

Biomaterial Research for Pathogen Control and Food Quality

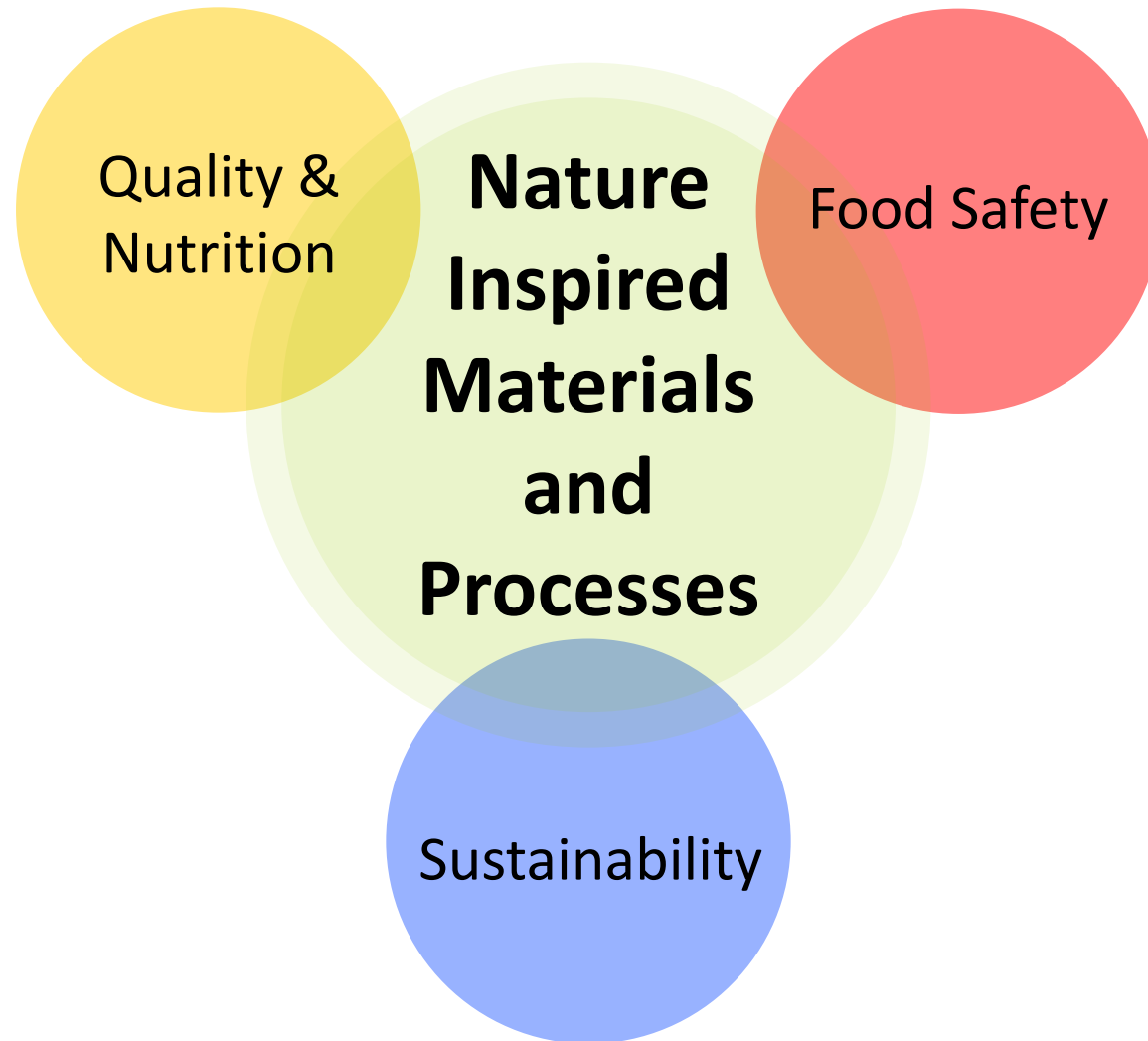
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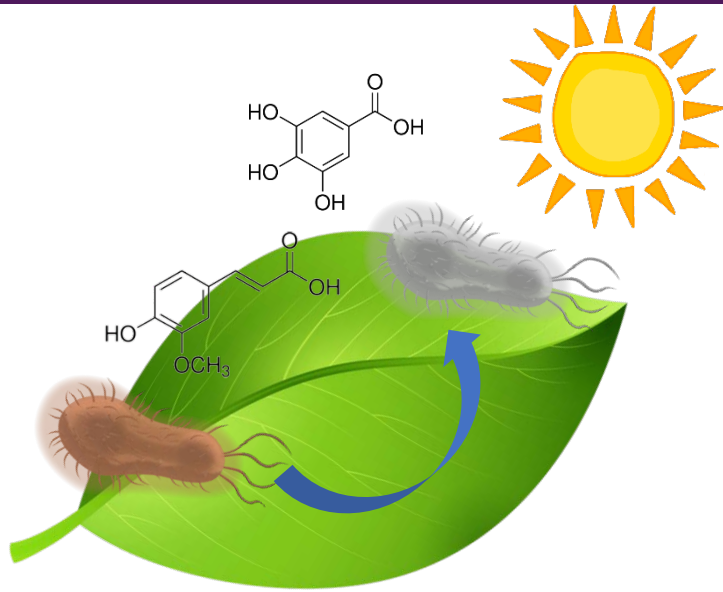
University of California-Davis



