



# Plasma Generation

- Plasma can be generated in different ways, and the most common method of generating plasma is electric discharge in neutral gases. This is done by applying a high electric voltage difference between two electrodes on a gas under a certain pressure, which leads to the generation of an electrical discharge between the anode and the cathode in the gas.



# Low Temperature Plasma Advantage

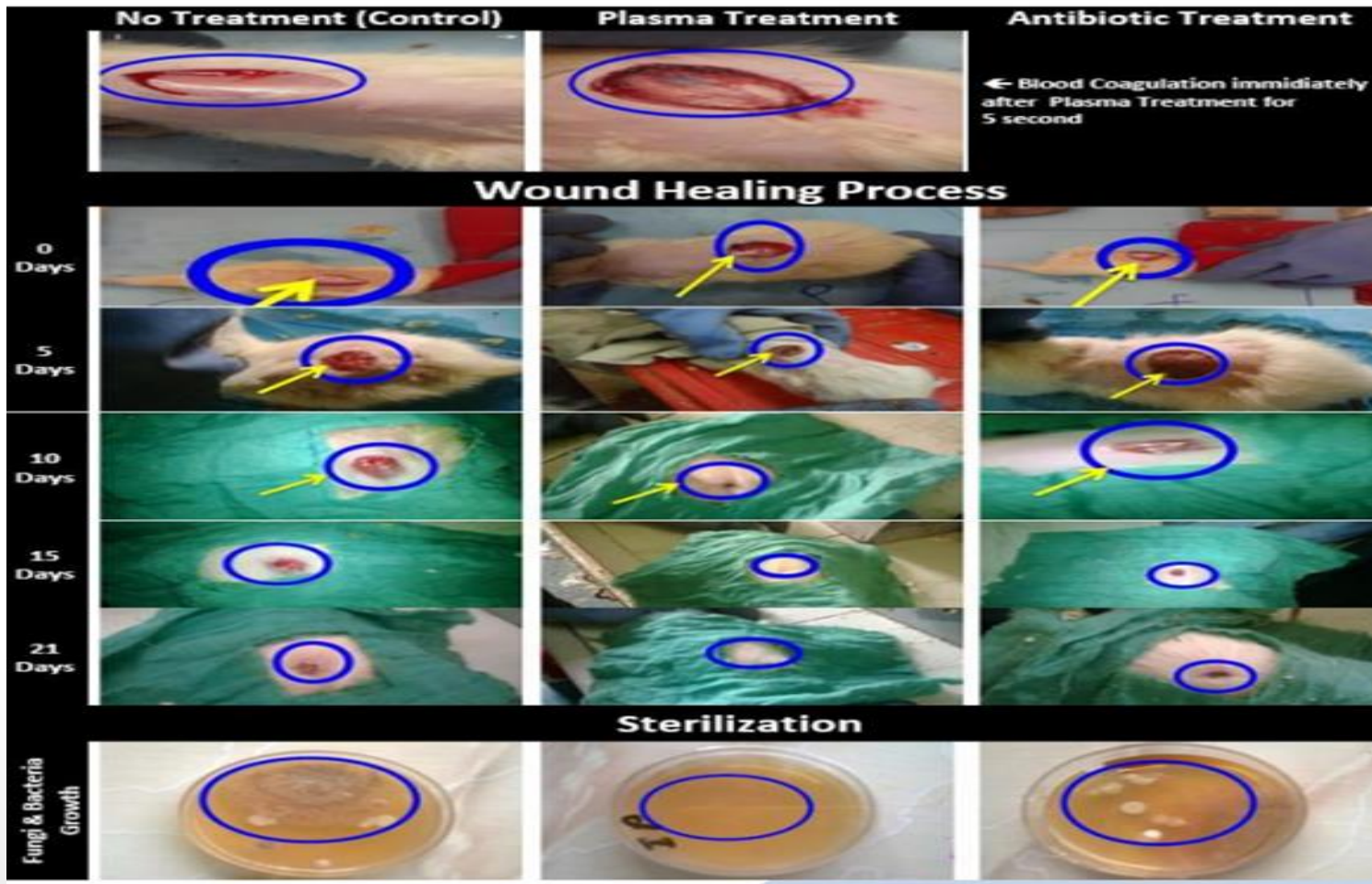
- Low temperature.
- Direct treatment.
- Ultra low cost.
- Efficient.
- Environmentally Friendly.



