

See
10/1/21



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>Ngee Sing Chong</u>	
Department/Office: <u>Chemistry</u>	Phone # (Office): <u>615-898-5487</u>
MTSU Box #: <u>PO Box 68</u>	Phone # (Cell) : <u>615-556-5509</u>
E-mail: <u>nchong@mtsu.edu</u>	Submittal Date: <u>October 1, 2021</u>

2. Project Categories (Select One)			
Select the category that best describes the project.			
<input type="checkbox"/>	Energy Conservation/Efficiency	<input checked="" type="checkbox"/>	Sustainable Design
<input type="checkbox"/>	Alternative Fuels	<input 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>Study of Fire Suppressants for Mitigating Exposure to Wildfire Smoke and Their Impact on Environmental Sustainability</u>
3b. Project Cost Estimate: <u>The requested project funding of \$4,831 will be used for the purchase of items needed for the gas chromatography-mass spectrometry (GC-MS) analysis of wildfire emissions. MTSU Chemistry Department will provide matching funds of about \$1500-\$2500 toward the purchase of lab consumables.</u>
3c. Source of Estimate: <u>The price information of the requested items can be found at the vendor websites and it is included in this proposal.</u>

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 Raman microscope accessories needed for studying microplastic particles in contaminated waters. These particles are widespread in surface waters and are showing up in both tap and bottled waters. This request is for the purchase of solid phase microextraction accessories for analyzing toxicants found in inhalable smoke particles collected on particulate sampling devices. The main instruments used to identify and quantify the organic toxicants is GC-MS and FTIR. The harmful heavy metals will be analyzed by X-ray fluorescence spectrometry.

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

Both homeowners and firefighters have used fire suppressant formulation containing diammonium phosphate to prevent or extinguish wildfires. The thermal degradation of the suppressant could pose serious health hazards because diammonium phosphate decomposes at around 70°C (158°F) to ammonia and monoammonium phosphate and at 155°C (311°F), it decomposes to highly toxic fumes such as phosphorus oxides, nitrogen oxides and ammonia. Since the short-term exposure limit of ammonia is at a low level of 35 ppm according to NIOSH, it is important to conduct evaluation of the release of ammonia and other volatile organic compounds (VOCs) under well-defined laboratory conditions at MTSU and field studies of with the help of fire departments in Murfreesboro and Gatlinburg, TN.

The analysis of vapor constituents with molecular weight of smaller than 50 atomic mass units (i.e. ammonia and carbon monoxide) will be performed with the use of Fourier Transform infrared spectroscopy (FTIR)

with a long pathlength gas cell. The reference spectra from the FTIR databases of Environmental Protection Agency (EPA) and Pacific Northwest National Laboratory (PNNL) will be used. The use of FTIR for the preliminary testing of the burn of pine cones with and without ammonium phosphate is shown in the Figure 2. It can be clearly seen that the VOCs and carbon monoxide in the emission of pine cones treated with ammonium phosphate are significantly reduced compared to the untreated pine cones. The proposed FTIR testing will focus on the thermal degradation of ammonium phosphate without the flaming stage as shown in this figure for the combustion experiment. Thermal degradation without combustion is more likely to yield ammonia, nitrogen oxides, and nitro-containing VOCs. Field study of the decomposition of flame suppressant chemicals under actual fire conditions will be planned with the assistance of fire chief of Murfreesboro Fire Department

The analytes or contaminants present in the air samples will be analyzed by gas chromatography-mass spectrometry (GC-MS) after analyte preconcentration via cryogenic and Tenax traps. The analytes in the water samples will be extracted by solid phase extraction, purge-and-trap technique, or a headspace instrument followed by analysis using GC-MS and quadrupole/time-of-flight mass spectrometry (q-TOF/MS). The volatile organic compounds in air will be analyzed using a method similar to the USEPA Compendium of Air Toxics TO-15 Method. The metals present in the inhalable particulate matter will be analyzed by X-ray fluorescence spectrometry

4b. Scope: Benefit Statement

The severity and frequency of wildfires in the western part of the US have intensified in recent years. In Tennessee, the likelihood of wildfires loom in the vicinity of the Great Smoky Mountains National Park. In 2016, the wildfire in Gatlinburg devastated the community and tourist industry after causing the deaths of 14 people, injuries to 175 persons, and property damage estimated at more than \$500 million. Therefore, it is beneficial to conduct a study on the use of suitable fire retardants to lower the risks of wildfires. By investigating the efficiency of the fire suppressant for reducing the exposure of residents and firefighters to wildfire toxicant, less people will be admitted to hospital for adverse pulmonary diseases like asthma and lung cancer.

4. Project Description (continued)

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

The Gas Chromatography Laboratory in Science Building Room 3101 and the Sample Preparation Facility in Room 3070 will be used for the processing of air and smoke particulate samples collected from wildland fires.

4d. Participants and Roles

Project Leader-Dr. Ngee Sing Chong (Planning and implementing the project and directing students in the analysis of air and water samples)

Instrument Support Specialist-Mr. Jessie Weatherly (In charge of the maintenance and repair of instruments throughout the project)

4e. Student participation and/or student benefit

This project provides experiential learning opportunities for students from different departments. Chemistry majors will learn useful laboratory techniques such as inductively coupled plasma-optical emission spectrometry (ICP-MS), X-ray fluorescence spectroscopy, and gas chromatography-mass spectrometry (GC-MS). Majors from other departments will learn to communicate environmental issues to the public and influence park rangers and policy makers of National Park Service at the Great Smoky Mountains National Park.

4f. Future Operating and/or Maintenance Requirements

The project will continue with the support of Chemistry Department at MTSU. The preliminary data obtained after Year 1 will be used to prepare a proposal for external funding via grants from EPA, FEMA, or National Institute of Occupational Safety and Health (NIOSH). The cost of consumables for the GC-MS and the headspace autosampler will be covered by the departmental operating expenses for student research projects.

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

This project seeks to provide objective and useful scientific data to help the fire service personnel and residents living in regions impacted by wildfires. This environmental research project will also highlight MTSU's capability for investigating potential risks of human exposure to contaminants via the collaborative efforts of the MTSU Chemistry Department as well as Murfreesboro and Gatlinburg Fire Departments. The ultimate goal is to utilize the scientific data for the protection of environment and human health.

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. Chong usually receives about \$1500-\$2500 per year from Chemistry Department for consumable research supplies. The graduate student working on this research project is supported by graduate stipend for conducting the thesis-based research. The undergraduate students involved in this project receive course credit for the CHEM 3880 course.

PAL.710-994

\$3,884.00



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SKU: PAL 710-994



Description Additional information

Description

SPME Fiber Conditioning Station consisting of: 1 pc heater up to 350°C with connection cable and bracket 40mm; 1 pc flush gas connection; 1 pc fitting for Combi PAL flush gas regulator incl. tubing; 1 pc alternate bracket 14mm

Manufacturer Part #:093631-064-00



57584-U Supelco

Diffusive Sampling Fiber Holder for SPME FFA

NACRES: NB.21

SKU	Pack Size	Availability	Price	Quantity
57584-U	1 EA	Estimated to ship on October 29, 2021	\$947.00	<input type="text" value="1"/>

[All Photos \(1\)](#)

Requested Item No. 1: SPME Fiber Conditioning Station	\$3,884
Requested Item No. 2: Diffusive Sampling Fiber Holder for SPME FFA	\$ 947
Total cost	\$4,831