UNIVERSITY OF LOUISIANA AT LAFAYETTE

STEP Committee

Technology Fee Application

Purchase of an Infrared Spectrometer for Chemistry

Title

Thomas Junk, August A. Gallo and Ryan L. Simon

Name of Submitter
(Faculty or Staff Only)

UL Department of Chemistry

Organization

Title: Professor/Head Date: 7/9/19
Name (Contact Person): Thomas Junk
Address: Department of Chemistry, P.O. Box 44270, University of Louisiana at Lafayette, 70504
Phone Number: 337-482-6735 Email: txj9137@louisiana.edu
Department/College/Org: Department of Chemistry

ABSTRACT (250 words or less):
Funding is requested to purchase an infrared spectrometer for the Department of Chemistry. The budgeted instrument will address a shortfall in chemistry, which has arisen for the continued growth of the program, as well as a high demand for infrared spectra generated by both teaching labs and student research. Over 400 students currently record infrared spectra of all compounds they prepare in our teaching labs as evidence for the successful completion of their experiments. This alone amounts to over 3,000 analyses per year. Undergraduate student research and walk-in's from other units create additional demand. All analyses are currently handled by a single existing instrument, which is being pushed to its limits due to excessive sample loads. This has created a bottleneck, delays in obtaining analyses, and undue wear of the exiting unit. The budgeted infrared spectrometer, and Agilent Technologies CARY 630 FT-IR spectrometer with associated software is rugged, easy to operate, and has an expected life of 15-20 years. It will benefit all students majoring in the sciences and many engineering majors.

3a. Purpose of grant and impact to student body as a whole

The proposed project consists of the acquisition of an infrared (IR) spectrometer. Briefly, such instruments operate by measuring the absorption of infrared light as a function of the wavelength for a chemical or test article, resulting in information concerning its nature and composition. This type of instrumentation is used by all students enrolled in Organic chemistry Labs I and II (CHEM 233 and234), with an average of eight IR spectra required each semester for each student. With 180 students enrolled each semester and 50 students during summer, this amounts to over 3,000 experiments on account of these two labs alone. In addition, students enrolled in Inorganic Chemistry Lab (CHEM 252), Analytical Chemistry (CHEM 222) and Undergraduate Research (CHEM 362 and 462) also use the instrument frequently, as do walk-in's from other departments, notably other science units and chemical engineering. A single instrument is currently available to handle the demand of the entire chemistry program as well as walk-in's from other departments.

While the existing instrument is rugged and operates very well, it is currently being pushed to its limits by excessive sample loads. A reduction of the sample loads is not feasible, due to a continuing very high demand for chemistry labs and the fact that infrared spectroscopy is the primary method available to students to validate the outcome of their chemical experiments. This is further exacerbated by the fact the chemistry program continues to experience steady growth, further increasing the need to acquire an additional instrument. A second IR spectrometer would drastically improve the situation by assuring student access and facilitating the routine maintenance of both instruments.

The teaching of spectroscopy, particularly IR, in chemistry begins at the sophomore level when students enrolled in analytical, inorganic and organic chemistry courses are introduced to the subject. Ultimately, all students enrolled in the sciences and most of those majoring in engineering will use infrared spectroscopy routinely throughout their academic careers, many of them throughout their professional careers as well. There has been a concerted effort to update the chemistry curriculum and instrument holdings of the chemistry department over the past 10-15 years to meet the demands of a growing student body and to alleviate bottlenecks. This has been largely successful, providing instrumentation that is up to date and meets student demands. However, the availability of a single infrared spectrometer remains a bottleneck. The impact of the proposed system is obvious. It will provide sufficient capacity to assure that students can complete their tasks in a timely fashion.

Infrared spectroscopy enjoys widespread use due to the simplicity and inherent safety of its operation. Consequently, it is in widespread use in laboratories that support a range of professions including biology, geosciences, forensics, heath care, safety, environmental monitoring, quality control and engineering. Experience in operating infrared spectrometers and interpreting their results benefits students with a wide range of majors, not only those majoring in chemistry.

3b. Projected lifetime of enhancement

With routine maintenance, the life expectancy of an infrared spectrometer is 10 years. After this time, several optical components typically need to be replaced, resulting in another 5-10 years of service. Instruments of this type typically become obsolete after 15-20 years.