# Cold Plasma Application

## 1-Plasma Medicine :

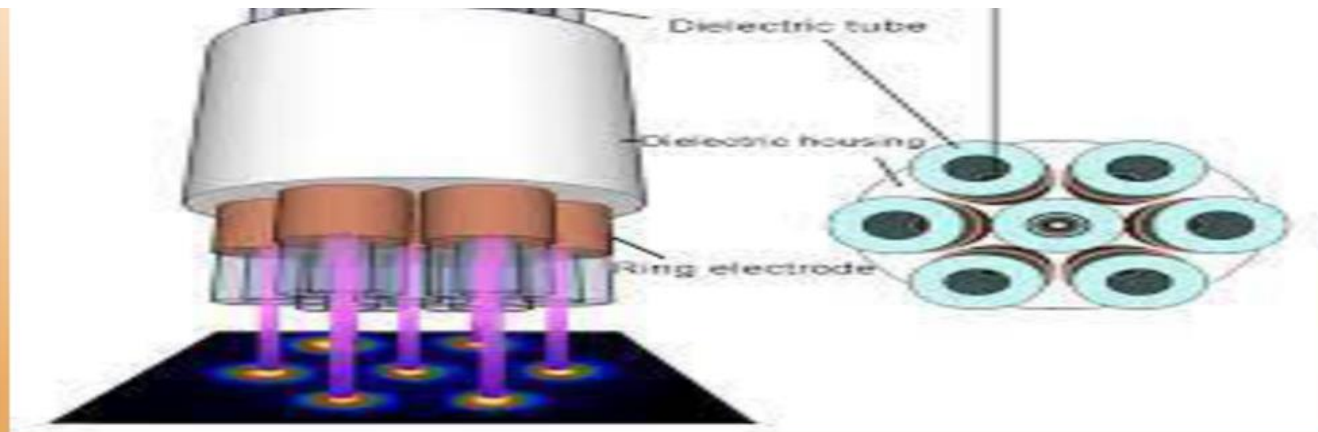
- Wound healing



# Cold Plasma Application

## 1-Plasma Medicine :

- Skin tumor



# Cold Plasma Application

## 2-Food & Agriculture :



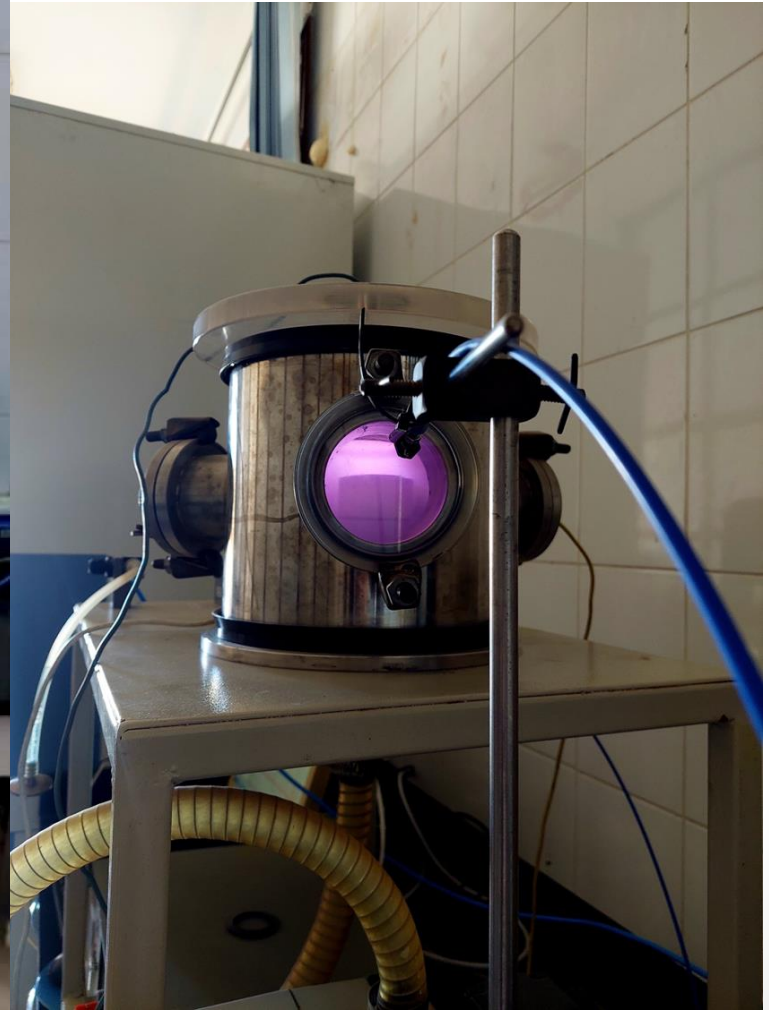
