Alternatives to post-harvest pear disinfection using plasma-activated water and electrolyzed water

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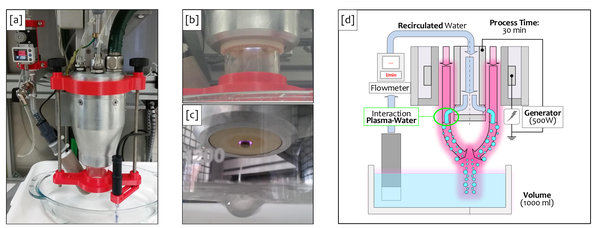
Introduction

- The **storage of pears** in controlled atmosphere chambers (CAC) for a **long term conservation** is not enough to mantain a good quality of the pears.
- The use of **post-harvest treatments** before their storage in CAC intends to delete or **reduce the development of rot** and pathophysiology during preservation → **Higher number of lossed pears after 8 months of storage.**
- The **use of fungicides** in the post-harvest treatment of pears before their storage in CAC may **cause resistances** to different pathogens.
- The use of alternative technologies [**Plasma Activated Water (PAW) and Neutral Electrolyzed Water (NEW)**] to the use of fungicides could be an interesting solution.

Methods

- An **Atmospheric-Pressure Plasma Jet (APPJ)** system was used to generate **PAW** (Fig. 1).
- An **ENVIROLYTE EL-400** system was used to generate **NEW**.
- During the 2018-2019 harvest, **9 different pear batches were prepared,** which were treated by **starting immersion** (Fig.2[a]), at a ratio of 1:2 for 10 minutes, **with distilled water (DW), PAW and NEW.**
- The **pears were placed in three CAC**, one batch of each initial treatment per chamber.
- The chambers were balanced until the storage conditions were reached (0.5 % CO_2, 0.8 % O_2 and -0.5°C). The **relative humidity for each chamber** was maintained at **95% with DW, PAW and NEW**, respectively (Fig.2[b]).
- The **chambers were opened at t0, t2, t4, t5, t6, t7, t8 and t9 months**. In each exit, **aerobic mesophiles, mould and yeast counts, color, texture and °Brix were analyzed.**

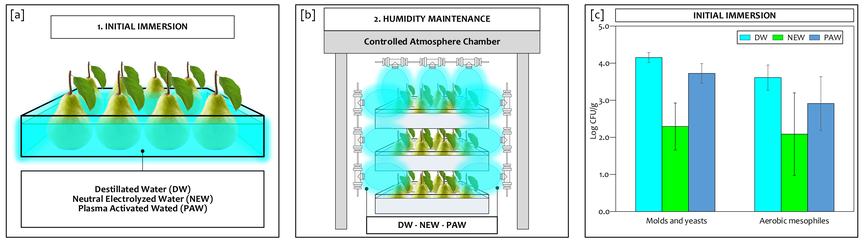
Fig. 1. [a] PAW generation system; [b] and [c] Close view of the plasma jet; [d] Scheme of PAW generation process.



Results and Discussion

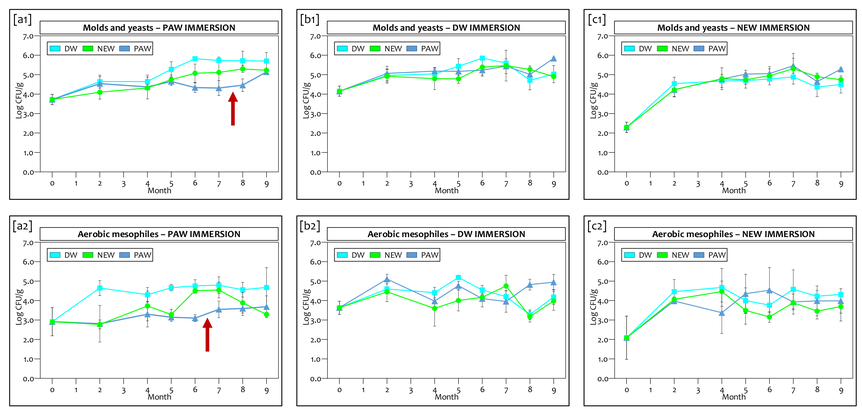
- **Initial immersion treatments:** for pears inmersed in **NEW and PAW a reduction in contamination** by aerobic mesophiles, molds and yeasts was observed in comparison to pears inmersed in DW (Fig.2[c]).

