

Engineering Student Technology Committee

<http://www.engr.colostate.edu/ESTC>

College of Engineering

Colorado State University

1. Title of Proposal:

High Performance Liquid Chromatography: An Essential Tool for Undergraduate Students in CBE

2. Proposal Participants:

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Primary Contact for Proposal

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Department/Major: Chemical and Biological Engineering

Circle One: Faculty

Additional proposal participants

3. Proposal Abstract (limit to 100 words):

Liquid Chromatography is an essential technique used to separate and detect compounds in a complex mixture. It is widely used in industry and in academia for a wide variety of applications. It is increasingly important that students in CBE become familiar with this technique so that they have the skills necessary to be competitive in the job market. We are requesting support from the ESTC to purchase an HPLC machine to support an estimated 150-200 students per year in the CBE undergraduate program.

4. Proposal Budget

List of items to be purchased and cost

| Items: | <i>dollar amount</i> |
|--------------------------|----------------------|
| Shimadzu Prominence HPLC | \$39,478.50 |

This HPLC consists of a controller, a binary pump, a degasser, an autosampler, a column oven, and Labsolutions software.

Please see the attached quotation

TOTAL: \$39,478.50

Dollar or percentage amount requested from ESTC: 50%

(The CBE Department will match the ESTC funding.)

5. Full description of proposal:

The Department of Chemical and Biological Engineering (CBE) is requesting help to purchase a High Performance Liquid Chromatography (HPLC) machine to be used in the undergraduate teaching labs. Liquid Chromatography is an essential tool used to separate and detect compounds in a complex mixture. This technology is widely utilized in industry and in academia for a wide variety of application. Thus, knowledge of HPLC is increasingly critical for students wishing to pursue a variety of careers in Chemical and Biological Engineering.

This HPLC will be utilized by all undergraduate students in CBE during several different undergraduate labs. Our freshman students taking CBE 101/102 will first be exposed to the basic principles of liquid chromatography during class and then can be shown in real time how compounds are separated on a column and detected utilizing the HPLC. Our senior students will utilize the HPLC in their unit operations laboratory (CBE 443) to track substrate utilization and product formation during a bioreactor experiment growing *E. coli*. The HPLC will allow students to quantify how much sugar the cells have consumed and how much product such as ethanol the cells have produced. Students in Senior Design (CBE 452) and independent study (CBE 495) will have access to the HPLC for their individual project needs to quantify and detect compounds of interest. We anticipate that between 150 and 200 students per year will make use of the instrument as part of their required coursework and independent-study courses.

We are requesting \$39,478.50 to purchase a Shimadzu Prominence HPLC. This HPLC consists of a controller, a binary pump, a degasser, an autosampler, a column oven, and Labsolutions software. The necessary detector (refractive index) has already been purchased by the CBE department and is temporarily used on an HPLC within Dr. Peebles lab. This detector will be moved to the undergraduate teaching labs when the above HPLC components are purchased. For educational purposes it will be ideal to have a separate HPLC system located in the CBE undergraduate teaching labs so that the undergraduates can gain hands on experience in running the HPLC.

| Line # | Product Number | Product Name | Qty | List Price | Ext'd Price |
|--|----------------|---|-----|-------------|-------------|
| Primary | | | | | |
| 1 | 220-91398-20 | CBM-20A W/ Network Switch | 1 | \$3,000.00 | \$3,000.00 |
| Central communication and control module for the Prominence Series. System components connect via fiber optic cables for easy "plug and play" configuration. Internal web server offers convenient control and monitoring of the HPLC system through a web browser. | | | | | |
| 2 | 228-45002-32 | LC-20AB HPLC PUMP | 1 | \$11,900.00 | \$11,900.00 |
| Binary High Pressure pump that utilizes micro-volume plungers for pulse-free HPLC gradient formation and solvent delivery. The LC-20AB is ideal for binary gradients of 1-2 mL/min. It provides the performance of dual LC-20AD pumps in a space saving platform. | | | | | |
| Flow Rates from 0.0001 to 10 mL/min; 3 nL/step resolution; 10 µL sapphire pistons; CBM-20A Lite can be installed; Graphite/Teflon® seals. | | | | | |
| 3 | 228-35830-93 | High pressure mixer, 100 µL | 1 | \$1,000.00 | \$1,000.00 |
| Stainless steel mixing chamber (ternary inlet) for use in semi-micro to standard analytical applications. Required when using XR pumps up to 9500 psi. Performance is excellent at flow rates from 250 µL to 5 mL/minute with common HPLC solvents. | | | | | |
| 4 | 228-45018-43 | DGU-20A3R | 1 | \$2,400.00 | \$2,400.00 |
| 5 | 220-91397-02 | SIL-20AC UFLC AUTOSAMPLER W/ INSTALLATION KIT | 1 | \$15,900.00 | \$15,900.00 |
| High speed, temperature controlled (4-40C), low carryover autosampler for analytical HPLC. Accommodates several vial sizes and titer plate formats for fast (10 sec.), accurate, and precise HPLC sample injection. The needle in the flow path design coupled with patented material technology virtually eliminates carryover. | | | | | |
| Sample Capacities: 175 1 mL; 70 2 mL; 50 4 mL, 2 MTP (STD 96, DW 96, or STD 384); Control Rack accommodates 10 2 mL vials; 0.1 to 100 µL inj vol; 6 nL/step metering pump motor resolution; 2nd Peltier unit for dehumidifying sample compartment. Includes 1.5 mL vial rack (no substitutions), 100 1.5 mL vials, Prominence vial sample pack, and 4.6 x 50 mm C18 column and 4-component test mix. | | | | | |
| 6 | 228-45009-32 | CTO-20A | 1 | \$3,100.00 | \$3,100.00 |
| Full-sized oven with forced air temperature control from 10 C above ambient temperature to 85 C. Can accommodate a manual injector, mixer, and 2 switching valves. | | | | | |
| Linear temperature programming is possible; Optional Column Management Device (228-37281-91) with CMD Cable (228-39991-01) can be used. | | | | | |
| 7 | 223-07723-99 | Labsolutions Workstation Ver.5 Single-LC PDA (WITH PDA) | 1 | \$6,565.00 | \$6,565.00 |
| 8 | I&F | INSTALLATION AND CUSTOMER FAMILIARIZATION | 1 | \$0.00 | \$0.00 |
| 9 | 1YW | 1 YEAR WARRANTY | 1 | \$0.00 | \$0.00 |

NOTE: Taxes are not included in the quoted amount

| | |
|--------------------------|-------------|
| Total List Price | \$43,865.00 |
| Academic discount | \$4,386.50 |
| Subtotal | \$39,478.50 |
| Total Amount | \$39,478.50 |