Progress Report

University of Córdoba- Physics Department

Plasma Technology as a new Preservation Technique

R. Rincón and M. D. Calzada

June 2011

Plasma Technology as a new Preservation Technique

- On the use of Plasma Technology as a food preservation Technique
- Active species and UV radiation un Surface Wave Discharges (SWDs)
- Action of a Surface Wave Discharge on browning of sherry Fino wine and growth rate in lentils
- Conclusions

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On the use of Plasma Technology as a food preservation Technique

- One serious problem for food industry is the deterioration of foods during the storage

- The consumers are increasing their demands related to the use of the preservation process

To improve food preservation techniques

To develop NEW food preservation techniques

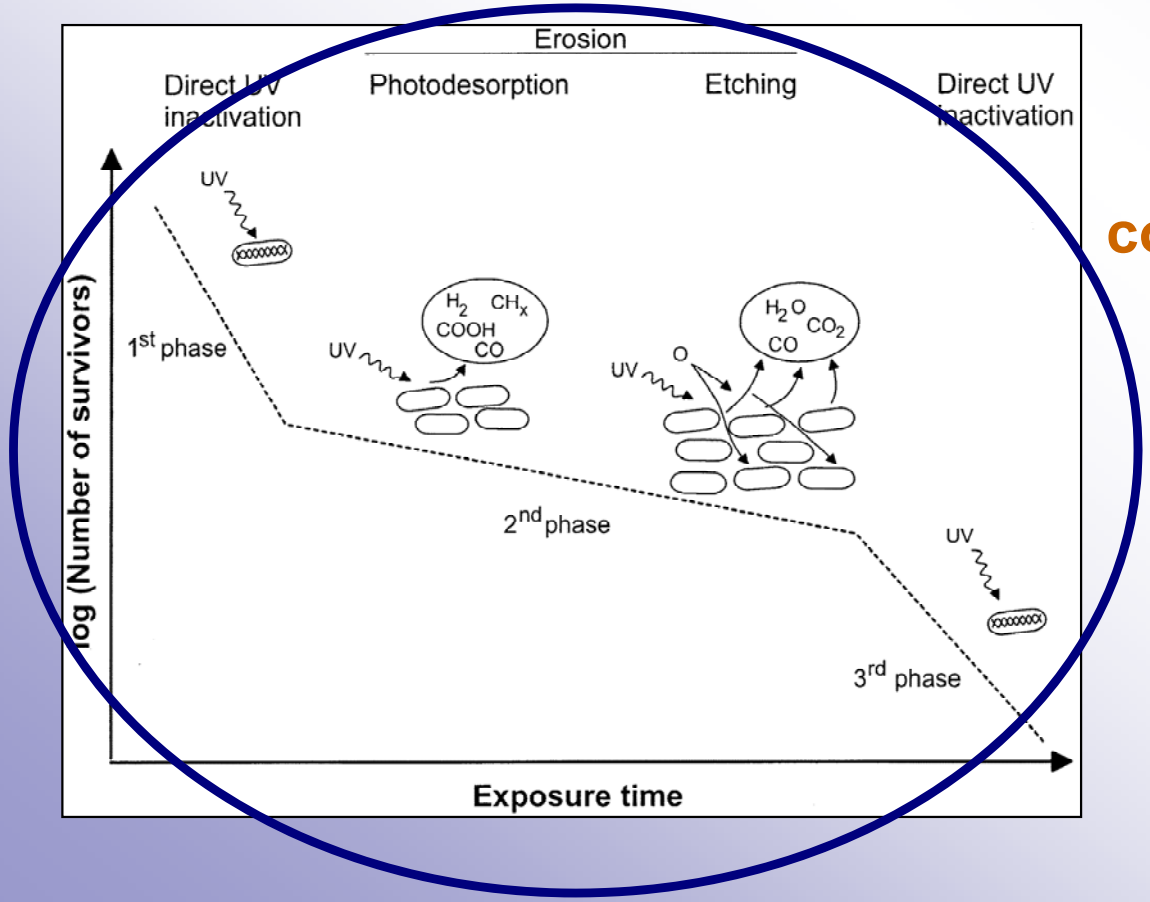
On the use of Plasma Technology as a food preservation Technique