# Cold Plasma Application

## 3-Water purification :

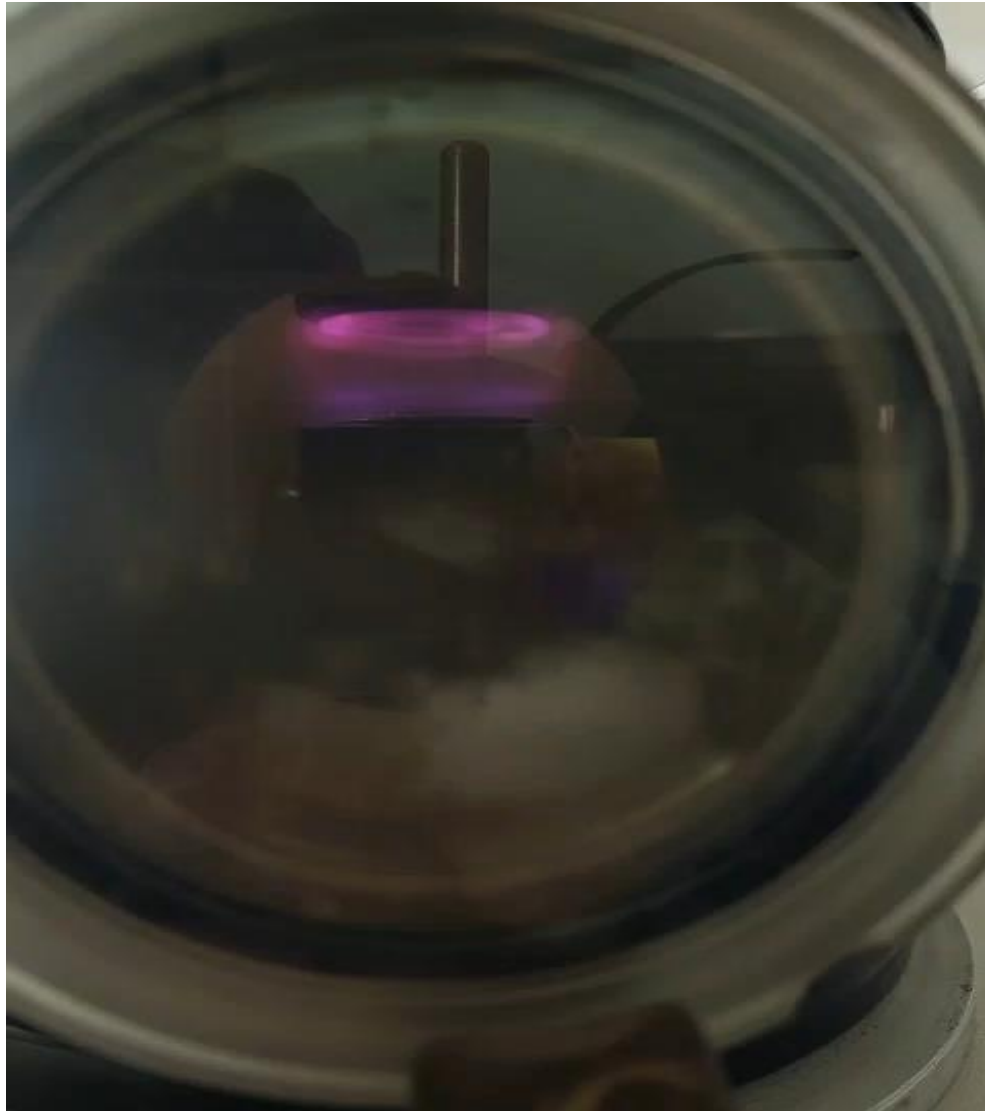
- Recycle wastewater
- Lake Decondamination
- Degradation of pharmaceutical compound
- Evaluation of treatment and disinfection of water
- Removal of pathogenic bacteria