Overall Research Goals- Nitin lab



Pest and Pathogen Control- Natural Approach



Concept of Synergy

log CFU/g

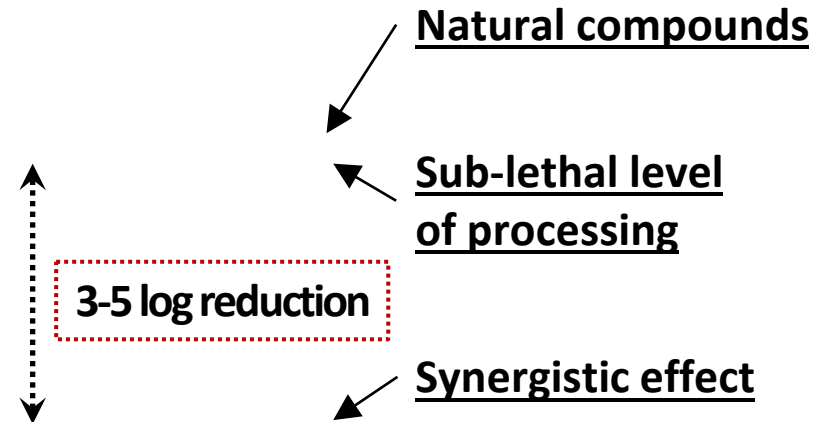
Light (heat, remove moisture)