To develop NEW food preservation techniques

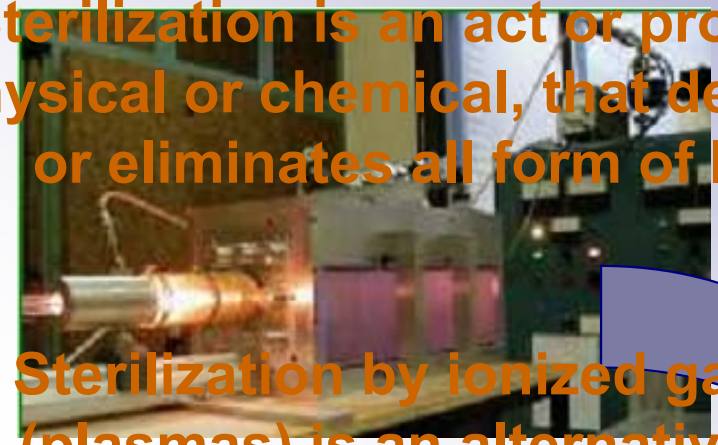
Non-thermal alternative Technology	Process
HPP (High Pressure Processing)	**Food is exposed to a high hydrostatic pressure for a few minutes**
PEF (Pulsed Electric Field)	**Food is exposed to pulses at high electric field intensity for a few milisecons**
Ionizing radiations	**Food is exposed to gamma radiation and electron beam with doses of 2-10kGy**
Ultraviolet (UV) Energy	**Food is exposed to non-ionizing radiation with germicidal properties**
Plasma ???	

On the use of Plasma Technology as a food preservation Technique

Plasma Sterilization:



Sterilization is an act or process, physical or chemical, that destroys or eliminates all form of life.



Sterilization by ionized gases (plasmas) is an alternative to conventional sterilization systems

Active Species

+

UV Photons

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Ultraviolet (UV) Energy	**Food is exposed to non-ionizing radiation with germicidal properties**
Plasma	**Food is exposed to active species like metastable $N_2(A^3\Sigma^+_u)$ and UV photons in the range of 200-280 nm such as those emitted by NO_γ band**

