Florida Citrus Advanced Technology Program

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

Instructions Complete the fields based on your project specs. When finished, save the form to your local disk using a unique name. Then, go to **http://research.fcprac.com**, and log in with your user name and password using Researcher Login in the lower left. Find this project title and click on **Submit a Report**. Update your profile information if needed, then upload this report as directed.

2009-2010 REPORT	CATEGORY (drop-down)	TODAY'S DATE (m/d/yr)
(●) *Quarterly Report* ( ) *Annual Report* ( ) *Final*	Canker Pathology	7/14/09

WHAT IS THE "HEADLINE" FOR THIS REPORT (e.g. a one-sentence "newspaper headline" describing what you accomplished)

Copper loaded silica nanogel - a new generation of nanobiocide for the prevention of citrus canker disease

TITLE and CONTACT INFORMATION

Proposal Title Development of nanoparticle/nanogel formulation for the prevention of citrus canker disease

Principal Investigator Swadeshmukul Santra	*PI Last Name* Santra
Email ssantra@mail.ucf.edu	*FDACS Contract Number* 186
Phone 407-882-2848	*Project Duration (years)* 1 *Year of Project* 1
Organization University of Central Florida	*Total Direct Funds (current year)* 90,000

REPORT UPDATE (650 words; provide details about your headline)

The goal of this study is to apply nanotechnology for developing Cu based silica nanoparticle/nanogel (CuSiNP/NG) formulation (nanoformulation) for effectively treating citrus canker. By design, this nanoformulation will be unique and expected to become superior to the traditional Cu based formulation in at least two aspects: sustained Cu release mechanism and better adherence properties, allowing long-term prevention of the citrus canker disease. As proposed, we have accomplished the following tasks.

Task 1 (CuSiNP/NG design, synthesis, characterization and protocol optimization): During this quarterly reporting period, we have synthesized a series of CuSiNG formulations by varying three experimental parameters: de-ionized water to 95% ethanol (V/V) ratio, amount of copper sulfate pentahydrate (CuSO4.5H2O) and amount of silane precursor (tetraethylorthosilicate, TEOS). The objective is to maximize the Cu loading per gm of CuSiNG nanomaterial.
(i) The amount of water in ethanol was varied from 30% to 70% by volume to determine an optimal mixed solvent composition that spreads the CuSiNG formulation uniformly on to the leaf surface. The DI water to ethanol ratio of 1.2 was found to be the optimal solvent composition. The maximum solubility of Cu-sulfate in this solvent mixture was determined to be 4.55 mg/mL.
(ii) Keeping the Cu sulfate concentration fixed at 4.55 mg/mL in water/ethanol mixture, we increased the concentration of TEOS from 0.187 gm/mL to 2.61 gm/mL. The optimal concentration of TEOS was determined on the basis of its adherence property to the leaf surface. The CuSiNG with TEOS concentration of 1.31 mg/mL showed the best adherence property to the leaf surface. We also determined that 1.31 mg/mL TEOS was enough to trap all the Cu ions in the SiNG material.
(iii) We have performed characterization of a few CuSiNG samples using UV-VIS, TEM, EDAX, XPS and FTIR techniques. The data is being analyzed.
(iv) We have sent some nanoformulation to our collaborator, Dr. James H. Graham (CREC, Lake Alfred, FL) to conduct preliminary field experiments.
Future Plan: We will report the data on CuSiNP in the next reporting period. We will also report data on CuSiNG characterization.

Task 2 (Assessment of the antimicrobial activity of the nanoformulation): We have performed disk-diffusion assay to evaluate the anti-bacterial efficacy of a series of experimental CuSiNG samples (synthesized in the Task 1) using E. coli as a model system. We used Cu-sulfate and Kocide® 3000 as controls. We are in the process of analyzing the data. We have also received Xanthomonas Alfalfea (a citrus canker surrogate) from our collaborator, Dr. James H. Graham (CREC, Lake Alfred, FL). We have plans to perform similar experiments on Xanthomonas Alfalfea in the near future.
Future Plan: We will report the disk diffusion assay data on CuSiNP in the next reporting period.

Task 3 (Develop large-scale nanoformulation production set-up): We are in the process of setting up 20 gallon batch synthesis setup for the CuSiNP/NG formulation.