+

Nature preserve plants



Enhance the efficacy of killing

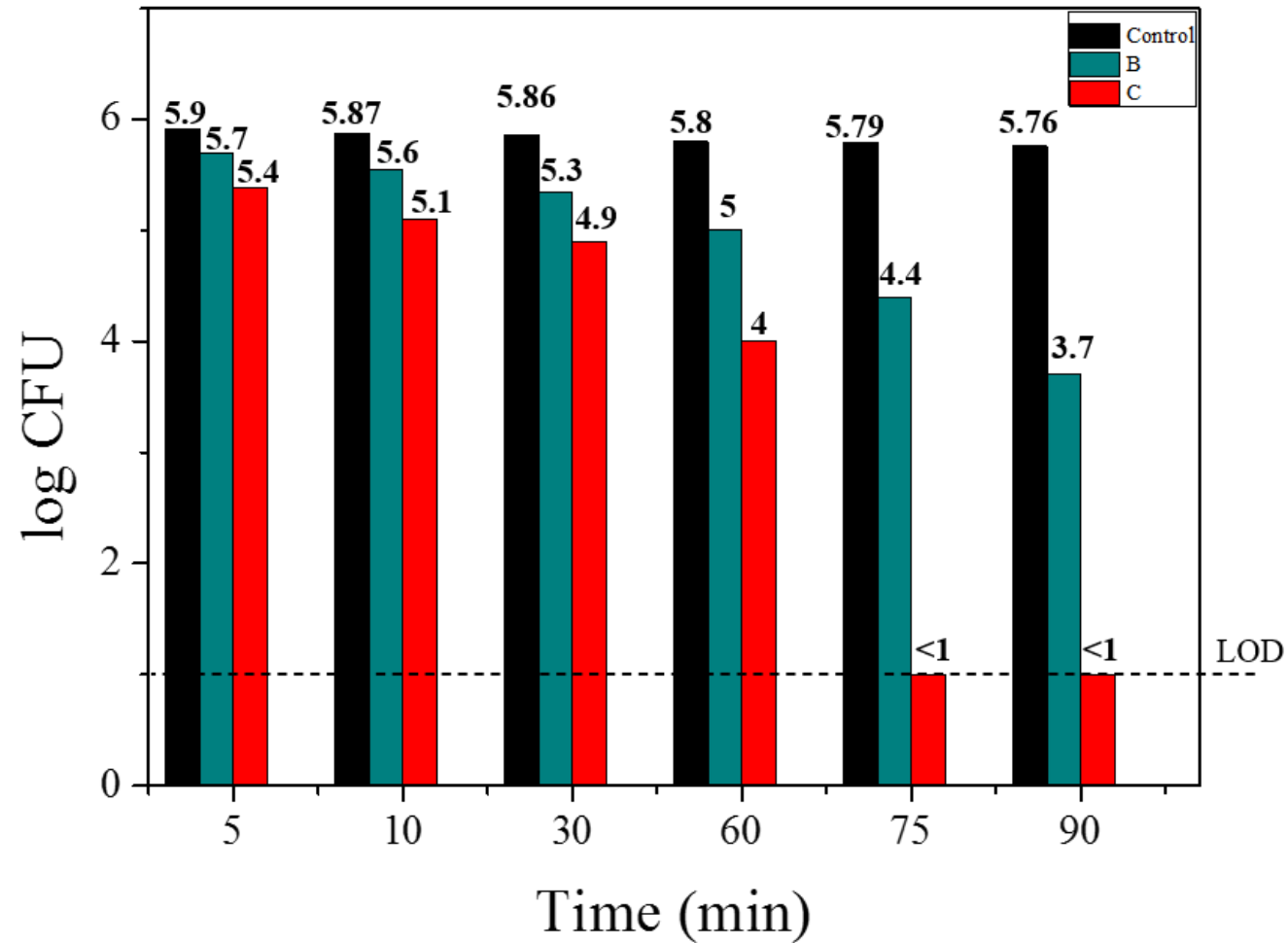


Summary

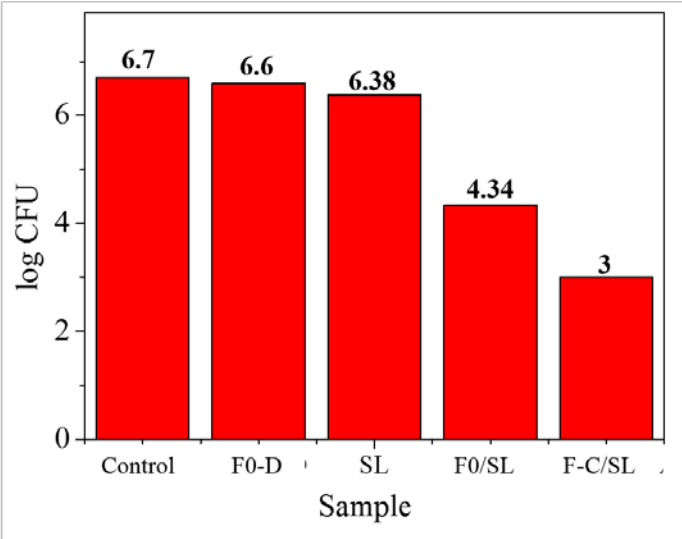
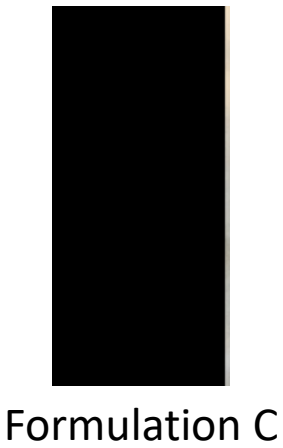
- Discovered and developed formulations of
 - Food grade small molecules
 - Food grade biopolymers and their modifications

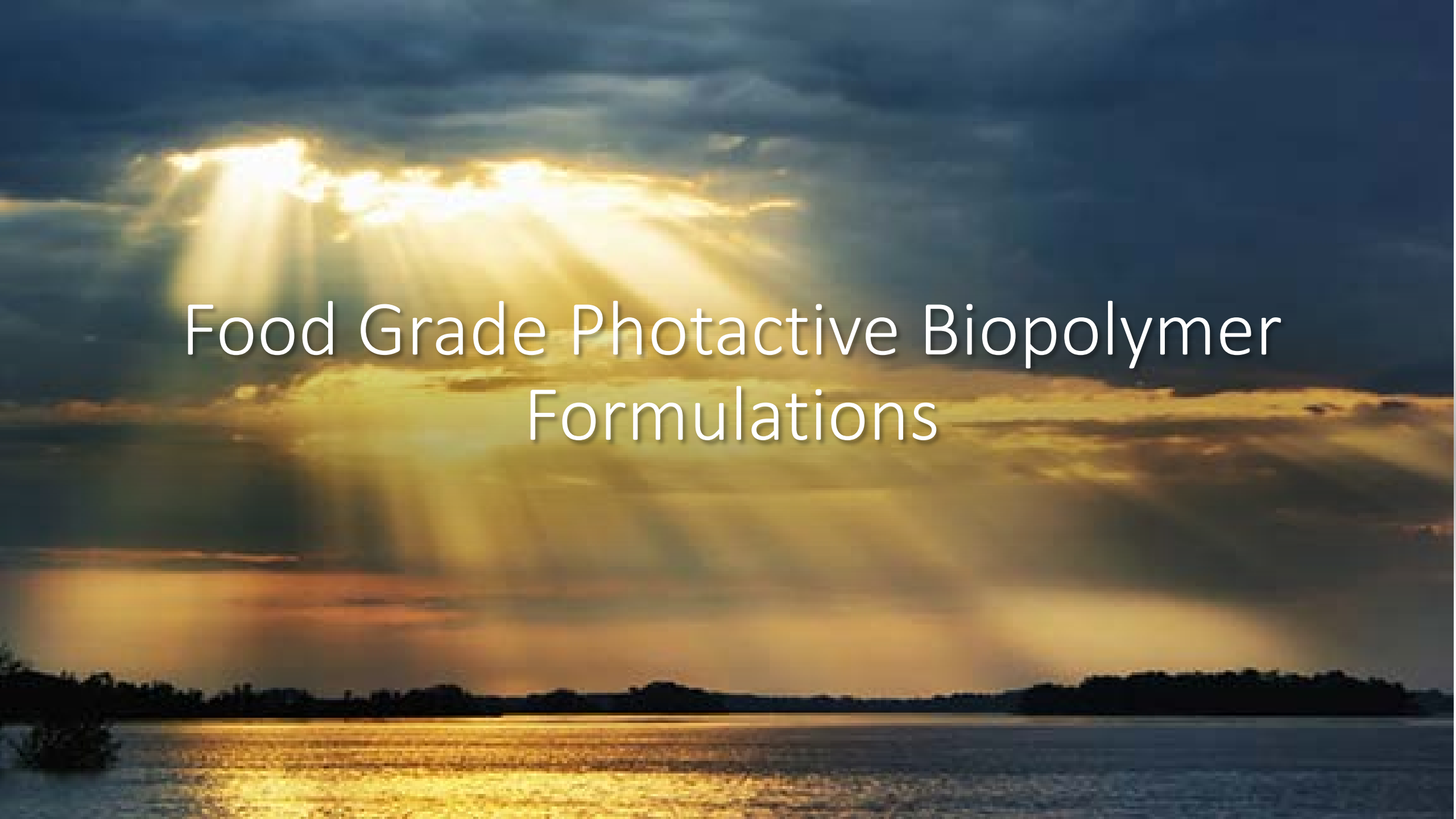
for the inactivation of pathogens- including viruses, bacteria and fungi (ongoing work) in the presence of “day light” on surfaces/solution and sunlight on plants