GEP

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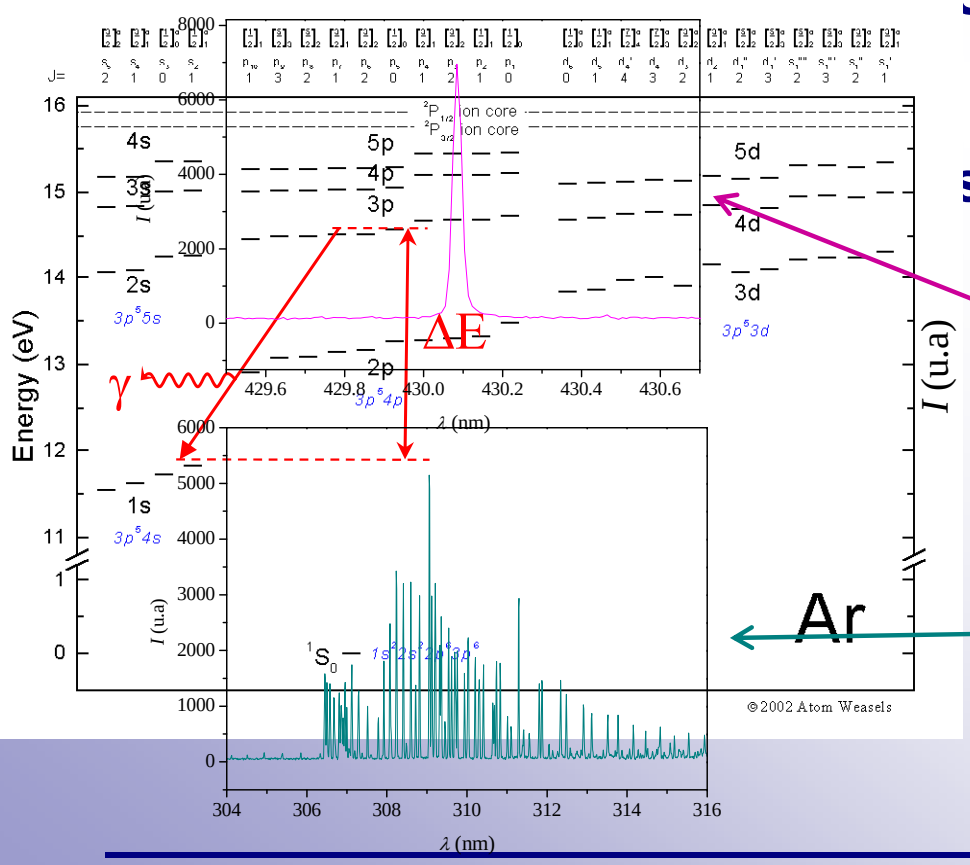
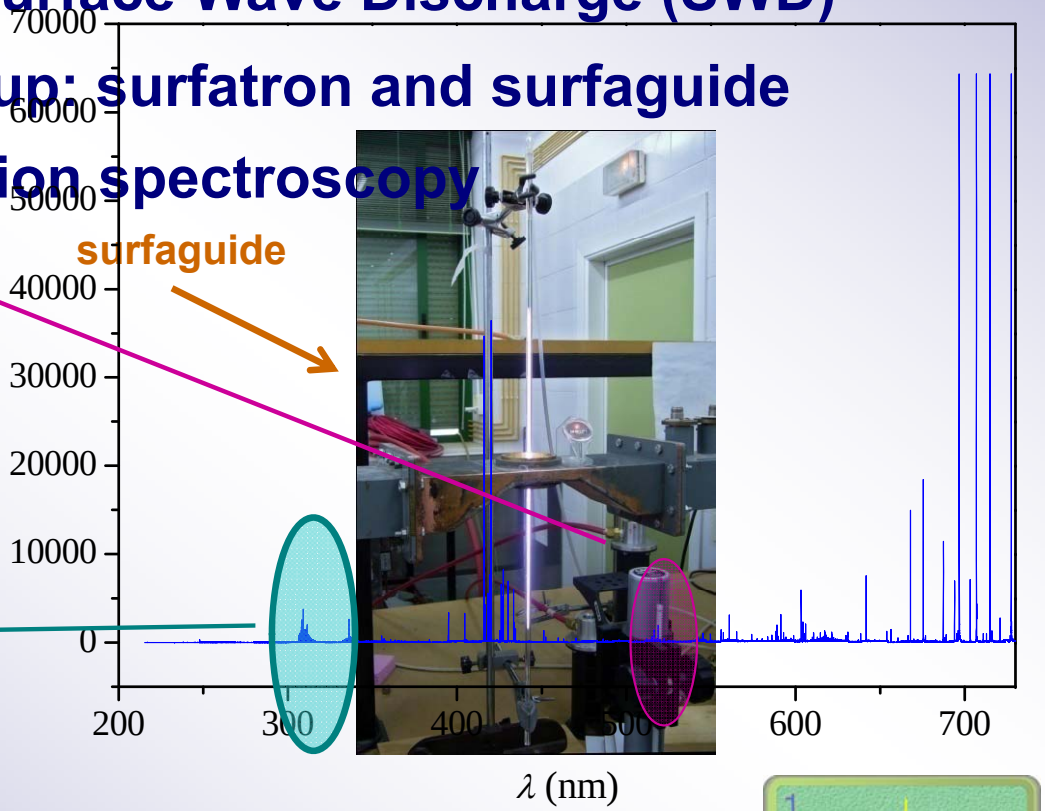
Active species and UV radiation in Surface Wave Discharges (SWDs)

- **Objective:** To find active species and UV photons using plasma technology
- How?: 1. Kind of plasma: Surface Wave Discharge (SWD)

