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## 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](mailto: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): 615-898-5487
MTSU Box #: <u>PO Box 68</u>	Phone # (Cell) : 615-556-5509
E-mail: <a href="mailto:nchong@mtsu.edu">nchong@mtsu.edu</a>	Submittal Date: September 27, 2024

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. <b>Any funding request is a 'not-to-exceed' amount. Any proposed expenditure above the requested amount will require a resubmission.</b></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>Examining the Environmental Impact and Sustainable Uses of Recycled Tire Materials</u>
3b. Project Cost Estimate: <u>The requested project funding of \$8626 will be used for the purchase of pyrolysis accessories needed for analyzing chemical emission from the burning of tire rubber materials for energy recovery and thermal desorption of volatile compounds during the extrusion of recycled polymer products. MTSU Chemistry Department will provide matching funds to cover the purchase of lab consumables for this research project.</u>

3c. Source of Estimate: The price information of the requested items has been provided by a separate attachment of the vendor's quote. The combined items from both sections of the quote gives a total of \$8,626 (\$5,246+\$3,380), which is the amount requested for funding this research 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 a reactor equipped with ultrasonication device for producing carbon black particles and chemicals. This request is for the purchase of pyrolysis accessories and consumables to be used with a gas chromatography-mass spectrometry instrument to analyze harmful chemicals from recycled tire products.

#### **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

Waste tires have been accumulating at an alarming pace and they could pose undesirable environmental consequences through the release of contaminants and microplastics. Existing recycled products include tire-derived fuel (TDF) for industrial facilities, tire-derived aggregates used in lightweight embankment fill and road repair, rubber mulch as playground groundcover material, crumb rubber as the constituents used for athletic tracks and fields, rubber mats, and rubber powder with secondary uses from injection molded products, roofing materials and asphalt applications. All these applications or products can potentially cause inadvertent toxicant exposure to the public and workers in the tire recycling industry due to their potential to leach chemical constituents and emit volatile organic

compounds upon heating or burning. The goals of the research are to elucidate the toxicant profile of recycled tire materials and cryo-milled tire tread (CMTT) particles.

**Method:** Contaminants released from the EcoShred tire rubber and CMTT samples from United States Tire Manufacturing Association (USTMA) via combustion and thermal desorption are characterized by gas chromatography coupled to mass spectrometry (GC-MS) and Fourier Transform infrared (FTIR) spectrometry. GC-MS is used to investigate the thermal desorption of volatile organic compounds (VOCs) in the temperature range of 40-50 °C encountered via the heat absorption of the recycled products during the hot summer weather and in equatorial climate. Thermal desorption is also conducted at 200-350 °C to investigate the release of VOCs during the injection molding process for manufacturing recycled tire rubber products. The leaching experiments were carried out with the EcoShred and CMTT materials soaked in rainwater. The chemicals leached from the water samples were subsequently extracted with C18 and Strata-X solid phase extraction cartridges prior to GC-MS analysis.

#### 4b. Scope: Benefit Statement

Research results from this study will benefit the tire recycling industry by informing recyclers of the need to optimize their operational parameters to produce recycled products that are safe, cost-effective, and yet capable meeting consumer needs. It will also help the Tennessee Department of Environment and Conservation manage the disposal of waste tires, avoid the undesirable dumping of tires in landfill and rivers, and prevent the occurrence of fires at tire storage facilities. Preliminary results from this study will be used to prepare a proposal next year for the tire recycling grant program of the Tennessee Department of Environment and Conservation. A related proposal focusing on the devulcanization chemistry of tire rubber will be submitted to the National Science Foundation.

### **4. Project Description (continued)**

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

The Analytical Chemistry Research Laboratory (SCI 3070), 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 recycled tire materials.

#### 4d. Participants and Roles

Project Leader-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-Ms. Amrutha Pogadapula in the MSPS program will continue to carry out this research project and train new students majoring in the STEM programs offered by the CBAS.

Instrument Support Specialist-Mr. Jessie Weatherly will be 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. In addition to FTIR spectrometry, chemistry majors will also learn useful laboratory techniques such as inductively coupled plasma-optical emission spectrometry (ICP-OES), X-ray fluorescence spectroscopy, and gas chromatography-mass spectrometry (GC-MS). Students participating in Dr. Chong's research projects has a long history of receiving industrial job offers upon graduation.

#### 4f. Future Operating and/or Maintenance Requirements

The project will continue with the support of Chemistry Department at MTSU. The preliminary data obtained after the first year will be used to prepare proposals for external funding by both the Tennessee Department of Environment and Conservation and the National Science Foundation. 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

Awareness of the toxicant profiles is crucial to the development of sustainable technologies for recycling waste tires. For instance, the investigation of causal relationships between specific toxicant concentrations and adverse human health effects is necessary for ensuring the health and safety of athletes who work out and practice at artificial turfs. Full toxicological risk assessment is needed to promote manufacturing practice with pre-treatment and removal of toxicants from the recycled tire material. In summary, this study provides data pertaining to the human health issue of toxicant exposure via inhalation and dermal absorption associated with the use of recycled tire products.

