SWAMI VIVEKANANDA UNIVERSITY

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Workshop: 2-Days Hands on Industrial training on HPLC

Date: 8th – 9th November, 2024

Department of Biotechnology

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Mission

To provide participants with in-depth theoretical knowledge and practical expertise in High-Performance Liquid Chromatography (HPLC) through hands-on industrial training, enabling them to apply analytical techniques in pharmaceutical, food, environmental, and chemical industries. This training aims to bridge the gap between academic learning and industrial applications, fostering skill development and career growth.

Vision

To establish Swami Vivekananda University as a center of excellence in analytical instrumentation training by equipping students and professionals with industry- relevant skills in chromatography techniques. This initiative aspires to enhance research capabilities, promote innovation, and contribute to quality assurance and regulatory compliance in various scientific domains**.**

Participants Details

Sl No.	Name	Course	Department	Institution
1	Mayuree Mondal	M.Sc	Biotechnology	Swami Vivekananda University
2	Riyanka Sarkar	M.Sc	Biotechnology	Swami Vivekananda University
3	Aditi Dinda	M.Sc	Biotechnology	Swami Vivekananda University
4	Megha Verma	M.Sc	Biotechnology	Swami Vivekananda University
5	Sweta Thakur	M.Sc	Biotechnology	Swami Vivekananda University
6	Saheli Ghosh	M.Sc	Biotechnology	Swami Vivekananda University
7	Anushree Guchhait	M.Sc	Biotechnology	Swami Vivekananda University
8	Ankana Ghosh	M.Sc	Biotechnology	Swami Vivekananda University
9	Surya Das	M.Sc	Biotechnology	Swami Vivekananda University
10	Tanujit Dutta Choudhury	M.Sc	Biotechnology	Swami Vivekananda University
11	Sheikh Abdul Karim	M.Sc	Biotechnology	Swami Vivekananda University
12	Manab Paul	M.Sc	Biotechnology	Swami Vivekananda University
13	Shrestha Mallick	M.Sc	Biotechnology	Swami Vivekananda University

14	Pijush Das	M.Sc	Biotechnology	Swami Vivekananda University
15	Dipanjana Adak	M.Sc	Biotechnology	Swami Vivekananda University
16	Niranjan Barik	M.Sc	Biotechnology	Swami Vivekananda University
17	Mainak Barua	M.Sc	Biotechnology	Swami Vivekananda University
18	Chandralekha Gayen	M.Sc	Biotechnology	Swami Vivekananda University
19	Aparna Ghosh	M.Sc	Biotechnology	Swami Vivekananda University
20	Simran Ghosh	M.Sc	Biotechnology	Swami Vivekananda University

Speaker and Topic Details

Dr. U Satyanarayana

Dr. U. Satyanarayana is a well-known doctor specializing in Emergency Medicine. Dr. U. Satyanarayana has over 33 years of experience practicing medicine in various hospitals and clinics. Dr. U. Satyanarayana currently works at Medanta Hospital Gurugram, Haryana as Consultant Cardiology. Apart from association with different hospitals, Dr. U. Satyanarayana has put skills to the test in many other ways. He has been an active member of Indian Academy of Echocardiography. Dr. U. Satyanarayana completed Fellowship Emergency Medicine from Royal College General Physicians and thereafter earned M.B.B.S. from Kakatiya Medical College.

Topics Covered:

Day 1: Fundamentals & Instrumentation

- **Introduction to HPLC** – Understanding the principles, applications, and significance in various industries (pharmaceuticals, food, environmental, etc.).
- **Components of HPLC System** – Learning about pumps, injectors, columns, detectors, and data analysis systems.
- **Types of HPLC Techniques** – Exploring Reverse Phase, Normal Phase, Ion-Exchange, and Size-Exclusion Chromatography.
- **Sample Preparation & Method Development** – Practical steps for preparing samples, selecting mobile phases, and optimizing separation conditions.
- **Instrument Calibration & Maintenance** – Hands-on experience in system calibration, troubleshooting, and routine maintenance.

Day 2: Practical Applications & Data Analysis

- **Hands-on Sample Injection & Method Execution** – Running real samples using HPLC, adjusting parameters, and troubleshooting errors.
- **Peak Identification & Quantification** – Understanding chromatograms, retention times, and integration of peaks for analysis.
- **Data Interpretation & Software Training** – Using chromatography software for data acquisition, processing, and reporting.
- **Troubleshooting Common Issues** – Identifying and resolving peak tailing, baseline noise, pressure fluctuations, and resolution problems.