up: surfatron and surfaguide

sion spectroscopy

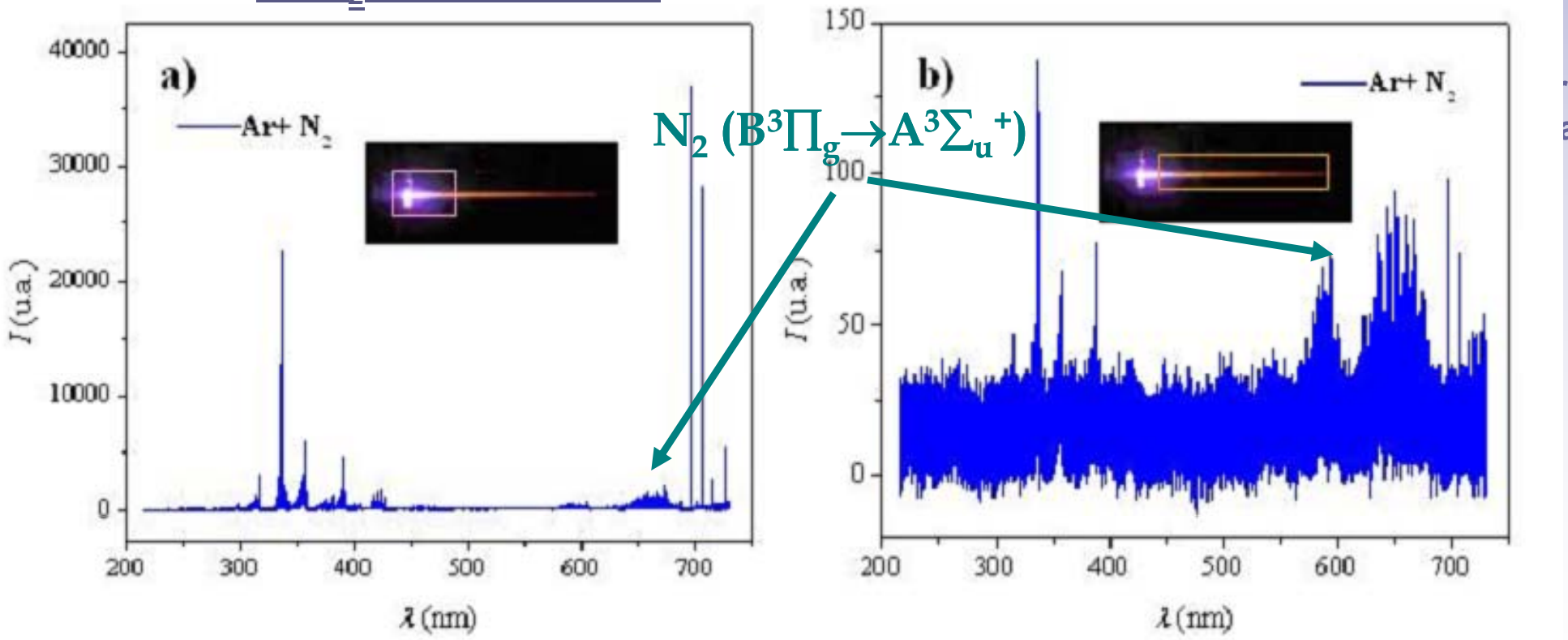




Active species and UV radiation in Surface Wave Discharges (SWDs)