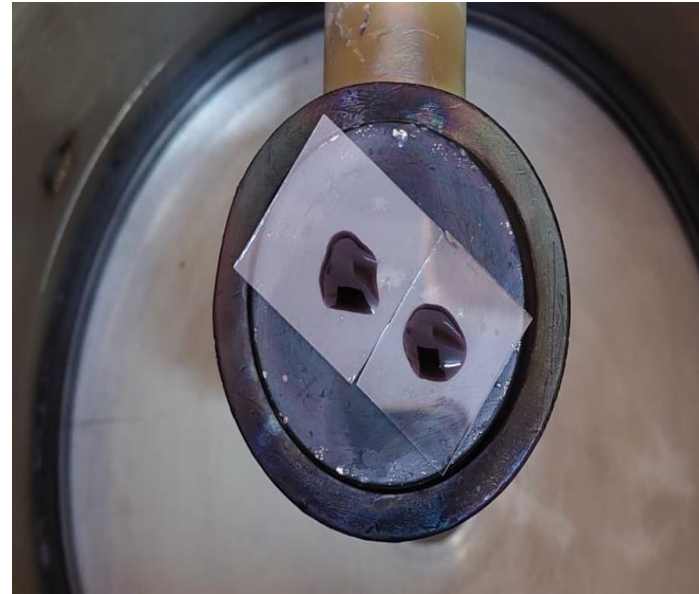
# Capacitive Coupled Plasma (CCP)



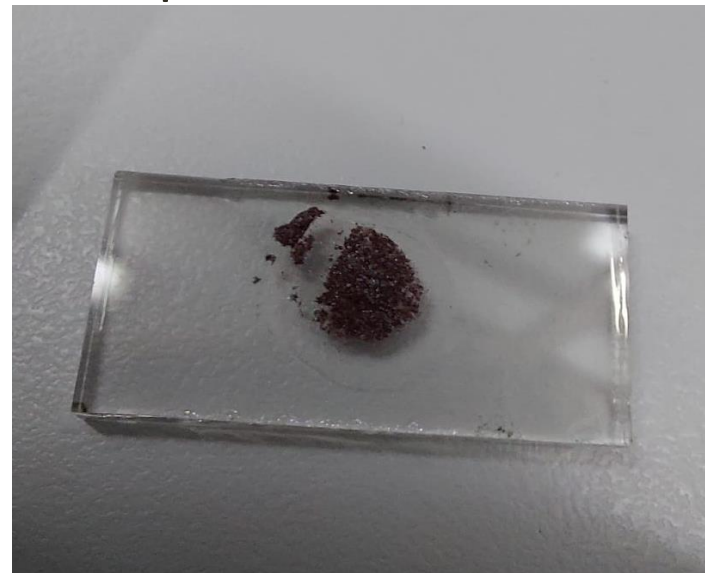
# Operation steps



# Operation steps

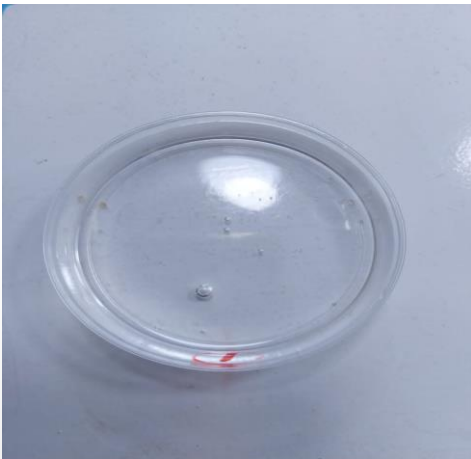
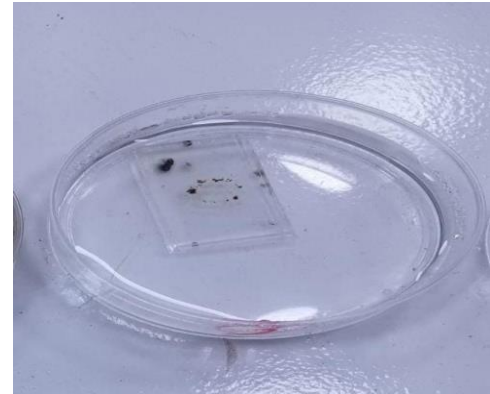
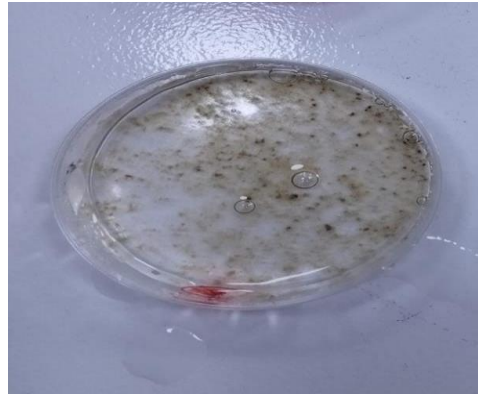


