1) Pérez Faggiani et al 2024

Authors: INIA and DMC

Summary: This study evaluated the efficacy of Allium-based extract Proallium® (rich in propyl thiosulfinate oxide, PTSO) for controlling green mold (*Penicillium digitatum*) and sour rot (*Geotrichum citri-aurantii*) in mandarins. Laboratory and commercial-scale trials were conducted using different mandarin cultivars (Nova, Tango, Orri, Afourer, Murcott, and Nules Clementine).

Conclusion: Proallium® was effective in reducing green mold and sour rot, particularly in commercially treated mandarins. Its potential use as a natural biofungicide could be integrated into postharvest management strategies, helping to reduce dependence on synthetic fungicides and mitigate the problem of fungicide resistance.

2) Ariza et al., 2024:

Authors: DMC, University of Granada, PTS Hospital, and University of Groningen

Summary: This study evaluated the antimicrobial efficacy of organosulfur compounds derived from Allium, specifically propyl propane thiosulfinate (PTS) and propyl propane thiosulfonate (PTSO), in comparison with allicin, diallyl sulfide (DAS), and dipropyl sulfide (DPS). Their synergistic effects were tested with the antimicrobial peptide L-11 (from DMC) to enhance food safety in ready-to-eat (RTE) foods.

Methodology:

- The antimicrobial activity was tested against Escherichia coli, Salmonella enterica, Yersinia enterocolitica, and Shigella sonnei using minimum inhibitory concentration (MIC) assays and fractional inhibitory concentration index (FICI) tests.
- Challenge tests were conducted on salmorejo, alioli, pumpkin cream, and spinach cream, stored at 4°C.

Key Findings:

- PTS and PTSO were the most effective compounds, achieving up to 99% pathogen inhibition in the tested food matrices.
- Synergistic effects were observed when combined with L-11, particularly with PTS and PTSO, achieving up to a 32-fold reduction in bacterial load compared to individual treatments.
- PTS/PTSO combined with L-11 outperformed potassium sorbate, leading to near-total elimination of Salmonella enterica in alioli and Shigella sonnei in pumpkin cream.
- The effective doses of these compounds did not significantly alter food sensory properties.

Conclusion: Among all evaluated compounds, PTS and PTSO exhibited the strongest antimicrobial activity, outperforming allicin, DAS, and DPS. Their combination with L-11 significantly enhanced antimicrobial efficacy, achieving up to a 32-fold reduction in microbial

load, surpassing potassium sorbate in certain food matrices. These findings position PTS and PTSO as the leading candidates for biopreservation applications, with the potential to replace synthetic preservatives in the food industry, aligning with the growing demand for clean-label products and sustainable food safety strategies.

3) Fernández et al 2022

Authors: INRA

Summary:

This study evaluated the efficacy of **natamycin and Allium extract (PTSO: propyl thiosulfinate oxide, Proallium FRD®)** for controlling **sour rot caused by *Geotrichum citri-aurantii*** in artificially inoculated lemons. Both **laboratory and commercial-scale trials** were conducted to determine the feasibility of these compounds as safe alternatives for postharvest disease control.

Conclusions:

- PTSO and natamycin proved to be viable alternatives for postharvest sour rot control, demonstrating efficacy both individually and in combination.
- PTSO applied at 290 mL/L with the **FOOD COAT** edible coating was an effective and safe option, preventing phytotoxic effects on lemon peel.
- Natamycin (500 mg/L) applied in the packing line after a bicarbonate pre-treatment was highly effective, significantly reducing disease incidence.
- The combined strategy of PTSO applied via drenching and natamycin in cascade application was the most effective, practically eliminating the disease after 20 days of cold storage.

4) Bernat et al., 2018

Authors: IRTA

Summary: This study assessed the efficacy of six eco-friendly disinfectants, including Proallium FRD-N®, against major fungal pathogens affecting stone fruits on plastic and wooden surfaces. The study examined its impact on Monilinia fructicola, Penicillium expansum, Rhizopus spp., and Alternaria spp., comparing it to conventional disinfectants such as hydrogen peroxide, peracetic acid, and sodium hypochlorite.

Results of Proallium®:

- Proallium® demonstrated high efficacy in reducing the viability of fungal conidia on contaminated surfaces.
- Its efficacy was comparable to traditional chemical disinfectants, with significant reductions in colony-forming units (CFU).
- It was particularly effective against M. fructicola, reducing fungal loads by 97% on wooden and plastic surfaces.

- Against *P. expansum* and *Rhizopus* spp., Proallium® was more effective on plastic surfaces than on wood, yet still significantly reduced microbial loads.

Conclusion: Proallium® represents an effective and eco-friendly alternative for surface disinfection in postharvest environments, offering a sustainable and residue-free solution. Its potential as a biodecontaminant could be integrated into postharvest management strategies to reduce reliance on chemical fungicides and enhance food safety in the fruit industry.

5) Llana Mellado et al., 2017

Authors: University of Seville and DMC

Summary: This study evaluated the incorporation of Proallium® and oregano essential oil (OEO) into active polypropylene (PP) films for the packaging of cooked ham, aiming to enhance product preservation and inhibit microbial growth.

Conclusion: Proallium® exhibited strong antimicrobial efficacy, particularly against *Brochothrix thermosphacta*, a key spoilage microorganism in cooked ham. Active films containing 4% Proallium® completely eliminated bacterial populations after 60 days of storage. Moreover, films with lower Proallium® concentrations were better accepted by consumers, leading to a higher purchase intention compared to films without additives. The use of Proallium® represents a promising strategy to extend the shelf life of meat products without synthetic preservatives. Its strong antimicrobial properties and consumer acceptance suggest its potential industrial application as a sustainable and efficient biopreservation method for the meat industry.

6) Llana Mellado et al., 2015

Authors: University of Seville and DMC

Summary: A biodegradable active packaging based on polylactic acid (PLA) incorporating Proallium® (Allium spp. extract) at 2%, 5%, and 6.5% was developed to enhance the shelf life of ready-to-eat salads under modified atmosphere packaging (MAP) conditions. The mechanical, optical, antioxidant, and antimicrobial properties of the packaging were evaluated through in vitro assays and real storage conditions.

Conclusion:Incorporating Proallium® into PLA films proved to be an effective biopreservation strategy for ready-to-eat salads, significantly inhibiting the growth of pathogenic and spoilage microorganisms. The effectiveness was dose-dependent, with 6.5% Proallium® exhibiting the highest antimicrobial capacity, reducing the load of aerobic bacteria, enterobacteria, molds, and yeasts during storage. Notably, this concentration maintained its protective effect for up to seven days, highlighting its potential as an active packaging material to extend the shelf life of fresh products without the need for synthetic preservatives.