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Food Safety and Productivity in Vertical Farming

Pre- and Post-Harvest Gas Phase Hydroxyl-Radical Treatment to Decontaminate and Extend the Shelf Life of Microgreens in Controlled Environmental Agriculture Operations

Background

- Fresh produce is the #1 cause of foodborne illness outbreaks
- Vertical farming is considered less prone to risk because of the enclosed structure, but pathogens such as Listeria, Salmonella and E.coli can be introduced through the seeds, growth substrate, irrigation water, and unsanitary surfaces
- How can we stop human pathogens without negatively affecting crop performance?

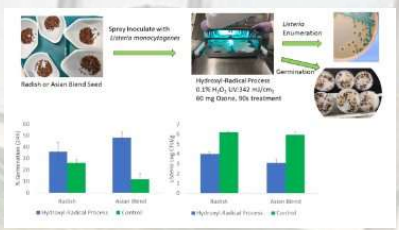
Gas Phase Hydroxyl-Radical Process

Solution

- Hydroxyl-radicals have strong antimicrobial properties and leave no residue
- The radicals are generated from UV-C degradation of hydrogen peroxide and ozone
- Treating seeds, substrate, and plants with hydroxyl-radicals is a rapid process with no residue

Seed disinfection

Radish seeds were inoculated with *Listeria monocytogenes*. Pathogen levels were reduced by 2 log (99%) on the radishes and the germination rate increased.


Seed disinfection, hydroxyl radical process, graphs of seed germination and pathogen reduction

Irrigation Water

- Disinfection with Advanced Oxidation Process
- Pathogen reduction independent of water turbidity
- No residues to negatively affect plant growth.


Irrigation water disinfection

Pre-harvest Plants

- Plants treated 48 hrs pre-harvest
- 1 log reduction in *L. moncytogenes* (90% reduction)
- Increase in chlorophyll and shelf life

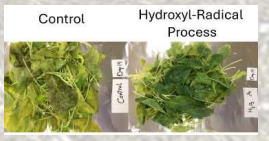

Chlorophyll levels


Pre-harvest plants

Post-harvest Plants

- Plants treated post-harvest showed a 1-2 log reduction of pathogens (90-99%)
- Extended shelf life
- Commercial units installed

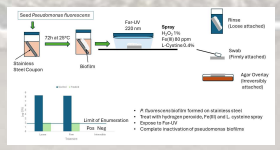

Hydroxyl-radical treatment of plants post-harvest



Kale baby leaf 19 days post-harvest storage

Biofilm Busting

-Hydrogen peroxide and Fe(III) eliminated pseudomonas biofilm


Biofilm elimination

Conclusions

- The hydroxyl radical process is an effective decontamination process
- When applied at different stages in the crop cycle it has the potential to reduce pathogens, increase sprout yield, and increase shelf life without leaving residues

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