Antibacterial activity of natural formulations under daylight



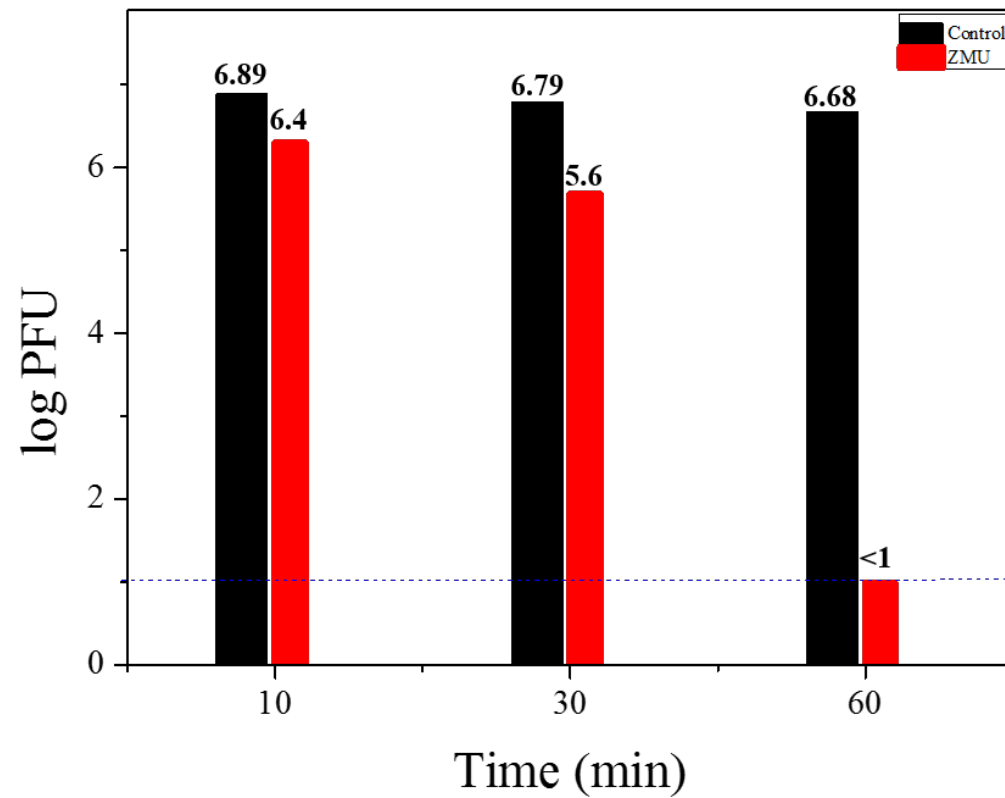
Antimicrobial activity of Formulation C under sunlight for foliar application on plants



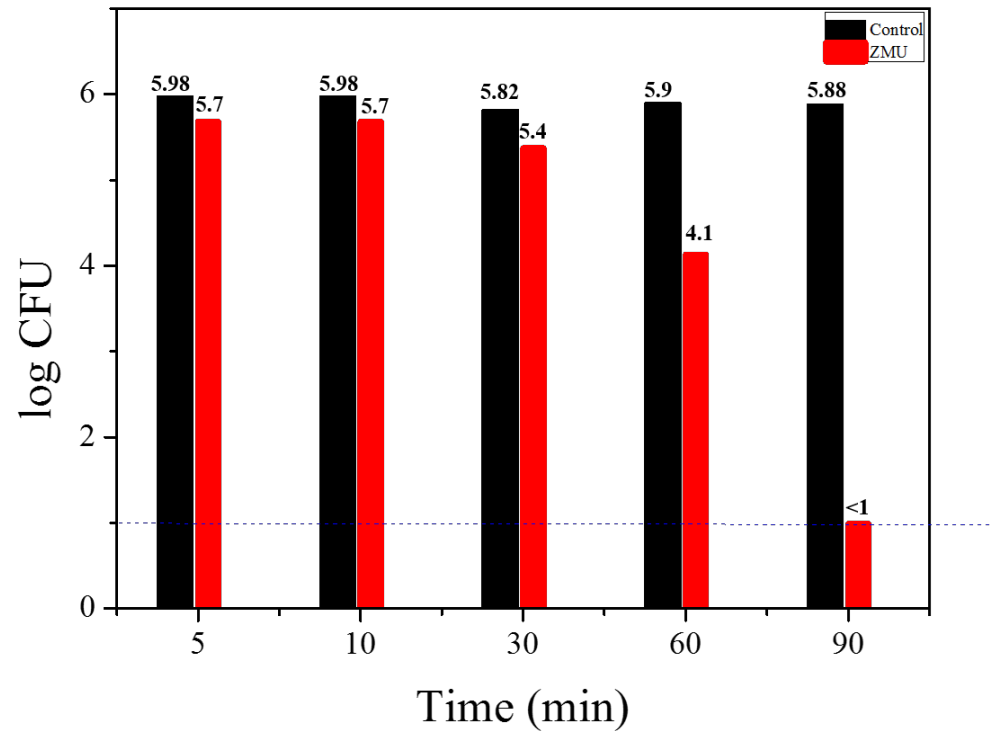
A dramatic sunset scene over a body of water. The sun is partially obscured by dark, heavy clouds, creating a strong lens flare effect with bright yellow and orange light rays streaming outwards. The sky transitions from a deep blue at the top to a warm orange near the horizon. The water in the foreground reflects the intense light from the sun, creating a shimmering, golden path. The horizon line is dark, showing the silhouettes of distant land or trees.

