CITRUS ADVANCED TECHNOLOGY PROGRAM

QUARTERLY & FINAL REPORTS: Control of Citrus Greening, Canker & Emerging Diseases of Citrus

▶ INSTRUCTIONS

(●) *Quarterly Report* ( ) *Annual Report* ( ) *Final*

Required: What is the "headline" for this report (e.g. a one-sentence "newspaper headline" describing what you accomplished)

Alternative antimicrobial agent for citrus protection

Proposal Title

Fixed-Quat: A novel alternative to Cu fungicide/bactericide for preventing citrus canker

Today's Date	Sponsoring Organization (drop-down)	Category (drop down)
10/15/14	Citrus Research and Development Foundation	Pathogen/Disease Detection

REPORT UPDATE (500 words; summarize your accomplishments)

Prolonged use of Cu compounds in citrus industry has significantly raised concerns pertaining to Cu accumulation in soil and development of Cu resistance to target organisms. To protect citrus crops from devastating citrus canker disease a suitable alternative to Cu compounds is highly desirable. "Fixed-Quat" is designed to be film-forming, locally systemic, non-phytotoxic. All the chemical ingredients of "Fixed-Quat" material are environmentally-friendly and USEPA approved. Superior anti-bacterial efficacy of Quat compounds must be maintained to maximize the benefit of Fixed-Quat material as an alternative to Cu biocides.

In our earlier reports we have discussed synthesis, optimization and characterization of two Fixed Quat NG formulations and results on their antimicrobial efficacy against Xanthomonas alfalfae subsp. citrumelonis (a citrus canker surrogate) and Escherichia coli. In this reporting period we focused on developing two Fixed-Quat nanoparticle (NP) formulations (named hereafter Fixed-Quat NP-A and NP-B). Traditional Stober sol-gel synthesis method was used with certain modifications to load Quat compounds in Fixed-Quat materials. Fixed-Quat NPs form thin film on plant surface once spray applied. The material formed fairly smooth film when deposited over a silicon wafer by spin-coating technique. Particle size in vacuum was characterized by the Scanning Electron Microscopy (SEM) technique. Particle size in solution was estimated by using Dynamic Light Scattering (DLS) Technique. Both the SEM and DLS size measurements are in agreement and the average particle size was estimated to be in the sub-micron range (400-600nm). Antimicrobial studies of optimized Fixed-Quat NPs have been conducted against Escherichia coli and Xanthamonas alfalfae subsp. citrumelonis using a number of assays including in-vitro microplate alamar blue assay, bacterial viability expressed as colony forming units (CFU/mL) and the determination of the Minimum Inhibitory Concentration (MIC). Antimicrobial efficacy of the Fixed-Quat NPs were compared against Kocide 3000 (as a Cu control). The MIC of Fixed-Quat NP-A was determined to be as low as 4.4 and 1.1 ppm against E. coli and X. alfalfae respectively, whereas, the MIC values of Fixed-Quat NP-B were 8.8 and 4.4 ppm against E. coli and X. alfalfae, respectively. The difference in the MIC values has been attributed to the types of the Quat compounds used. Industrially-viable concentrated formulations of Fixed-Quat NP-A and NP-B were prepared at 17740 ppm and 22250 ppm with respect to the respective Quat content.

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Total Funds (current year) $85,495.00

SUBMIT REPORT

CITRUS RESEARCH AND DEVELOPMENT FOUNDATION, INC.