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10/9/15

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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 or mail to MTSU Box 57.

1. General Information	
Name of Person Submitting Request <u>Beng Guat Ooi</u>	
Department/Office SCI 3081	Phone # (Office) 615-898-2076
MTSU Box # Box 68, MTSU Chemistry	Phone # (Cell) 615-918-0945
E-mail bgooi@mtsu.edu	Submittal Date 10/9/2015

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 checked="" type="checkbox"/>	Alternative Fuels	<input checked="" type="checkbox"/>	Other (Research)
<input type="checkbox"/>	Renewable Energy		

3. Project Information
<ul style="list-style-type: none"> a. Please provide a brief descriptive title for the project. 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. c. List the source of project cost estimates. d. Provide a brief explanation in response to question regarding previous funding.
3a. Project Title <u>Applying the ultrasonic generator for biofuels research</u>
3b. Project Cost Estimate <u>\$6,360.00</u>
3c. Source of Estimate <u>Quote from Hielscher, vendor for ultrasonic generator</u>

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

I propose the purchase of an ultrasonic generator device for use in my biofuels research. The ultrasonic device allows efficient use of sonication energy for increasing the rate of reactions and the yield of reaction products. Besides being involved in the research areas of producing bioethanol and biodiesel, I have also investigated the use of glycerol, a waste by-product of the transesterification reaction for making biodiesel, to produce glycerol-based esters and ethers. These biofuel components or additives are environmentally sustainable alternative fuels for powering vehicles.

4b. Scope: Benefit Statement

The successful development of biofuels can reduce our reliance on the non-renewable fossil fuels that have also been linked to environmental disasters like the Deep Water Horizon incident that contaminate the coast of Louisiana and Exxon Valdez tanker leak that polluted Prudhoe Bay in Alaska. The use of ultrasonic generator can improve the production of biodiesel as described in the vendor's website. We would also like to explore its use in the glycerol-based production of esters and aldehydes because these additives have been shown to reduce the toxic emission of carbon monoxide and volatile organic compounds like benzene, formaldehyde, and 1,3-butadiene.

4. Project Description (continued)

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

Science Room 3080

4d. Participants and Roles

Beng Guat Ooi: Purchase and installation of the ultrasonic generator; using ultrasonic device in teaching and research; evaluating the efficiency of the device in improving product yields and shorten reaction times to achieve savings in energy.

Research students: Learn to use the ultrasonic generator for chemical reactions and explore its use for dispersing nanoparticles and lysing bacterial or yeast cells in other projects.

4e. Student participation and/or student benefit

Students using the ultrasonic generator will be able to complete their chemical synthesis in less than half the time compared to the more common "heat and stir" approach. It also results in a higher product yield and helps make a reaction more economically feasible. Students who learn the sonication technique will be able to use this technique for multiple research projects in the laboratory.

4f. Future Operating and/or Maintenance Requirements

The Hielscher sonicator does not require much maintenance. Our Instrument Support Engineer, can help with troubleshooting or repair if necessary. The Biochemistry laboratory has other equipment for performing the biofuels research.

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

The Hielscher ultrasonic generator is capable of the following research applications including (i) [Ultrasonic Homogenizing](#) (ii) [Ultrasonic Dispersing and Deagglomeration](#) (iii) [Ultrasonic Cell Disintegration](#) (iv) [Ultrasonic Transesterification of Oil to Biodiesel](#), and (v) [Ultrasonic Degassing of Liquids](#).

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 because that there are currently no sonochemical devices at MTSU to compare the Hielscher ultrasonic generators with.

5b. Annual Energy COST Savings (\$)

Not applicable.

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

Other research-related expenses for sonochemical synthesis are estimated at about \$300 per year.

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

The Department of Chemistry will pay for the annual operating course of about \$300 per year. I already have other equipment items for my biofuel research project and so no other expenses are anticipated besides the annual operating cost and the cost of purchasing the ultrasonic device.

Hielscher USA, Inc.

19 Forest Road
Ringwood, NJ 07456
United States

Phone (973) 616-9136
Fax (973) 616-9131
Email usa@hielscher.com

Quote #: 00017177

Bill To:
Middle Tennessee State University
2006 Lock Rock Ct.
Murfreesboro, TN 37130-1790

Ship To:
Middle Tennessee State University
2006 Lock Rock Ct.
Murfreesboro, TN 37130-1790

Attn.: Ngee Chong
Tel.: 615-867-2173
Fax: 615-898-5182

Attn.:
Tel.:
Fax:

SALESPERSON	P.O.	SHIP VIA	FOB POINT	SHIP DATE	TERMS	DATE	PG.
Gerhard Keil			Ringwood		Net 15	8/24/2015	1
QTY.	UNIT	DESCRIPTION		PRICE	DISC %	EXTENDED PRICE	
1	pcs	ultrasonic generator UP200St-G 200W, 26kHz (autom. tuning system), touch screen, amplitude adjustable 20-100%, pulse 10-100%, dry running protected, IP51, incl. power measurement, socket for ethernet and PT100, power supply, network cable		\$2,195.00		\$2,195.00	
1	pcs	ultrasonic transducer UP200St-T Ø45mm, approx. length 230mm, titanium horn Ø10mm (amplitude 70µm), IP65 grade, start/stop button, LEDs for sample illumination, with ST1-Clamp, with mounting tools		\$2,195.00		\$2,195.00	
1	pcs	FC7Kspec flow cell, made of stainless steel (1.4301), with cooling jacket, volume: 10ml, for sonotrodes up to 7mm (D-type), with NBR O-Rings (19x3.2mm), hose connection 4x1/8", plastic clamps, and hose (2m), autoclavable, with 2 phase inlet		\$1,380.00		\$1,380.00	
1	pcs	S26d7D sonotrode, made of titanium, 7mm dia.(38.5mm²) approx.length 95mm, male thread M6x0.75, with seal for closed systems (2 O-Rings Viton 9x3mm), amplitude ratio approx. 1:2.5, autoclavable		\$590.00		\$590.00	
1		Our Terms & Conditions of Sales ("ToS") apply to this quote and any resulting orders, exclusively. The ToS are available at www.hielscher.com/tos or by fax on your request. Until we receive full payment, the goods shall remain our sole property.					
Delivery: 1 week				SALE AMT.		\$6,360.00	
				FREIGHT		\$0.00	
				SALES TAX		\$0.00	
				TOTAL AMT.		\$6,360.00	
				PAID TODAY		\$0.00	
				BALANCE DUE		\$6,360.00	