Food Grade Photactive Biopolymer Formulations

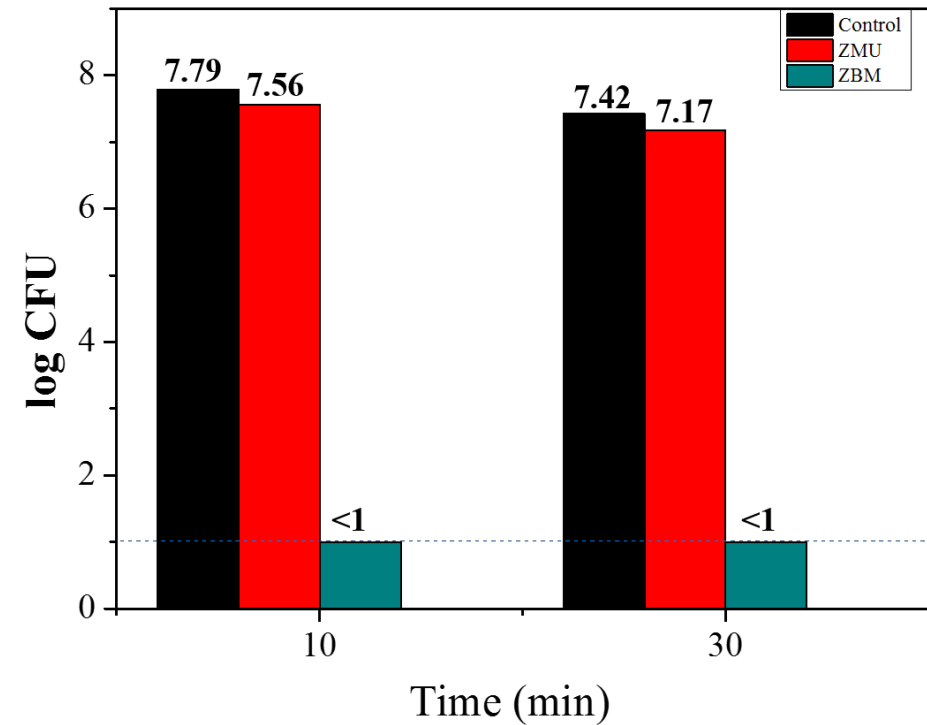
Antiviral activity of Bioformulation (ZMU) under UVA



Antibacterial activity of Bioformulation (ZMU) under UVA

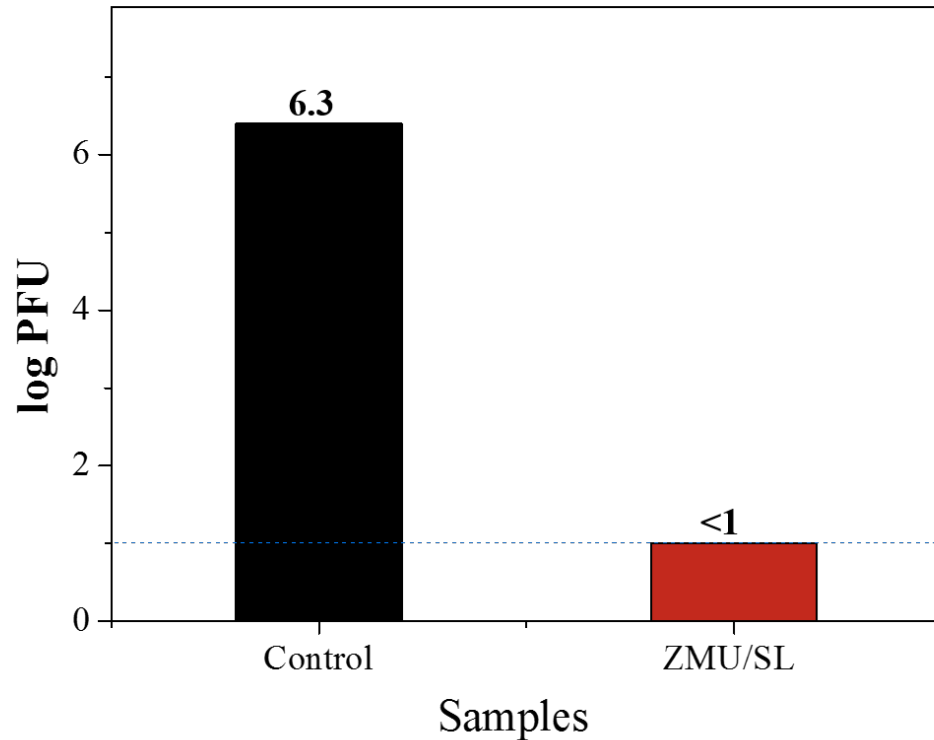


Enhance affinity ZMU by biomolecules (ZBM)