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Time: 11 AM Onwards

1. **To Bridge the Gap between Theory and Practice**: The primary objective was to help students connect their theoretical knowledge from the classroom with real-world industrial applications in the food sector.
2. **To Enhance Practical Knowledge**: The visit aimed to provide students with hands-on experience in food production processes, quality control, microbiology, and biotechnology practices used in the food industry.
3. **To Observe Cutting-edge Technologies**: Students were exposed to modern technologies and machinery used in large-scale food production, helping them understand industry innovations in manufacturing and packaging.
4. **To Understand Quality Control Measures**: The visit focused on showcasing the importance of quality control in food production, including methods for maintaining food safety, testing for contaminants, and monitoring shelf life.
5. **To Gain Insights into Food Safety Practices**: Students learned about food safety regulations and how companies implement hygiene and contamination control protocols to ensure consumer safety.
6. **To Explore Career Opportunities**: The visit aimed to expose students to potential career paths in the food and biotechnology industries by interacting with professionals and understanding industry needs.

Inaugural session

(Day-1 of training) at SVU

(Day-2 of training) at SVU

Program Outcome

The 2 days hands on industrial training on HPLC at Swami Vivekananda University (SVU) was designed to provide final-year postgraduate students of Microbiology and Biotechnology with invaluable hands-on learning opportunities. Below are the key programmed outcomes of the visit:

1. **Bridging Theoretical Knowledge with Practical Application**: The visit successfully bridged the gap between academic learning and real-world industry practices. Students were able to see firsthand how the theoretical concepts they studied in microbiology and biotechnology are applied in food production. By observing the production process, quality control, and preservation techniques, students learned how science plays a crucial role in the day-to-day operations of a food manufacturing plant.

2. **Understanding the Role of Biotechnology and Microbiology in Food Production:** The visit emphasized the critical role that both biotechnology and microbiology play in ensuring food safety, quality, and innovation. Students observed how biotechnology is used for the development of new food products enhancing nutritional value, and extending shelf life. They also saw microbiological processes that ensure the products are free from harmful microorganisms and fit for consumption.

3. **Exposure to Modern Industry Standards and Techniques**: The students were exposed to cutting-edge technologies and modern industry practices in food production. This included the use of automation in production lines, real-time quality control, and monitoring systems to ensure compliance with food safety regulations. This exposure to industry standards helped students appreciate the complexity of large-scale food manufacturing.

4. **Hands-on Learning About Quality Control Procedures**: Students gained practical insights into the rigorous quality control measures. They learned about various testing protocols for microbiological contamination, shelf-life analysis, and product safety. Understanding how these protocols are implemented in a production environment gave students the skills and knowledge needed for a successful career in the food industry.

5. **Insight into Career Paths in the Food and Biotechnology Sectors**:

Through interactions with industry professionals, including engineers, production managers, and quality control personnel, students were able to clarify doubts, ask questions, and gain insights into potential career paths within the food and biotechnology sectors. These interactions were valuable in helping students understand the professional landscape and future opportunities in these industries.

Awareness of Hygiene, Sanitation, and Contamination Control: The visit also focused on hygiene and sanitation practices in the food industry. Students learned about the preventive measures taken by the company to avoid microbial contamination and maintain product integrity. This helped students understand the critical importance of maintaining clean and controlled environments in food processing, directly connecting to their microbiological knowledge.

6. **Understanding Product Development and Innovation**: By witnessing the integration of new technologies and scientific research into product development, students saw how innovation drives the food industry forward. They gained a deeper appreciation for the ongoing research and development that ensures new, safe, and nutritious products meet consumer demand.

7. **Career Preparation and Professional Development**: The visit provided students with a practical understanding of the skills required in the food and biotechnology industries, preparing them for future career opportunities. By gaining exposure to the daily operations and challenges of the industry, students developed a clearer idea of how to apply their academic knowledge in their professional careers.

8. **Promoting Entrepreneurial Thinking:** Exposure to the operational side of inspired students to think about entrepreneurship and innovation in the food sector. The visit showcased how industries balance large- scale production with scientific research and development, sparking ideas for future ventures and opportunities for students interested in starting their own businesses.

9. **Fostering Interdisciplinary Learning:** The visit helped students realize the importance of interdisciplinary learning in the food industry. By integrating microbiology, biotechnology, engineering, and management, students saw how diverse fields of study come together to ensure efficient production, product quality, and consumer safety in food manufacturing. This enhanced students' ability to collaborate across various disciplines in their future careers.

Conclusion

The 2-day hands-on industrial training on High-Performance Liquid Chromatography (HPLC) at Swami Vivekananda University was an insightful and enriching experience that provided participants with a deep understanding of both theoretical and practical aspects of HPLC. The training covered key topics such as instrumentation, method development, calibration, troubleshooting, data analysis, and industrial applications, ensuring that attendees gained valuable skills and knowledge that can be applied in laboratory and industrial settings.

