

Brief Curriculum Vitae

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➤ Positions held

Professor (Emeritus) 2004 onwards Initiated Laboratory for Advanced Research in Natural and Synthetic Chemistry, V. G. Vaze College, Mithagar road, Mulund (E), Mumbai 400 081, India.

Professor, 1984-2002 Department of Chemistry, Indian Institute of Technology Bombay, Mumbai 400 076, India;

Senior Research Scientist and Head Natural Products Division, Basic Research, Hoechst Pharmaceuticals, 1972-1984.

Postdoctoral Research Associate: Florida State University, USA, 1968-1972, with Prof. Werner Herz.

Ph.D. Research Scholar National Chemical Laboratory, Pune India, 1967, with Prof. S. C. Bhattacharya; **M.Sc.** Karnataka Univ, Dharwad, Karnatake, India ,1963.

Research Interests: Areas of Specialization: Development of Bioactive Molecules with Pharmaceutical, Agrochemical, Perfumery & cosmetic applications; Medicinal Chemistry, Organic Synthesis, Natural Products, Bioconversions; Green Chemistry, Development of New Synthetic Methods including Asymmetric Catalysis,

Teaching Experience: 45 years, UG, M.Sc. and Ph.D. levels; **Supervised Research Projects** of Students leading to Ph.D., M. Tech. and M.Sc. degrees- >101;

Supervised Several Sponsored Research Projects: Both from Industries (including S. H. Kelkar & KEVA fragrances, Godrej Agrovvet, Ranbaxy, Sun Moon Chemicals, BIOAmber, USA etc.) and Government Agencies (including DST, CSIR, ICMR, BRNS, Forest Department).

➤ **Professional Awards/Honors**

- Best Scientist Award, Pearl Foundation, Maurai, **2017**.
- Convener, 'Modern Concepts in Pharmaceutical and Chemical Industries' This short term course was conducted in V. G. Vaze College, Mulund East, Mumbai 400 081, May **2015, 2016, 2017**.
- Inter University Research Competition, Avishkar, Anvesion - Ph. D. students represented Mumbai University, Maharashtra state and Western Zone of India Received **Gold/ Silver Medals** since inception, (**2007-2014**) including National Level.
- Co-convener, UGC sponsored National Symposium on Emerging Trends in Life and Material Sciences Mission Mankind, 25th Jan **2012**.
- Subject expert in Chemistry (**2008-2012**), Department of Science and Technology, New Delhi for Women Scientist Scheme.
- Organized Research Scholars Meets for Indian Chemical Society (Mumbai Branch) in **1991** (Indian Institute of Technology, Bombay) and **2008** (Vaze College).
- Fellow of Maharashtra Academy of Sciences (**2001**).
- VASVIK Award for Industrial Research (**1998**).
- INSA Senior Academic Exchange Fellow with Royal Society, U. K. (**1994**).
- Convener/member of various committees of Chemistry Department, Biomedical engineering/ Institute, Indian Institute of Technology, Bombay (**1984-2002**).
- Served as council member of Indian Chemical Society (Mumbai Branch) for several years.
- Served as sectional president (Organic Chemistry) of Indian Council of Chemists, **2000**.
- Felicitation by Rotary Club, Thane, **2013**.
- Felicitation by Thane Municipality, Thane, **2016** and by Senior Citizens' club Thane North, **2016**,
- Upgraded of research facilities. in Research Center, Hoechst Pharmaceuticals, Chemistry Department, Indian Institute of Technology, Bombay, Vaze College, Mumbai and Some industries.

➤ **Academic Awards and Recognition**

- *First rank with distinction* in M. Sc. Chemistry examination of Karnataka University in 1963;
- *Recipient of University Fellowship* for M. Sc. (Organic Chemistry) course of Karnataka University.
- *Recipient of Gold medal* for standing first in M. Sc. examination;
- *Recipient of Junior Research fellowship & Senior Research Fellowships* Council of Scientific and Industrial Research (CSIR), New Delhi 1963-1967;
- *Received CSIR, Research Associate Fellowship* 1967-1968;
- *Postdoctoral Fellowship* from Florida State University USA, 1968-1972.