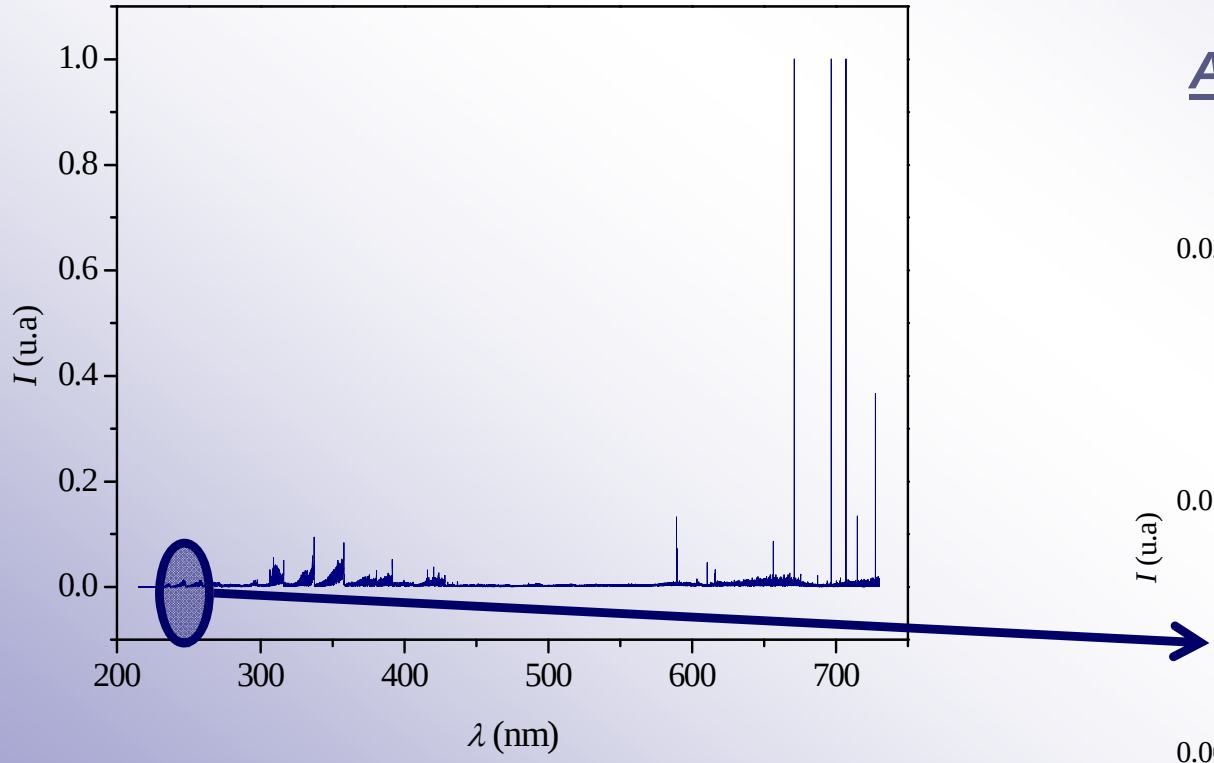
UV photons: de-excitation of $NO(A^2\Sigma^+) \rightarrow$ UV radiation:220-260 nm

Ar-N_2(4.90-0.10 slm)

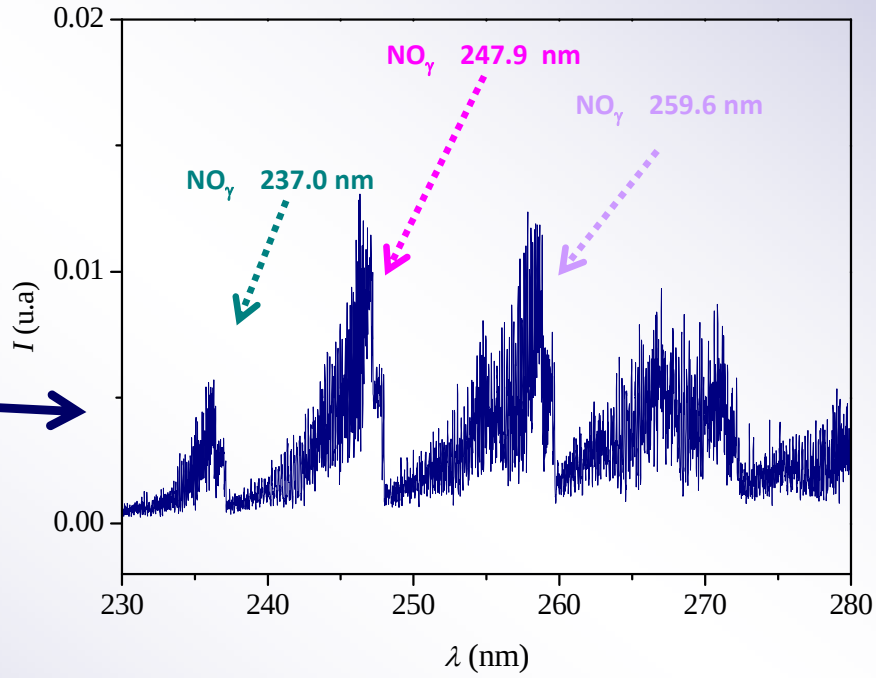


Active species and UV radiation in Surface Wave Discharges (SWDs)

⇨ UV photons: de-excitation of $NO(A^2\Sigma^+) \rightarrow$ UV radiation:220-260 nm



Ar-N_2O (4.90-0.05 slm)



