Central Instrumentation Facility (CIF)

Jai Hind College received the grant for enhancing quality and excellence in teaching and infrastructure facilities from Government under Rashtriya Uchchatar Shiksha Abhiyan (RUSA). Central Instrumentation Facility (CIF) is used by the students and faculty of all science departments of the college. UV- Vis Spectrophotometer was purchased for the CIF using the funds from RUSA. All other instruments are used for research, hands on training and testing projects.

Uv – visible spectrometer

The addition of UV-Vis spectrophotometer has significantly contributed to a variety of research activities across science departments in the college. M.Sc. students have employed the UV-Vis instrument for several notable projects. These projects include investigating the photocatalytic activity of synthesized nanomaterials by studying their dye degradation ability, which allows for the assessment of their effectiveness in environmental cleanup applications. Additionally, the UV-Vis spectrophotometer has been used to determine the excitation wavelengths of fluorescent organic compounds for application in sensing, providing critical data for the development of sensitive detection methods. The study of absorption properties of HPLC derivatizing agents has also been facilitated by the UV-Vis spectrophotometer, enabling the incorporation of chromophores into aliphatic analytes with poor UV absorbance, thereby improving their detectability. Furthermore, the UV-Vis spectrophotometer has been instrumental in studying the optical bandgaps of nanomaterial metal oxides using Tauc's plot, providing valuable insights into their electronic properties and potential applications in optoelectronics. In addition to student projects, faculty members have also extensively utilized the UV-Vis spectrophotometer in their research. One faculty member pursuing her Ph.D. has used the instrument for the study of flavonoid content and phenol content in flower extracts. This research is crucial for understanding the antioxidant properties of various plant materials and their potential health benefits.

Differential Scanning Calorimetry (DSC):

The Differential Scanning Calorimeter (DSC) has been a particularly valuable instrument, supporting several key initiatives. Our DSC instrument was extensively used during an internship program involving four M.Sc. Part 2 students, providing them with practical skills in thermal analysis and enhancing their academic and professional development. Additionally, the CIF provided analytical services to the Institute of Chemical Technology's Pharmaceutical Department, analyzing samples to study the effects of additives on the generation of amorphous formulations. This consultancy work was crucial in understanding the thermal behavior of pharmaceutical compounds, aiding in the development of more stable and effective drug formulations. Furthermore, the DSC played a critical role in the doctoral research of a faculty member of the institution, focusing on the thermal characterization of molecules synthesized for OLED applications. This research involved determining the glass transition temperatures and melting points of these materials, with significant findings published in the journal ACS Applied Optical Materials 1 (9), 1546-1558. These activities highlight the CIF's commitment to supporting high-level research, education, and industry collaboration, demonstrating the essential role of our facilities in advancing scientific knowledge and technological innovation.

Spectrofluorimeter:

Extensive utilization of our spectrofluorophotometer has significantly contributed to a variety of research and educational endeavors. M.Sc. students have utilized this sophisticated instrument for their dissertation projects, focusing on the development of fluorescent sensors for metal ions and picric acid. These projects have advanced our understanding of fluorescence-based detection methods, providing valuable experience for the students and contributing to the field of analytical chemistry. One notable achievement includes a poster presented by a student at a National conference in the University Department of Chemistry, University of Mumbai, which detailed the application of fluorescent carbon quantum dots in the fluorescence sensing of Fe(III) ions. This work highlighted the innovative use of carbon quantum dots as sensitive and selective sensors, underscoring the potential of these materials in environmental and industrial monitoring. Furthermore, under the guidance of faculty mentors, an M.Sc. project student published a paper on the application of an organic fluorophore for fluorescent ON-OFF sensing of Cu(II) ions. This publication is a testament to the high-quality research being conducted at CIF, demonstrating the practical applications of fluorescent sensing technologies. In addition to student projects, faculty members have also made significant contributions using the spectrofluorophotometer. They have developed a water-soluble fluorescent sensor for Al(III) ions, aimed at applications in fluorescence bioimaging of DNA. This research has been published in the Journal of Photochemistry and Photobiology A: Chemistry 425, 113699, showcasing the potential of these sensors in biological imaging and further solidifying CIF's role in pioneering research. CIF has engaged in outreach activities to promote the understanding and application of advanced scientific instruments. As part of the CheMentor program, we invited TY BSc students from other colleges to visit our facility and see the spectrofluorophotometer in action. This initiative allowed students to experience firsthand the practical applications of the concepts they learn in their theoretical coursework, enhancing their educational experience and inspiring future scientific endeavors.

High Performance Liquid Chromatography:

High-Performance Liquid Chromatography (HPLC) system has significantly contributed to a variety of research, educational, and outreach activities. M.Sc. students have employed the HPLC instrument for several notable projects. One project focused on studying the effect of surfactants on the solubility of curcuminoids. The student explored the use of cationic, anionic, and non-ionic surfactants to achieve the maximum concentration of curcuminoids, as determined by reverse-phase HPLC (RP-HPLC) using a UV detector. This research provided valuable insights into optimizing the solubility of curcuminoids, which has implications for their use in pharmaceuticals and nutraceuticals. Another significant M.Sc. project involved developing a derivatizing agent for aliphatic amino acids that lack chromophores, enabling their sensitive detection in RP-HPLC methods. This work enhanced the detectability of these amino acids, which are otherwise challenging to analyze due to their lack of inherent UV absorbance, thereby contributing to advancements in analytical chemistry. The CIF has also extended the HPLC facility for testing consultancy to a faculty member of KC College's Department of Chemistry. This service supported the doctoral research of a student working on phytochemical analysis, who has since completed her Ph.D. Her thesis is now available in the Shodhganga repository (https://shodhganga.inflibnet.ac.in/handle/10603/395407), demonstrating the practical impact and academic success facilitated by the HPLC system.

Additionally, the CIF has engaged in meaningful outreach activities to promote the understanding and application of advanced scientific instruments. As part of the CheMentor program, we invited TY B.Sc. students from other colleges to visit our facility and observe the HPLC instrument in action. A total of 149 students from 11 city colleges participated in this program, where they were demonstrated an HPLC assay of curcuminoids, including sample preparation, injection, and result interpretation. This initiative allowed students to experience firsthand the practical applications of the concepts they learn in their theoretical coursework, enhancing their educational experience and inspiring future scientific endeavors.

Rotary Evaporator:

The extensive utilization of our Rotary Evaporator has significantly contributed to a variety of educational, research, and collaborative activities. In our M.Sc. syllabus, the Rotary Evaporator has been routinely used in conjunction with column chromatography for the purification of organic compounds as part of the practical coursework. This hands-on experience has been invaluable for students, providing them with practical skills in compound purification and reinforcing their theoretical knowledge of organic chemistry. Additionally, the Rotary Evaporator facility has been extensively used for various projects. M.Sc. and Ph.D. students from the Botany department have utilized the Rotary Evaporator to concentrate their plant extracts obtained through Soxhlet and room temperature extractions. This concentration step is critical for the isolation of different secondary metabolites, which are then studied for their potential applications in various fields such as pharmacology and biochemistry.

Furthermore, the facility has also been extended to a faculty member of St. Xavier's College's Biotechnology Department for the concentration of natural product solvent extracts. This collaboration highlights the versatility and essential role of the Rotary Evaporator in the preparation and analysis of natural products, supporting research that spans multiple disciplines and institutions.

These activities underscore CIF's commitment to supporting high-level education, fostering student development, and facilitating collaborative research efforts.