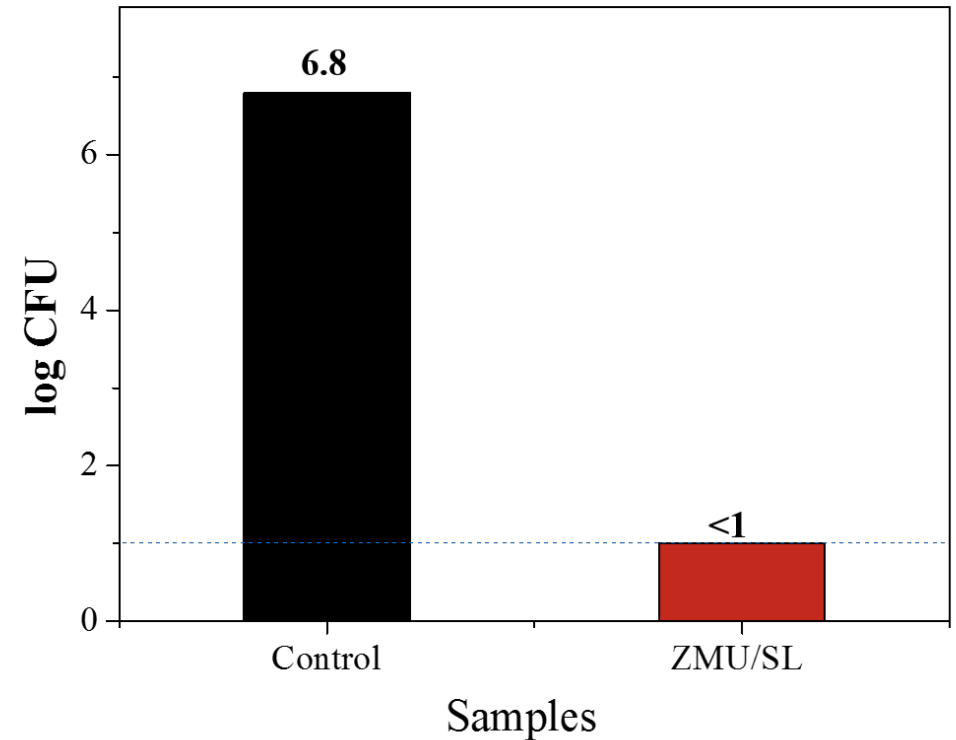


Antimicrobial activity of Bioformulation (ZMU) under sunlight

Antiviral with 30 min sunlight exposure

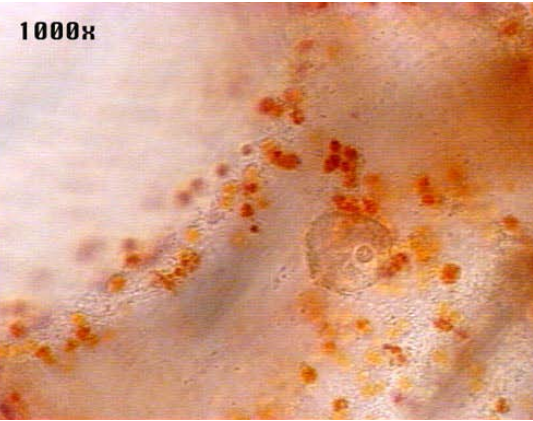
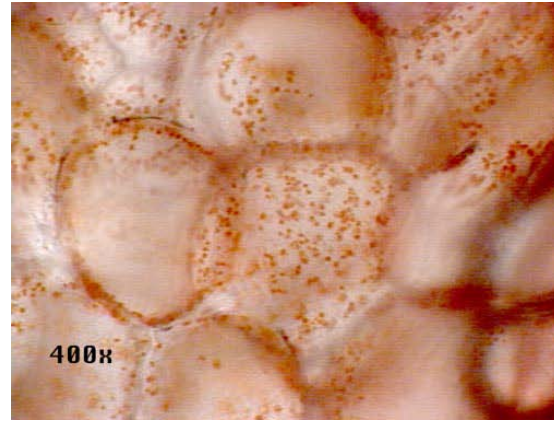


Antibacterial with 30 min sunlight exposure



Partitioning and interactions of carotenoids during tomato processing and storage

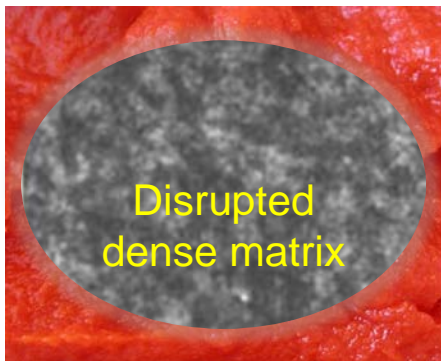
Background



Chromoplast with Carotenoids



Processing: Hot/Cold Break followed by sieving and heating (evaporation and sterilization)



Microstructural changes with processing



Storage



Carotenoids??

Physico-chemical characterization:



→ Brix Index



→ Bostwick consistency of hot break puree



→ Hunter (L, a, b) color



Partitioning and localization of lycopene

Oil

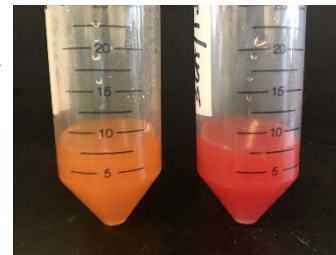
Diffusion level

Paste

Quantify carotenoids partitioning using UV-viz spectral approach

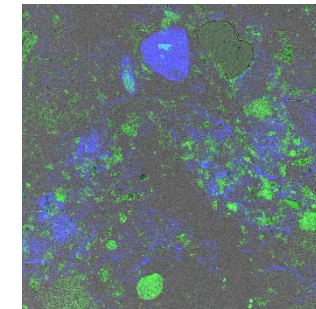
Carotenoid structural modifications with FTIR

