Rec 10/4/18

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 Scott Handy	
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MTSU Box # 68	Phone # (Cell)
E-mail shandy@mtsu.edu	Submittal Date 10/4/2018

2. Project Categories (Select One)			
Select the category that best describes the project.			
	Energy Conservation/Efficiency	X	Sustainable Design
	Alternative Fuels		Other
	Renewable Energy		

3. Project Information
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 Biorenewable Solvents for Pigment Extraction and Textile Dyeing
3b. Project Cost Estimate $380 (Acros - $88 for Oxalic Acid, TCI - $160 for Choline Chloride and $90 for Urea, Flynn - $100 for multifiber fabric test strips: extra in case there is shipping and handling that was not included or prices increase before a funding decision is made)
3c. Source of Estimate Company web sites

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

Funding was received last year for a very different project aimed at the use of electrochemistry to improve the environmental compatibility of organic synthesis. The current project is an entirely new and different effort.

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

This project is part of an interdisciplinary effort focused on new and more environmentally friendly approaches to textile dyeing. Traditionally, textile dyeing is a very resource intensive process that consumes large quantities of water and then requires the treatment of this waste water to remove a range of toxic chemicals. Additionally, most of the dyes currently in use are synthetic materials that must be produced (also generating waste) and that have poorly determined health risks. To address this situation, the team of Drs. Handy, Rudd, and Johnston (and students) are interested in exploring non-toxic alternatives to water for both pigment extraction from natural sources and textile dyeing. In particular, the materials to be used will be members of a family of solvents called deep eutectic solvents, whose components are intrinsically non-toxic. Further, these materials are known to be effective at extracting natural products from plants for medicinal purposes and are expected to be similarly effective with pigments. Thus, using plant sources such as hop leaves, sugar cane, saffron, etc. can afford a range of pigment solutions for use in dyeing. Using the solutions directly, would certainly minimize any water waste and the extraction solutions can be reused directly until all pigment is spent (used) and then recycled for further pigment extraction. If dilution with water is needed for the dyeing process, due to the non-toxic nature (indeed, one of the components – urea – is a common fertilizer component) of the deep eutectic solvents, the aqueous solution could be used to water

the very plants that are used to produce the pigments, thereby avoiding the issues of waste water treatment. The materials requested in this grant are needed to produce intermediate quantities of the deep eutectic solvents that will enable the early scale-up stages of exploration of both pigment extraction and textile dyeing, with all other materials being already available.

4b. Scope: Benefit Statement

The primary benefit of this project is the reduction in the amount of waste – especially waste water – generated during the textile dyeing process using natural pigments. The use of natural pigments also reduces waste in that no synthetic chemicals will need to be prepared and use – instead the pigments can be grown and harvested from nature. Further, even if some water is required during or after the dyeing process, this water/solvent mixture will be sufficiently non-toxic to be used to water plants grown for use in textile dyeing, thus creating an efficient closed loop with respect to water.

4. Project Description (continued)

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

Science 3020 for the Chemistry portion

4d. Participants and Roles

Scott Handy as the PI and several research students (undergraduate and doctoral). There will also be interactions with Dr. Lauren Rudd (Fashion Merchandizing) and Dr. Tony Johnston (School of Agriculture and Fermentation Science program) and their students on the dyeing and plant material aspects.

4e. Student participation and/or student benefit

Research students will be involved in the hands on work of this project as well as determining results and possible directions forward. It is likely that this extraction work will be integrated into undergraduate Organic labs going forward as a replacement for our traditional dye synthesis lab experiments.

4f. Future Operating and/or Maintenance Requirements

This is a proof-of-concept study. Any future funding of this project will come from external grant applications and/or industrial collaborations.

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

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.)

5b. Annual Energy COST Savings ($)

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

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

Plant materials and any other required chemicals are already available.