### 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 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.



Customer Information		Quantum Contact	
<b>Customer Address</b>	Middle Tennessee State University Science Building Room 3067 Murfreesboro, TN 37132	<b>Address</b>	Quantum Analytics 8301 New Trails Drive Suite 100 The Woodlands, TX 77381
<b>Contact Name</b>	Ngee Sing Chong	<b>Contact Name</b>	Crystal Chubb
<b>Phone</b>	(615) 898-5487	<b>Phone</b>	(773) 490-0419
<b>Email</b>	ngee.chong@mtsu.edu	<b>Email</b>	CCHUBB@LQA.COM
		<b>Website</b>	<a href="http://www.LQA.com">www.LQA.com</a>

To place an order, please submit a signed copy of this quotation along with your purchase order via email to:

Crystal Chubb **Phone:**(773) 490-0419  
**Email:** CCHUBB@LQA.COM

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Shipping City

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Shipping State

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Shipping 9 Digit Zip Code



**Plan: Purchase**

**This section contains items being purchased (one-time charges)**

Line	Manufacturer	Item	Description	Unit List Price	Unit Sale Price	QTY	Total Sale Price
1	Frontier Laboratories, Ltd.	PY1-EC80F-V4	Eco-Cup LF-V4 -- volume 80 µl, deactivated stainless steel, 100 ea, 4 sets	\$990.00	\$990.00	1	\$990.00
2	Frontier Laboratories, Ltd.	PY1-3018A	Quartz Pyrolysis Tube A3030 -- Quartz pyrolysis tube, 1 ea	\$182.00	\$182.00	1	\$182.00
3	Frontier Laboratories, Ltd.	PY1-3337	Glass Insert -- Deactivated glass insert. 1 ea	\$66.00	\$66.00	3	\$198.00
4	Frontier Laboratories, Ltd.	PY1-MC04P	Magic Chemisorber PEG-L (5 ea.) 1 set	\$650.00	\$650.00	1	\$650.00
5	Frontier Laboratories, Ltd.	PY1-MC02L-K	Magic Chemisorber L100 Kit -- Magic Chemisorber L100 (3ea), Eco-stick DF (5ea) and MC holder L (2ea), 1 set	\$440.00	\$440.00	1	\$440.00
6	Frontier Laboratories, Ltd.	PY1-MC01L-K	Magic Chemisorber L500 Kit -- Magic Chemisorber L500 (3ea), Eco-stick DF (5ea) and MC holder L (2ea), 1 set	\$440.00	\$440.00	2	\$880.00
7	Quantum Analytics	Shipping and Handling	Shipping - Fed Ex 3 Day, Insured	\$0.00	\$40.00	1	\$40.00
<b>Subtotal</b>				<b>\$2,768.00</b>	<b>\$2,808.00</b>		<b>\$3,380.00</b>

**This section contains optional or alternative items (one-time charges)**

Line	Manufacturer	Item	Description	Unit List Price	Unit Sale Price	QTY	Total Sale Price
1	Frontier Laboratories, Ltd.	PY1-7911	Graphite Vespel Ferrule -- Graphite vespel ferrule, 6mm hole i.d., for quartz pyrolysis tube, 5 ea	\$165.00	\$165.00	1	\$165.00
2	Frontier Laboratories, Ltd.	PY1-1274	ITF Needle Set N -- Interface needle N, 3 ea.	\$143.00	\$143.00	2	\$286.00



3	Frontier Laboratories, Ltd.	PY1-2021	O-Ring (P-6R). Quartz pyrolysis tube seal for EGA/PY-3030D/Rx-3050TR, silicon rubber, red, usable temp. range -50 to 200C, 10 ea.	\$24.00	\$24.00	1	\$24.00
4	Frontier Laboratories, Ltd.	PY1-ES20F	Eco-Stick DF -- For Double-Shot (for Eco-Cup LF only), 80 mm, 50 ea	\$187.00	\$187.00	1	\$187.00
5	Frontier Laboratories, Ltd.	PY1-5113	Glass Capsule B -- For On-line micro reaction sampler (PY1-1050), 40 mm, 20 ea	\$62.00	\$62.00	1	\$62.00
6	Frontier Laboratories, Ltd.	UV1-7701	O-ring (S4) -- O-ring (S4) for sealing of UV fiber and UV sampler, and for quartz insert A, fluorine rubber, black, 10 ea	\$22.00	\$22.00	1	\$22.00
7	Frontier Laboratories, Ltd.	PY1-1050	On-line Micro Reaction Sampler -- Only available to EGA/PY-3030D and PY-3030S furnace, includes sampler stand (1ea) and glass capsule (40 ea), modification of PY-2020iD/iS Mainframe is required if using 2020iD/iS. this shipping would be \$400.00	\$4,500.00	\$4,500.00	1	\$4,500.00
Subtotal				\$5,103.00	\$5,103.00		<b>\$5,246.00</b>

### Financing Options

Quantum Analytics offers Capital Leases, Operating Leases, Rentals, and Rentals with Equity.

Our financing options are designed to fit your business needs.

Example: \$100,000; 36 month Capital Lease = estimated monthly payment \$3,250\*

*\*Finance rates and terms vary based on equipment type and customer's credit*

Please contact your Quantum Analytics' sales representative for more information.

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### Terms and Conditions

- All standard Quantum Analytics terms and conditions apply
- Prices quoted are valid for 30 days
- Subject to credit approval; security deposit may be required
- This is not an invoice; invoiced amounts will be subject to all applicable taxes
- Payment is due within Net 30 days; past due accounts will be assessed a 2% per month late charge
- Warranty: Manufacturer's Warranty Applies
- FOB: Origin