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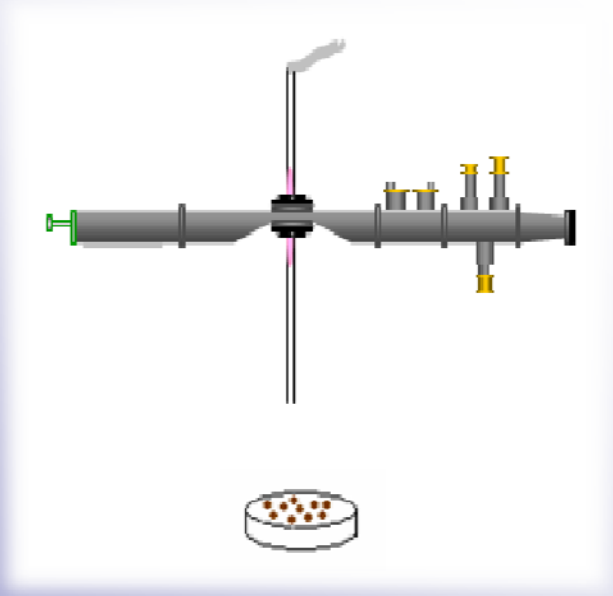
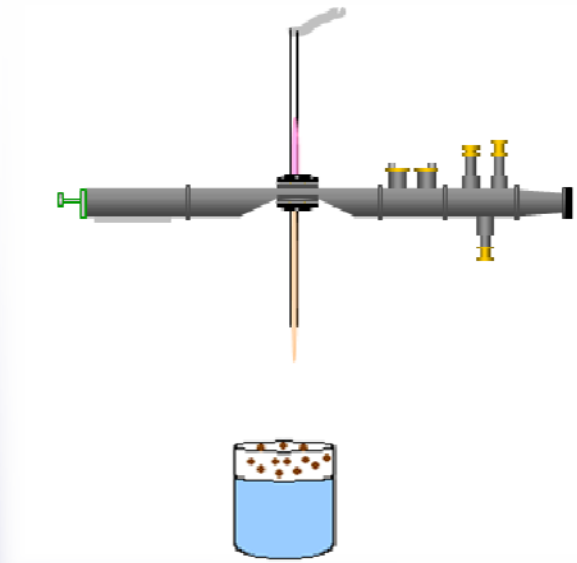
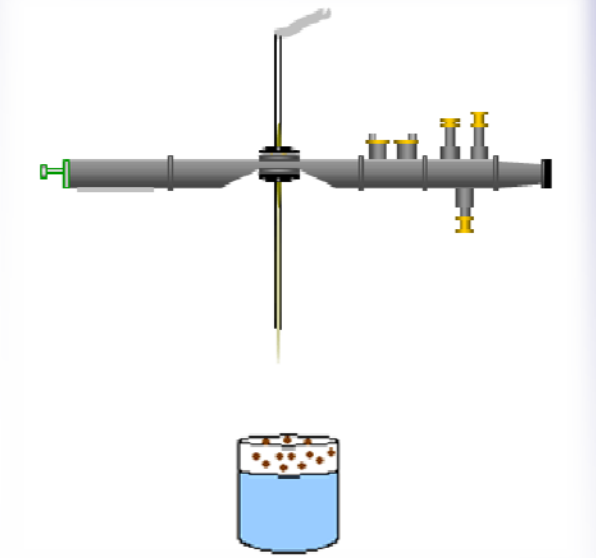
Action of a SWDs on Food: lentils and Sherry Fino wine

LENTILS TREATMENTS:







Mixture of Ar-N_2(I) (0.49 – 0.05 slm)

Mixture of Ar-N_2(II) (4.90 – 0.10 slm)

Mixture of Ar-N_2O (4.90 –0.05 slm)

Action of a SWDs on Food: lentils and Sherry Fino wine

⇨ *LENTILS TREATMENTS:*

CONTROL GROUP OF LENTILS

Ar-N_2(I)

Ar-N_2 (II)

Ar-N_2O

Action of a SWDs on Food: lentils and Sherry Fino wine

LENTILS TREATMENTS:

CONTROL GROUP OF LENTILS

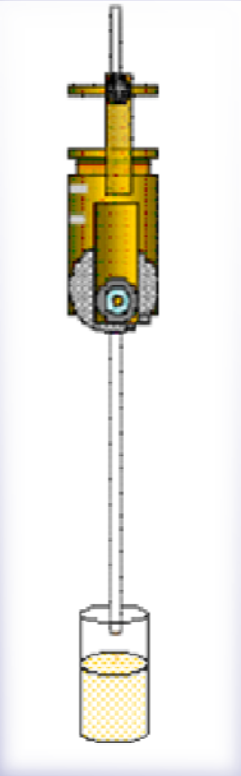
$Ar\text{-}N_2(I)$

$Ar\text{-}N_2$ (II)

$Ar\text{-}N_2O$

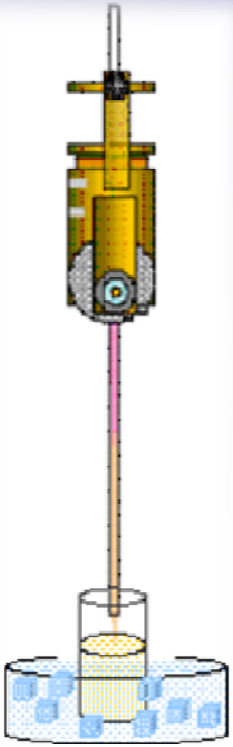
Action of a SWDs on Food: lentils and Sherry Fino wine

SHERRY FINO WINE TREATMENTS:



Mixture Ar-N_2 gas
(4.90 – 0.10 slm)

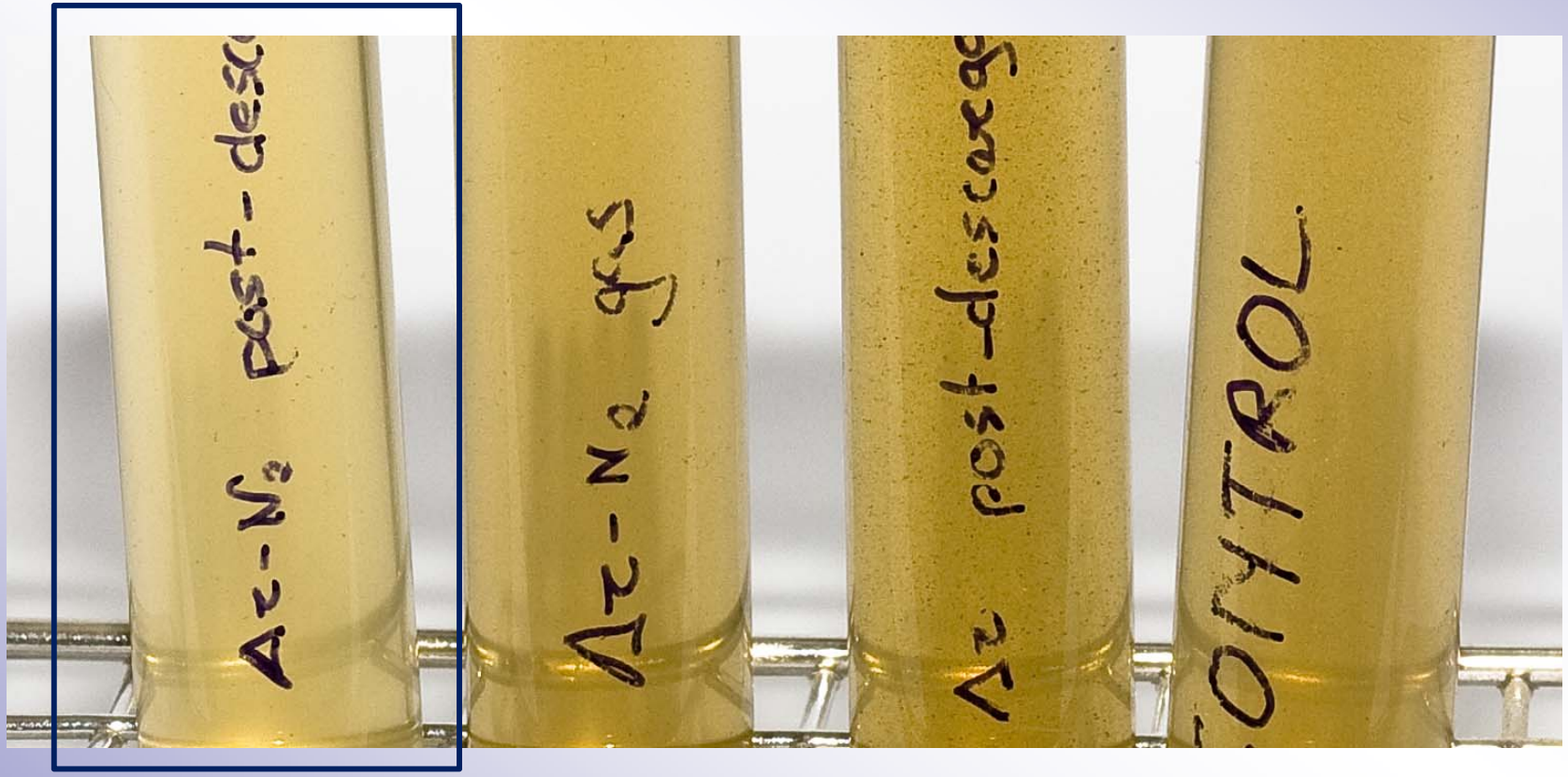
Ar Post-discharge
(4.90 slm)