Particle size distribution



Hot break Cold break

Diluted paste and filtered with muslin cloth



Confocal imaging for carotenoid localization



Tomato Varieties

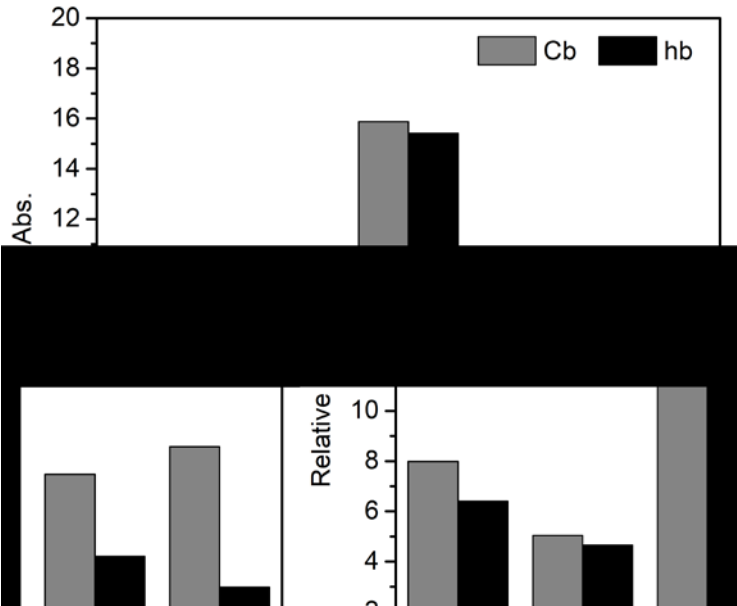
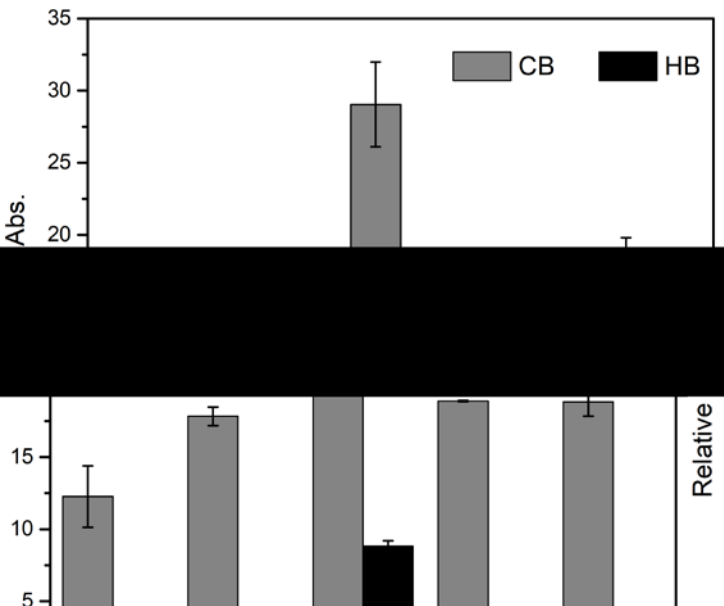
2018	2019
Batch 1: Davis field, Aug 21, 2018 Batch 2: Stockton field, Sep 10, 2018	Location K: Stockton field, Aug 14, 2019 Location C: Stockton field, Sep 12, 2019 Location V: Stockton field, Sep 25, 2019
Varieties: A: H1311 B: H1418 C: H1775 D: H5608 E: H8504	Varieties: H5608 } H8504 } same as 2018 H1311 } H1886 } N6428 } Replacements

Summary

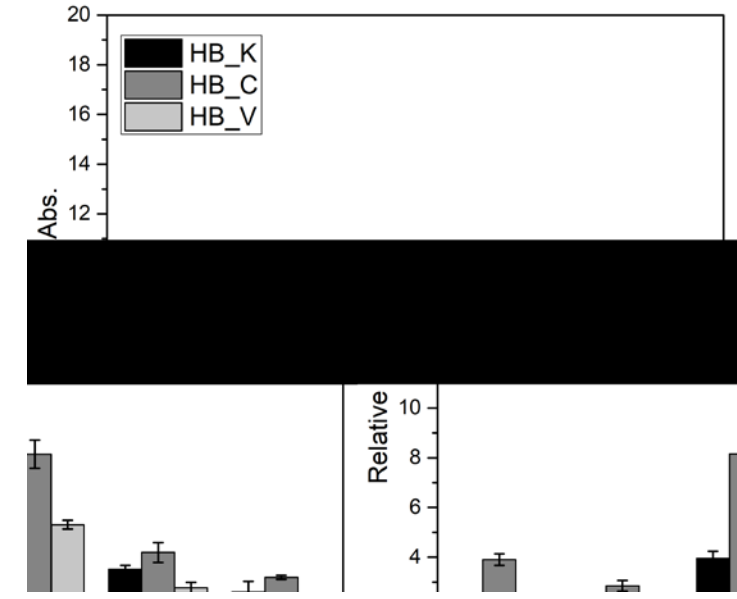
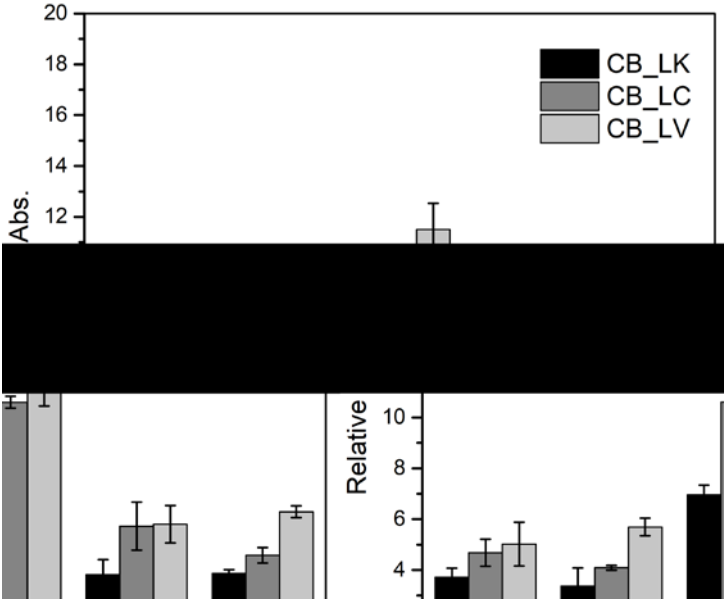
- Agronomical conditions has the significant effect on the physical properties and the accessible lycopene content of tomato samples.
- Accessible lycopene content in cold break tomato juices are significantly higher than that available in hot break juices immediately after processing.
- Melting out of carotenoid crystals during hot break processing and binding with the biopolymer matrices is the major cause for less accessibility of lycopene in hot break tomato juices
- Significant reduction in the accessible lycopene content of cold break juices during storage in comparison to that in hot break tomato juices