3c. Person(s) responsible for:

i. Implementation
Dr. Thomas Junk will procure the budgeted infrared spectrometer and deploy it.

ii. Installation
Installation will consist of integrating computer and instrument, then powering the instrument up and calibrating it. Dr. Ryan Simon, who has extensive experience in the operation and maintenance of an identical system, will implement these steps.

iii. Maintenance
Maintenance for infrared spectrometers consists mostly of the regular replacement of a cartridge containing a drying agent, which keeps the optics of the system dry and has to be replaced every 6 to 12 months. This procedure, which takes 20-30 minutes, will be performed by Dr. Simon.

iv. Operation
The apparatus can be operated safely by anyone after approximately 20 minutes of training. It is designed to primarily be student operated. Due to the inherently safe nature of infrared spectrometers, very limited supervision is required for its operation.

v. Training (with qualifications)
Dr. Gallo will supervise training, assisted by Drs. Simon and Junk. All chemistry faculty is familiar with the requested system, students can be trained to operate it in 20 minutes.

Budget Proposal

1.	**Equipment**	**$**	**23,595.20**
2.	**Software**	**$**	**0.00 (included in instrument cost)**
3.	**Supplies**	**$**	**0.00**
4.	**Maintenance**	**$**	**0.00**
5.	**Personnel**	**$**	**0.00**
6.	**Other**	**$**	**0.00**
TOTAL:		**$**	**23,595.20**

d. Budget Narrative:
Equipment covers one Agilent Technologies FTIR Spectrometer with ZnSe Optics, Diamond ATR Sample holder, software, power cord and USB cable for computer interface. A 20% academic discount applies to the list price of $29,494, resulting in a cost of $23595.20, as shown.

Previous funded STEP projects

Ryan Simon has previously authored the following funded STEP proposals:

- Organic Chemistry Laboratory Equipment Grant, R. Simon and A. Gallo, $3666.50, awarded in May 2016.
- Demonstration Equipment Grant, R. Simon, $501.64, awarded in January 2017.
- Maker Lab for Montgomery Hall, R. Simon and Y. Wang, $3649.79, awarded in May 2017.
- Whiteboards for Montgomery Hall, R. Simon, $6371.96, awarded January 2018.
- Chemical Reactions with Light: UV Lamps for Photochemical Experiments in Organic Chemistry Labs, T. Junk and R. Simon, $2100.00, awarded January 2018.
- Electric Thermometers Grant Proposal, R. Simon and A. Gallo, $1850.00, awarded May 2018.
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August Gallo has previously authored the following funded STEP proposals:

- Smart Classrooms in Chemistry, T. Junk and A. Gallo, $30,000, Awarded 2012.
- Purchase of an Attenuated Total Reflectance (ATR) Tool for Chemistry to Conduct Infrared Spectroscopy on Solids, T. Junk and A. Gallo, $5,602.50, Awarded 2016.
- Organic Chemistry Laboratory Equipment Grant, R. Simon and A. Gallo, $3666.50, awarded in May 2016.
- Acquisition of a Polarimeter for Chemistry Laboratories, A. Gallo and W. Xu, $540.00, awarded January 2017.
- Digital Thermometers Grant Proposal, R. Simon and A. Gallo, $1850.00, awarded May 2018.

Thomas Junk has previously authored the following funded STEP proposals:

- Smart Classrooms in Chemistry, T. Junk and A. Gallo, $30,000, Awarded 2012.
- Laptop Computers for Chemistry Lectures, T. Junk, $3,285, Awarded 2013.
- Raman Spectroscopy in Chemistry Labs, T. Junk, $10,655, Awarded 2015.
- Purchase of an Attenuated Total Reflectance (ATR) Tool for Chemistry to Conduct Infrared Spectroscopy on Solids, T. Junk and A. Gallo, $5,602.50, Awarded 2016.
- ChemDraw Chemical Structure Drawing Software for Student Use and Training, T. Junk, $4,460, Awarded 2017.
- Chemical Reactions with Light: UV Lamps for Photochemical Experiments in Organic Chemistry Labs, T. Junk and R. Simon, $2100.00, awarded January 2018.

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Quotation

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University of Louisiana Lafayette
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Product/Description	Qty/Unit	Unit List Price	Discount Amount	Extended Net Price
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