Sample without treated



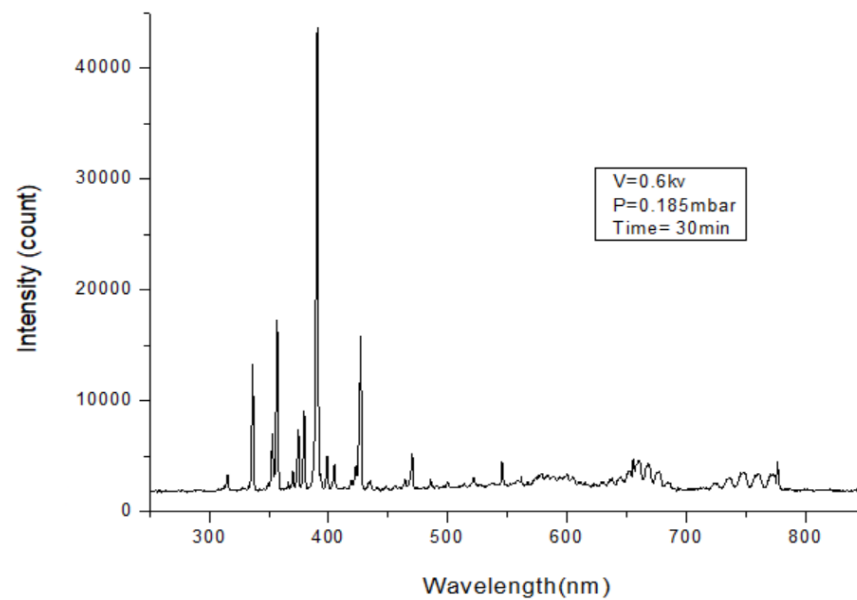
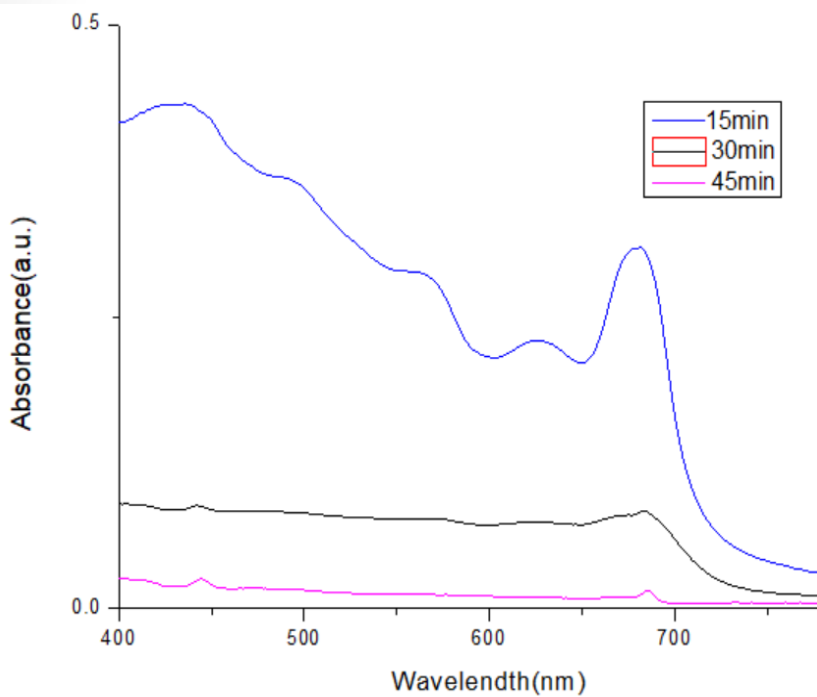
Sample with treated

