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9/27/24



MTSU Clean Energy Initiative Project Funding Request

There are five (5) sections of the request to complete before submitting. See <http://www.mtsu.edu/sga/cleanenergy.shtml> for funding guidelines. Save completed form and email to cee@mtsu.edu or mail to MTSU Box 57.

1. General Information	
Name of Person Submitting Request: <u>Beng Guat Ooi</u>	
Department/Office: <u>Chemistry</u>	Phone # (Office): 615-898-2076
MTSU Box #: <u>PO Box 68</u>	Phone # (Cell) : 615-918-0945
E-mail: bgooi@mtsu.edu	Submittal Date: <u>Sept. 27, 2024</u>

2. Project Categories (Select One)	
Select the category that best describes the project.	
<input type="checkbox"/> Energy Conservation/Efficiency	<input type="checkbox"/> Sustainable Design
<input type="checkbox"/> Alternative Fuels	<input checked="" type="checkbox"/> Other
<input type="checkbox"/> Renewable Energy	

3. Project Information
<p>a. Please provide a brief descriptive title for the project.</p> <p>b. The project cost estimate is the expected cost of the project to be considered by the committee for approval, which may differ from the total project cost in the case of matching funding opportunities. Any funding request is a 'not-to-exceed' amount. Any proposed expenditure above the requested amount will require a resubmission.</p> <p>c. List the source of project cost estimates.</p> <p>d. Provide a brief explanation in response to question regarding previous funding .</p>
3a. Project Title: <u>Releases of Ammonia and Volatile Organic Compounds from the Reaction of Flame Retardants with Biomass During Wildfires</u>
3b. Project Cost Estimate: <u>The requested project funding of \$5677 will be used for the purchase of accessories and supplies for analyzing emissions from biomass fires using direct analysis in real time-mass spectrometry (DART-MS). MTSU Chemistry Department will provide matching funds to cover the purchase of lab consumables for this research project.</u>
3c. Source of Estimate: <u>The price and product information of the requested items is provided by a separate attachment of the vendor's quote from</u>

Bruker Incorporated. The total amount of \$5677 based on four DART-MS items is requested for funding this project.

3d. If previous funding from this source was awarded, explain how this request differs?

My last Clean Energy project funding is for the purchase of items related to the production of biofuel and specialty chemicals. This request is for the purchase of DART-MS accessories and consumables for analyzing harmful compounds from burning biomass with and without the use of fire retardants based on Phos Chek formulation.

4. Project Description

(Completed in as much detail as possible.)

- a. The scope of the work to be accomplished is a detailed description of project activities.
- b. The benefit statement describes the advantages of the project as relates to the selected project category.
- c. The location of the project includes the name of the building, department, and/or specific location of where the project will be conducted on campus.
- d. List any departments you anticipate to be involved. Were any departments consulted in preparation of this request? Who? A listing may be attached to this form when submitted.
- e. Provide specific information on anticipated student involvement or benefit.
- f. Provide information for anticipated future operating and/or maintenance requirements occurring as a result of the proposed project.
- g. Provide any additional comments or information that may be pertinent to approval of the project funding request.

4a. Scope: Work to be accomplished

The emissions of ammonia during wildfire episodes are of concern to both firefighters and residents living near wildland-urban interface. Ammonia toxicity has several acute and chronic effects on humans. Short-term inhalation exposure to high levels of ammonia in humans can cause irritation and burns in the mouth, lungs, and eyes. Chronic exposure to airborne ammonia can increase the risk of respiratory irritation, cough, wheezing, and impaired lung function in humans. The levels of ammonia had been measured at 1.0-2.1 ppm by Fourier Transform infrared (FTIR) spectrometry with a long pathlength gas cell.

One possible source of ammonia emission is the thermal degradation of the Phos-Chek liquid product containing ammonium polyphosphate. Phos-Chek fire suppressants are frequently used to extinguish wildland fires and they are also used by homeowners to spray on the biomass and combustible

structures to reduce the spread of fire to the homes. Our project involves the quantitative comparison of ammonia concentrations in the smoke of burning biomass materials with and without the application of fire suppressants. Three types of biomass, namely pine cones, twigs, and leaves are burned after spraying them with different brands of fire suppressant formulations. The emissions of ammonia and other volatile organic compounds are compared with the emissions from biomass burned without the Phos Chek formulations.

