

Analytical Chemistry Division

Overview

Analytical Chemistry division of IIM Jammu is actively involved in Pharmacokinetic/ADME studies of structurally and therapeutically different drugs and of drug metabolites. The division is also responsible for the development of validated HPLC, HPLC-MS and HPLC-MS/MS methodologies for the standardization of plant extracts, active fractions & sub fractions of herbal and poly herbal formulations. separation, and purification of the natural products from plant sources is also carried out in this division with the help of preparative High Performance Liquid Chromatography and the separated compounds are identified with the help of $^1\text{H-NMR}$, $^{13}\text{C-NMR}$ and MS spectral data. The purity and identity of the compounds is established by Liquid Chromatography-Mass Spectrometer (LC-MS).

Mission and Goals

To provide safe and efficacious healthcare on affordable costs to the people of whole of the world in general and Indians in particular. India is a mega biodiversity country and there is resurgence of interest of the modern world in herbal drugs. India can play an important role as we in our country have rich storehouse of traditional remedies such as Ayurveda, Sidha and Unani. Our aim is to convert traditional remedies into modern drugs with the help of modern science. It is well known fact that modern drug discovery pipeline is getting dry day by day and many recent failures at the end of the pipeline has left people with no option except to look towards the herbal world with great expectations. We can take up few important plants which are well use in Ayurveda, Sidha and Unani in healthcare since centuries ago and convert these plants into moden drugs with the help of modern science.

Competencies

❖ To develop HPLC, HPLC-MS methodologies for the ADME studies of structurally and therapeutically different drugs in different matrices such as bio-fluids like blood, plasma , serum & urine and edible foods such as honey , milk and meat.

- ❖ To develop HPLC-MS and HPLC methods for the standardization of plant extracts, fractions and sub-fractions .
- ❖ To carry out trace analysis of antibiotics in honey by LC-MS. The analysis is mandatory to ensure the purity of edibles for export to EU and US through Export Inspection Council of India.

People

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Area of Research

- ❖ Isolation and characterization of natural products, from medicinal and aromatic plants used in the herbal preparations, by using techniques like thin Layer Chromatography (TLC), Column Chromatography (CC) and modern techniques like Medium Pressure Liquid Chromatography (MPLC) coupled with the use of spectroscopic techniques like $^1\text{H NMR}$, $^{13}\text{C NMR}$, LC-MS, IR and UV for structure elucidation. Besides the already known compounds a galaxy of unknown compounds having diversified structures have been isolated from the plants. Plants bearing edible colors have also been screened for the color bearing molecules.
- ❖ Screening of large no. of plants exhibiting various pharmacological activities such as Antidepressant, Immunomodulatory, Bioavailability enhancing activities.,

❖ Sepbox, a two dimensional chromatography system is used for the separation of constituents from huge mixtures like plant extracts and combinatorial products. The fraction collected from the system can be directly transferred to MTPS (Medium through put screens) or HTPS (High through put screens) for biological assays against specific targets..

❖ The plants analysed by HPLC, HPLC-MS and HPLC-MS/MS are as under:

1. *Hypericum perforatum*
2. *Echinacea purpurea*,
3. *Withania somnifera*
4. *Argyrolobium roseum*
5. *Vitex negundo*
6. *Colebrookeia oppositifolia*
7. *Boswellia serrata*
8. *Thevetia peruviana*
9. *Embelica officinalis*
10. *Zingiber officinalis*
11. *Dioscorea deltoidea*
12. *Valerian officinalis*,
13. *Podophyllum emodi*
14. *Crocus sativus*,
15. *Swertia chirayita*
16. *Tinospora cordifolia*
17. *Carum carvi*
18. *Cuminum cyminum*
19. *Cesrtum diurnum*
20. *Picrorrhiza kurroa*
21. *Bacopa monneiri*
22. *Centella asiatica*

❖ Pharmacokinetic studies of structurally and therapeutically different drugs were carried out in biological fluids in order to find out their therapeutic efficacy and bioavailability with and without a naturally occurring bioavailability enhancer. The most important drugs studied with bioenhancer were anti T. B. drugs such as Rifampicin, Pyrazinamide and isoniazid. These drugs have been studied both as such and in combination with piperine , a bio-availability molecule.

Facilities

1. LC-MSⁿ, Ion-trap
2. LC-Q-TOF
3. MALDI-TOF
4. Analytical HPLCs

5. Sepbox

6. Preparative HPLC

Current Research

❖ We are engaged in development of analytical methodologies for analysis of drugs in different matrices such as plant extracts monoherbal and polyherbal formulations, biofluids such as blood, serum and urine. Under the golden triangle project (GTP) number of monoherbal and polyherbal formulations have been standardised. The methodologies for the HPLC and HPLC-MS analysis of natural molecules such as piperine, Gallic acids and withanolides have been developed as these compounds form the major constituents of these herbal formulations.

❖ LC-MS is also being used to characterize molecules on the basis of MS/MS studies. We are also developing the LC-MS methods for analysis of different drugs for pharmacokinetic studies. The plant extracts are being standardized on the basis of biomarkers. The different accessions of different plant species are being cultivated as well as collected from different regions of the country and these wild as well as cultivated collections are being studied for the amounts of the marker compounds present in these accessions. This type of studies provide an important information about the quality of the plant material which is present at a certain location. The components present in the endophytic fungi and fermentation broths are also being determined and quantified with the help of LC-MS and LC-MS/MS. The metabolites of the drugs are being studied in different biofluids with the help of HPLC and HPLC-MS

Current Projects

- ❖ Natural/ Synthetic compounds (INF0007)
- ❖ Establishment of National Referral Lab (GAP0195)
- ❖ Development / commercialization of biomolecules from plant sources (COR0023)
- ❖ Development of natural products as Bioenhancers for oral care, Colgate Palmolive Sponsored project (Project No. SSP-0406)
- ❖ Natural additives for baby care wipes formulations Proctor and Gamble sponsored project (SSP0404)
- ❖ Validation of traditional ayurvedic drugs Golden triangle project (GAP-401)