Fig. 2. [a] Initial inmersion treatment; [b] Humidity maintenance treatment during storage; [c] Microbial counts after each inmersion treatment.



- **Throughout the evolution time: pears initially treated with PAW and sprayed with PAW** showed the **lowest counts** for both aerobic mesophiles and molds and yeasts (Fig.3[a1] and [a2]).
- **An improvement** was observed in **pears stored in chambers with PAW and NEW spraying** compared to those sprayed with DW.

Fig. 3. Microbial evolution during pears storage in CAC: [a1], [b1] and [c1] Molds and yeasts and [a2], [b2] and [c2] Aerobic mesophiles.



- It was observed a **greater influence on the organoleptic characteristics** of the product (texture, color, °Brix) **due to the sprayed treatment** in chambers.
- For pears stored in **chambers with PAW and NEW spraying** it was noted:
  - **Higher Greenery** (Hue angle).
  - **Higher Firmness.**
  - **Lower Ripening** (°Brix).
- **Pears inmersed initially in PAW and stored with PAW spraying** showed the **least number of losses (one of the main objectives).**

Fig. 4. Organoleptic parameters after 9 month storage: [a] Color; [b] Texture; [c] °Brix and [d] Percentage of lossed pears.

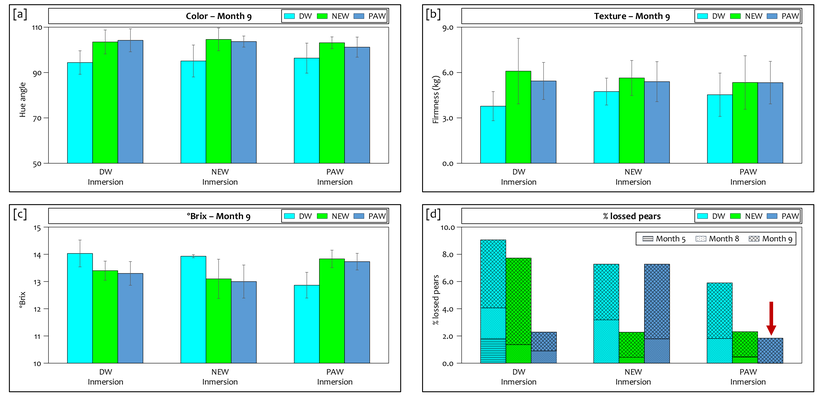
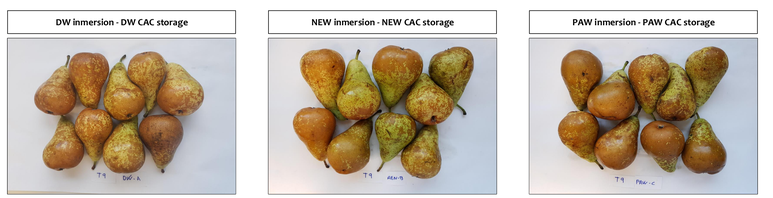


Fig. 5. Picture of pears after 9 month storage: [a] DW inmersion treatment – DW CAC storage; [b] NEW inmersion treatment – NEW CAC storage; [c] PAW inmersion treatment – PAW CAC storage.



Conclusions

- A **greater influence on the quality and hygienic-sanitary condition of the product was observed due to the sprayed treatment (with NEW or PAW)** during storage to the humidity maintenance in comparison to the starting inmersion treatment.
- **The PAW and/or NEW application on pears during store to the humidity maintenace in chambers is proposed as an alternative to the use of fungicides in post-harvest treatments.**

Equipment provided by: mpg. molecular plasma group

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