Ar-N_2 Post-discharge
(4.90 – 0.10 slm)

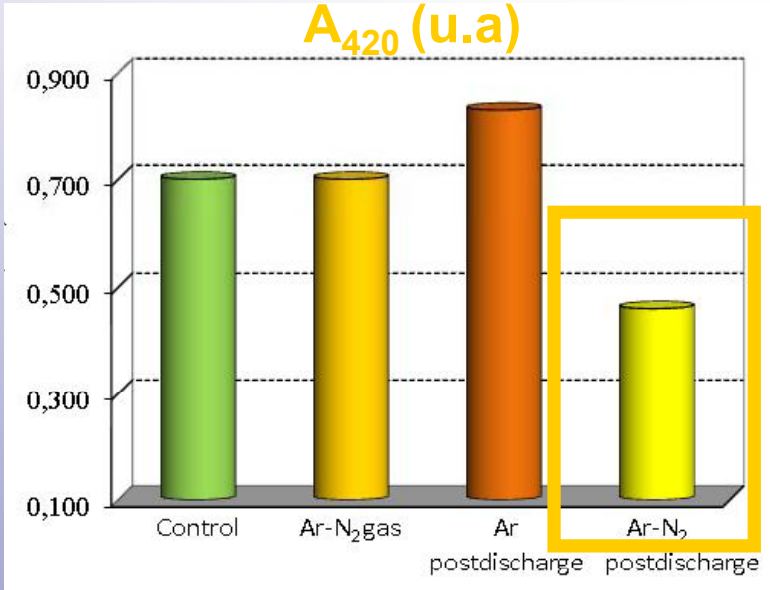
Action of a SWDs on Food: lentils and Sherry Fino wine

SHERRY FINO WINE TREATMENTS:



Action of a SWDs on Food: lentils and Sherry Fino wine

SHERRY FINO WINE TREATMENTS:



Parameters	Control	Ar-N_2 Gas	Ar Post-discharge	Ar-N_2 Post-discharge
a^*	1.96±0.02	2.30±0.01	3.26±0.02	-0.36±0.01
b^*	31.30±0.02	31.20±0.02	34.90±0.01	24.10±0.02
L_{ab}^*	82.40±0.03	81.90±0.04	78.60±0.02	90.10±0.04
A_{420nm}	0.701±0.010	0.701±0.010	0.829±0.020	0.459±0.010
A_{520nm}	0.257±0.020	0.265±0.010	0.318±0.010	0.14±0.010
A_{620nm}	0.130±0.010	0.135±0.020	0.166±0.020	0.062±0.020

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Conclusions

The results suggest that plasma Technology could be a New Preservation Technique

- **We have found that when we exposed lentils to plasma, those samples treated with plasma where exists active species and emission on UV photons grow less than the others samples**

- **The exposure of wine to an Ar-N_2 postdischarge could be used as a technique to increasing the resistance of the Fino wines to browning**

Emission spectroscopy is an important tool to assess the capability of plasma technology as a preservation technique

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