This training was instrumental in bridging the gap between academic learning and practical industry applications. Many students and professionals often learn the theoretical principles of analytical techniques like HPLC in classrooms but lack exposure to real-world laboratory conditions and challenges. This program effectively addressed that gap by offering hands-on experience with HPLC system operation, sample preparation, method validation, and troubleshooting techniques.

One of the most significant takeaways from the training was the detailed understanding of the fundamental working principles of HPLC. Participants learned about the various components of the HPLC system, including the pump, injector, column, detector, and data processing unit. Understanding how these components work together to separate, identify, and quantify compounds in a mixture was crucial in reinforcing the core concepts of liquid chromatography.

Moreover, the hands-on aspect of the training was highly beneficial. Participants were given the opportunity to prepare samples, select appropriate mobile phases, and inject samples into the HPLC system. This practical exposure allowed them to develop confidence in handling laboratory equipment, following standard operating procedures (SOPs), and troubleshooting minor errors that may arise during HPLC operation. By practicing under the guidance of experienced trainers, attendees were able to refine their laboratory techniques, ensuring accuracy and precision in their analytical work.

The training also emphasized the importance of method development and optimization. Understanding how to develop a robust HPLC method is critical for researchers and analysts working in industries such as pharmaceuticals, food and beverage, environmental testing, and biotechnology. Participants learned how to choose suitable columns, mobile phases, and detection methods based on the nature of their analytes. Additionally, they were introduced to gradient and isocratic elution techniques, helping them understand how different separation conditions affect chromatographic resolution and retention times.

A key highlight of the training was calibration and system suitability testing. Calibration ensures that the HPLC system is producing reliable and reproducible results. The training covered topics such as system validation, precision testing, and detector calibration, equipping participants with the knowledge to maintain the accuracy of their analytical methods. This aspect is particularly critical for industries where regulatory compliance is mandatory, such as pharmaceutical quality control and environmental monitoring.

Another essential component of the training was troubleshooting common HPLC issues. Many laboratories face challenges such as baseline noise, peak tailing, split peaks, pressure fluctuations, and column degradation. The training provided participants with practical insights into identifying and rectifying these issues, ensuring that the HPLC system operates optimally. Learning about preventive maintenance techniques, such as proper column storage, mobile phase filtration, and degassing, will help participants prolong the lifespan of HPLC components and maintain consistent performance.

Furthermore, data processing and chromatogram interpretation were covered in detail. Participants learned how to analyze chromatographic data, identify peaks, calculate retention times, and quantify analytes using calibration curves. The training also introduced them to HPLC software for data acquisition and report generation, which is crucial for documentation and regulatory compliance. Being able to interpret chromatograms correctly ensures that analysts can make informed decisions based on their experimental results.

The industrial relevance of HPLC was another critical aspect highlighted in the training. HPLC is widely used in various industries for quality control, drug development, forensic analysis, food safety testing, and environmental monitoring. Participants gained insights into how HPLC techniques are applied in real-world scenarios, such as analyzing pharmaceutical impurities, detecting contaminants in food products, and assessing water quality for hazardous chemicals. This knowledge will help them understand the broader impact of chromatography in ensuring public health and safety

One of the most valuable aspects of the training was the interactive and problem- solving approach adopted by the trainers. Instead of simply demonstrating HPLC procedures, the trainers encouraged participants to actively engage in discussions, ask questions, and troubleshoot real-time problems in the laboratory. This approach not only enhanced learning but also prepared participants to think critically and independently when working with HPLC systems in their respective fields.

Overall, the 2-day hands-on training at Swami Vivekananda University provided a comprehensive, well-structured, and practical learning experience. It successfully equipped participants with theoretical knowledge, hands-on skills, and problem- solving abilities required for HPLC-based analytical work. The training also reinforced the importance of precision, accuracy, and method validation, which are fundamental principles in any analytical laboratory.

By the end of the training, participants felt more confident in handling HPLC instruments, troubleshooting errors, and interpreting chromatographic data. This training will significantly benefit those pursuing careers in analytical chemistry, pharmaceuticals, biotechnology, food safety, forensic science, and environmental testing. The skills gained from this training will enable participants to contribute effectively to laboratory research, industrial quality control, and scientific advancements in analytical chemistry.

In conclusion, the 2-day hands-on industrial training on HPLC at Swami Vivekananda University was a highly valuable learning experience that provided participants with essential skills and knowledge for real-world applications. The combination of theoretical understanding, practical exposure, expert guidance, and industrial relevance made this training a transformative experience for all attendees. The insights and expertise gained from this training will serve as a strong foundation for their future careers, helping them apply HPLC techniques with confidence, accuracy, and efficiency in professional settings.