Biomass materials are burned in the fume hood of MTSU research laboratory. The emissions produced are collected with 3-liter Tedlar bags. Besides using infrared spectrometry for the determination of ammonia and hydrocarbon compounds of low molar mass, gas chromatography-mass spectrometry (GC-MS) is used to analyze the gas phase constituents of the burning emissions and the compositions of the fire suppressant formulations. Constituents that are potentially harmful are identified and quantified by using the calibration of reference standards.

4b. Scope: Benefit Statement

Research results from this study will help safeguard the health of not only firefighters but also residents living in fire-prone areas with frequent droughts. This includes areas such as the Gatlinburg and many western states such as California, Oregon, and Washington. Preliminary results from this study will be used to prepare a journal manuscript with students as co-authors. If published, this will lead to the preparation of external grant proposals.

4. Project Description (continued)

4c. Location of Project (Building, etc.):

The Biochemistry Research Laboratory (SCI 3080), the Gas Chromatography-Mass Spectrometry Laboratory (SCI 3101), and the Molecular Spectroscopy Laboratory (Room 3093) in the Science Building will be used for carrying out the experiments and analysis of the emission samples.

4d. Participants and Roles

Project Leaders-Dr. Beng Guat Ooi and Dr. Ngee Sing Chong (Planning and implementing the project and directing students in the production of biofuels and analysis of toxicants released from fuel combustion.)

Student Researchers-Mr. Patrick Ahuruonye in the Chemistry M.S. program will continue to carry out this research project and help with the training of undergraduate chemistry majors.

Instrument Support Specialist-Mr. Jessie Weatherly will be in charge of the maintenance and repair of instruments used in this project.

4e. Student participation and/or student benefit

This project provides experiential learning opportunities for students by providing hands-on experience with laboratory instruments used in industry. In addition to FTIR spectrometry, other laboratory techniques such as scanning electron microscopy with microanalysis and gas chromatography-mass spectrometry (GC-MS) will also be used. Students participating in this project will be well prepared for industrial jobs upon graduation.

4f. Future Operating and/or Maintenance Requirements

The project will continue with the support of Chemistry Department at MTSU. The data obtained will be used to prepare the M.S. thesis as well as a proposal for obtaining external funding. The MTSU lab fees for chemistry courses will be used to purchase consumable laboratory supplies.

4g. Additional Comments or Information Pertinent to the Proposed Project

The public awareness of the toxicants released from wildland fires, especially those with the application of Phos Chek flame retardant, is very limited currently. Hence, this study will provide insight on the possible adverse human health impact of wildland fires. This will in turn allow firefighters to devise proper protocols for avoiding the exposure to ammonia, carbon monoxide, benzene, 1,3-butadiene, aromatic amines, and other carcinogens. The long-term goal of this project is to improve the life expectancy of firefighters who often develop leukemia, cancers, and cardiovascular diseases.

5. Project Performance Information

Provide information if applicable.

- a. Provide information on estimated annual energy savings stated in units such as kW, kWh, Btu, gallons, etc.
- b. Provide information on estimated annual energy cost savings in monetary terms.
- c. Provide information on any annual operating or other cost savings in monetary terms. Be specific.
- d. Provide information about any matching or supplementary funding opportunities that are available. Identify all sources and explain.

5a. Estimated Annual Energy Savings (Estimated in kW, kWh, Btu, etc.)

Not Applicable

5b. Annual Energy COST Savings (\$)

Not Applicable

5c. Annual Operating or Other Cost Savings. Specify. (\$)

Not Applicable

5d. Matching or Supplementary Funding (Identify and Explain)

Dr. Ooi receives support from Chemistry Department for the purchase of consumable research supplies. The graduate student working on this research project has been supported by graduate stipend. The undergraduate students involved in this project will either receive course credit for the CHEM 3880 research course or awarded stipends via the URECA grant of MTSU Undergraduate Research Center.