Processed tomato lycopene partitioning in oil phase

2018

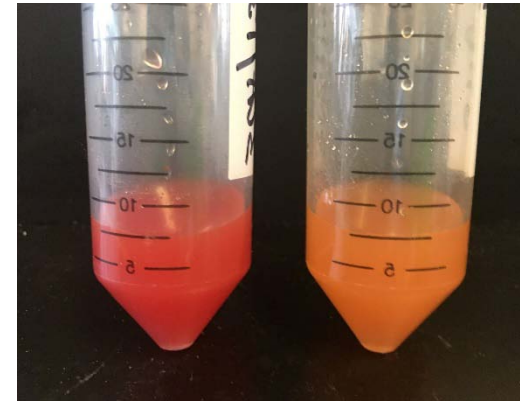


2019



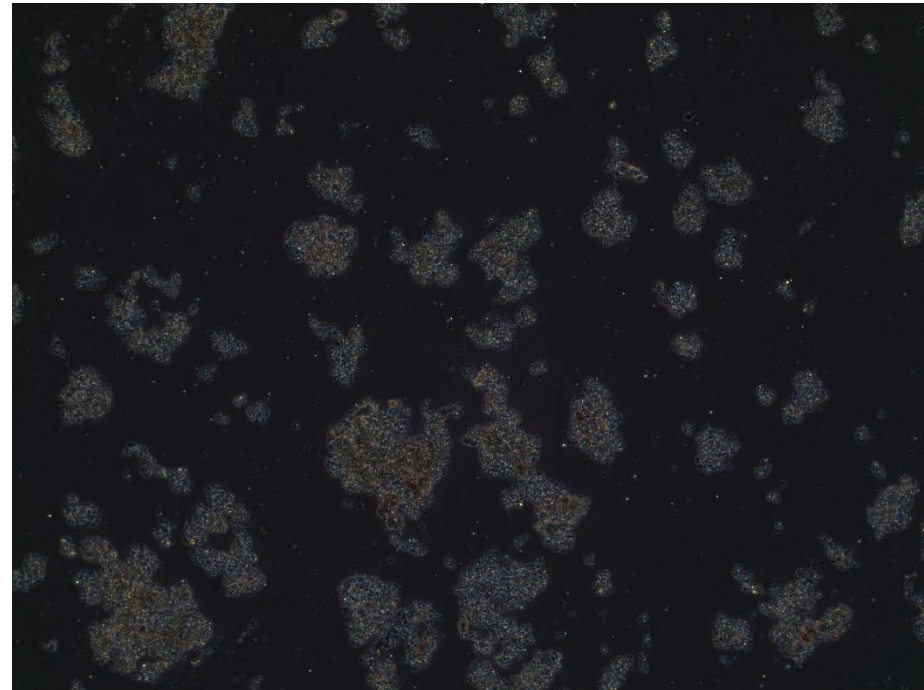
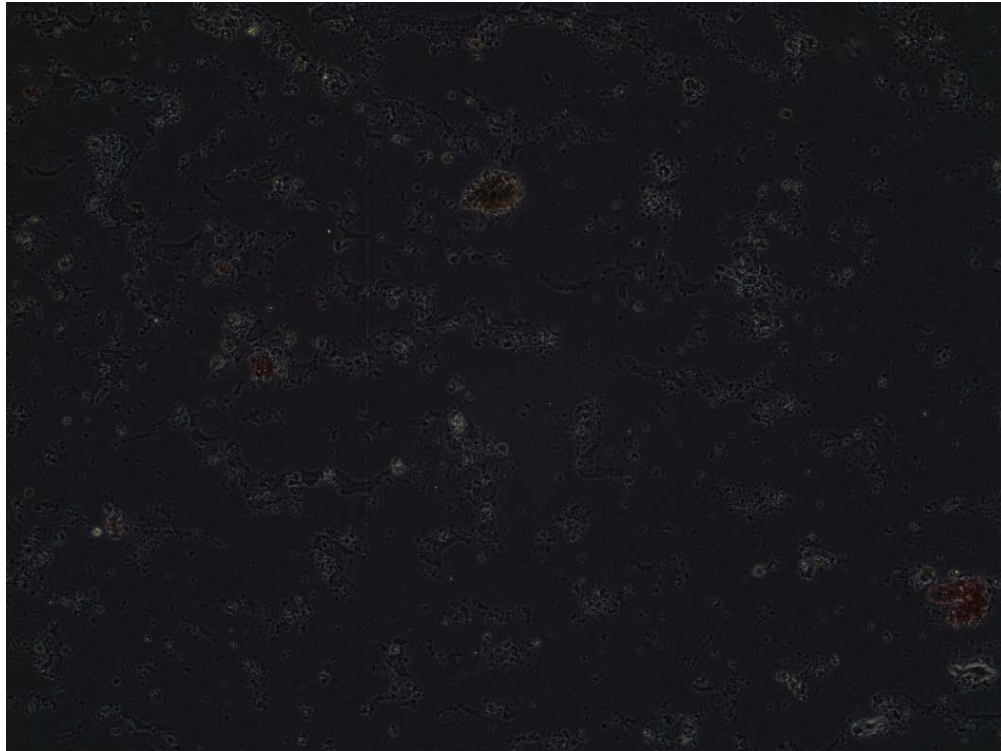


→
Paste separated, washed with
citrate buffer (pH 6.5)
and filtered with muslin cloth



Cold break

Hot break



Light micrographs; 10x objectives



Summary

- Food grade compounds and biopolymers for pathogen control in both pre and post-harvest applications
- Understanding changes in cellular and sub-cellular materials in plants during growth and processing can improve understanding of quality
- Agronomical conditions and their variation can have significant impact on lycopene content and its accessibility