# Results

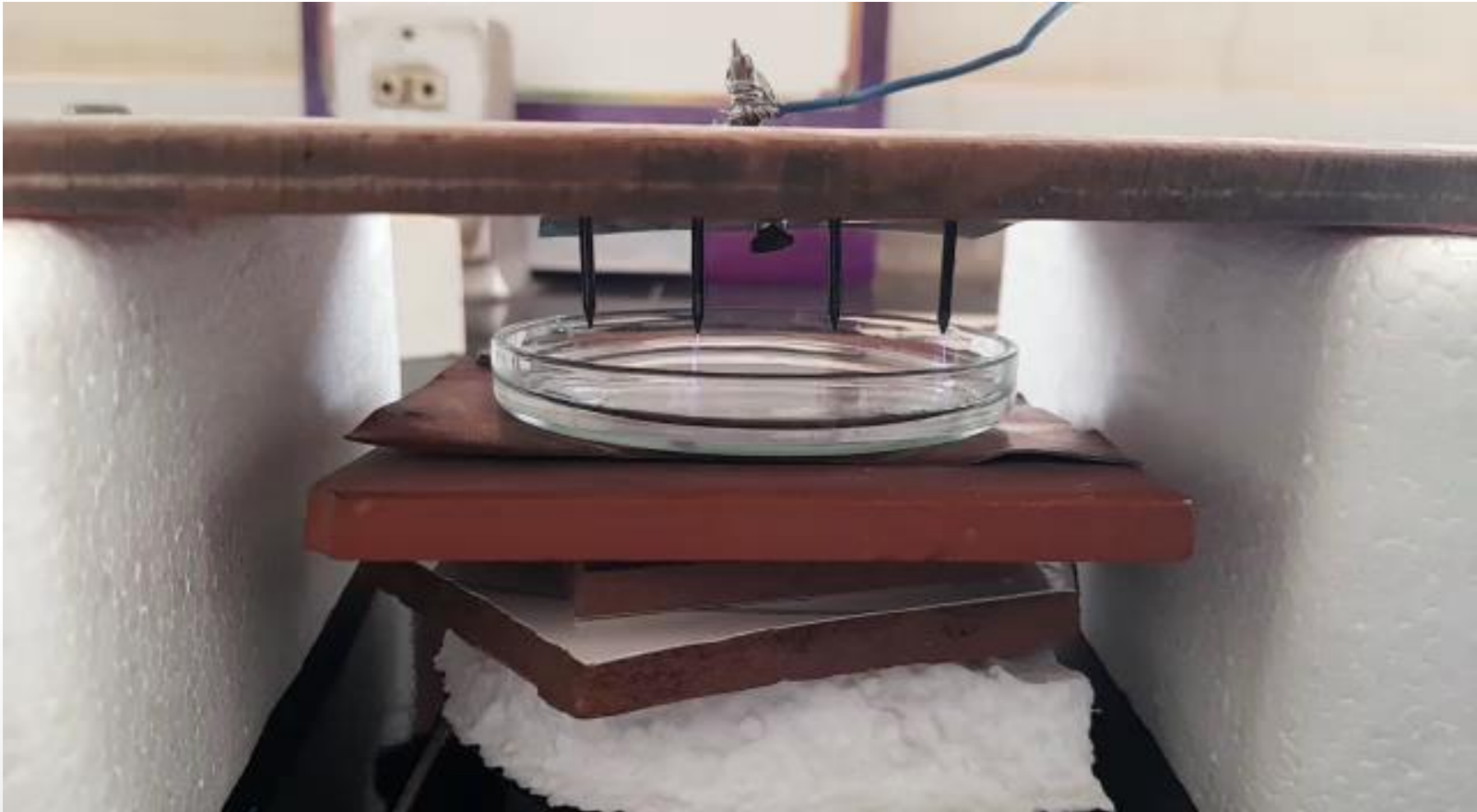




# Results



# Dielectric Barrier Discharge (DBD)



# Plasma Jet



# Summary

- Plasma: is a State of matter which is Ionized, Quasineutral and exhibits Collective Behavior.
- Plasma can be generated in different ways, and the most common method of generating plasma is electric discharge in neutral gases.
- Cold Plasma: Direct treatment, Low temperature, Ultra low cost, Efficient, Environmentally Friendly.
- Plasma is used in various applications, including medicine, agriculture, industry and water treatment.
- It was used CCP to study its effect on cyanobacteria. When we exposed the cyanobacteria to the plasma for different periods of time.
- The eliminate of bacteria varies with time.

# Time for dissection



***Thank You***