Your Quote Order



DART Tweezer Module

- 1 +

\$351.00



QuickStrip Sample Cards

5 boxes

- 1 +

\$1,990.00



OpenSpot Cards

4 boxes

- 1 +

\$2,690.00



DART TLC Plate Holder

- 1 +

\$646.00

Total

\$5,677.00

DART Tweezer Module

Bruker Daltonics

Part No: 1897990

\$351.00

Taxes and shipping costs are calculated at checkout

1 +

ADD TO CART 

ADD TO QUOTE #1

Q) Description

A

Bruker's Adjustable Tweezer Module for the DART-OS, DART JumpShot and DART HTS enables precise and automatic sampling of single tablets and other objects for DART-MS. The module enables you to pick up your solid sample with the self-closing lab tweezers, attach it to the base clamp and, using automation, analyze your solid samples once or multiple times, ensuring accurate sampling every run.

The Adjustable Tweezer Module accommodates solid samples of various sizes, shapes, and consistency.

&2Features

- 0 Simplification of sample preparation for solid samples
- 0 Enables automated analyses of solid samples with DART JumpShot and DART JumpShot HTS
- 0 Adjustable for a range of sample sizes

8 Compatibilities

A

Bruker's Adjustable Tweezer Module is compatible with DART-OS, DART JumpShot or DART JumpShot HTS.

QuickStrip Sample Cards

Bruker Daltonics

Part No: 1898005

QUANTITY

← 1 box →   (10 boxes)


\$1,990.00

Taxes and shipping costs are calculated at checkout

1

+

ADD TO CART 

ADD TO QUOTE 

(J) Description

A

QuickStripN Sample Cards are used to facilitate transmission DART analysis of up to 12 samples. These easy-to-use cards insure that no cross-contamination occurs. The twelve sample positions can be loaded automatically or manually, including standards for quantitation.

8 Compatibilities

A

The module package is compatible with Bruker/ IonSense DART ion sources DART-JS and DART-JS-HTS. QuickStripN Sample Cards require QuickStrip™ Module and SVP automation.

® Delivery Scope

QuickStrips™ are available in packages of 50 permitting 600 measurements per box.

c:} Additionally Available

@ QuickStrip module package

@ QuickStrip Sampling Aid

OpenSpot Cards

Bruker Daltonics

Part No: 1897997

PACKAGING SIZE


 [4boxes](#) [10boxes](#)

\$793.00

Taxes and shipping costs are calculated at checkout

1 +

ADD TO CART 

ADD TO QUOTE 

Q) Description

A

OpenSpot® sample card are easy-to-use cards for sample preparation using Bruker/ IonSense DART-OS ion source. Designed to retain either powders or liquids the consumable card serves to guide your sample into exactly the right position for successful analysis. After a few seconds the card is removed and discarded, leaving no solvent or vials to send out for disposal.

8 Compatibilities

OpenSpot® sample card are compatible with Bruker/ IonSense DART-OS ion source

@!;) Delivery Scope

1 box contains 250 cards.

DART TLC Plate Holder

Bruker Daltonics

Part No: 1897991

\$646.00

Taxes and shipping costs are calculated at checkout

1 +

ADD TO CART 

ADD TO QUOTE #1

Q) Description

Bruker's TLC Plate Holder permits scanning of flat objects such as glass slides, and thin layer chromatography (TLC) plates. Reproducible positioning of these objects provides for more accurate sampling allowing determination of relative retention time.

The TLC Plate Holder permits repeat analysis of samples at multiple gas temperatures to generate different sets of ions for the sample resulting in more comprehensive data.

&2 Features

- 0 Simplification of sample preparation for thin layer chromatography separations
- 0 Enables automated analyses with DART JumpShot and DART JumpShot HTS

8 Compatibilities

DART TLC Plate Holder is compatible with DART-OS, DART-JumpShot or DART JumpShot HTS