Served as Reviewer of National/International Journals, examiner for Ph.D. M. Tech. and M. Sc. Research dissertations., **Subject expert** for evaluation of research project proposals to funding agencies;

➤ **Professional Affiliations**

American Chemical Society (ACS); Chemical Research Society of India (CRSI), Life Member; Indian Chemical Society (ICS), Life Member; Society for Biomaterials and Artificial Organs, Life Member; National Nuclear Magnetic Resonance Society, Life Member; Indian Society for Bio-organic Chemists, Life Member.

➤ **Outstanding Research contributions**

➤ **Medicinal Chemistry:** Synthesis and Evaluation of Bioactive Molecules.

(Anti-tumor, Anti-HIV, Anti-Malarial, Antimicrobial including Computer-aided Design and structure-activity studies).

- **Natural Products Chemistry:** Extraction, Isolation, Identification of New Molecules from Medicinal and Aroma Plants.
- **Organic Synthesis:** Molecules with Pharmaceutical, Agrochemical and Perfumery Applications.



➤ **Instruments/ Equipments Used:** NMR, IR, UV, X-ray, HPLC, MPLC, HPLC-MS, GC, GC-MS, Softwares for Computer-aided design of new drugs and perfumery molecules - SYBYL X 1.2 and Discovery Studio, USA, Parallel synthesizer etc.

➤ **Research Achievements in Bioactive Molecules**

➤ **Natural Products Isolation, Structure Elucidation, Semi- synthesis, Structure-Activity studies:**

In our group at Basic Research Centre of Hoechst Pharmaceuticals Ltd.

❖ **1500 Ayurvedic plants were evaluated for various biological activities.** The structure elucidation and identification of several bioactive natural products of various skeletons belonging to terpenoid, alkaloid, chromone, coumarin, lignan etc. have been achieved. Our semisynthetic **work on bioactive molecules has led to structure-activity relationships.** New pharmaceuticals were made based on these results.

❖ **New Drug Development:** Adenylate cyclase stimulator **Forskolin** and anticancer **Rohitukine- Flavopiridol** were originated from our laboratory in Basic Research Centre of Hoechst Pharmaceuticals Ltd.

➤ **Forskolin:** This molecule is the most important contribution from our laboratory. A labdane diterpene, which is a unique activator of adenylate cyclase, has been selected by many researchers globally for further studies. Presently, forskolin and its different formulations are being sold as dietary supplement by many companies, in US, Japan, Europe and many other countries, for cardiogenic, lipid lowering, lean body mass and muscle toning properties. India is earning considerable foreign exchange by exporting forskolin based products. Presently, **Google and Scifinder** entries on forskolin are **7, 93, 000** and **12163** respectively. Our efforts in development of adenylate cyclase stimulant forskolin. Thus, our research effort has contributed to considerable increase in export. Presently 31 Indian companies are exporting forskolin from India.

➤ **Flavopiridol:** This chromone alkaloid is a synthetic molecule derived from lead antitumor immunosuppressive and anti-inflammatory chromone alkaloid **Rohitukine**. The anticancer activity of **Flavopiridol** is due to the inhibition of cyclin dependent kinase, which blocks cell cycle. Recently, Research Centre of Piramal India Limited, Mumbai, has developed two new antitumor molecules P276 and P1446, which are simple analogues of rohitukine-flavopiridol and are presently in clinical trials. Thus, our original contribution in the anti-tumor area is also still being pursued. **Google and Scifinder** entries on flavopiridol are **1,10,000** and **598** respectively.

➤ **Flavopiridol Analogue IIM-(N)-290/13:** This analogue is being followed at **Indian Institute of Integrative Medicine, Jammu**. (Target: CDK) IIM(N)-290/13 is a synthetic chromone alkaloid possessing potent Cdk inhibitory activity. It is a potent inhibitor of Cdk-1/A, Cdk-2/A, Cdk4/D3 Cdk5/p25, Cdk-6/D1 and Cdk-9/T1 showing IC₅₀ values < 100 nM. It possess cytotoxicity in different types of cancer tissues, with most potent cytotoxicity in leukemia and pancreatic cancer cells (IC₅₀ < 1 μM).

➤ **Synthesis and Development of New Anti-HIV Agents**

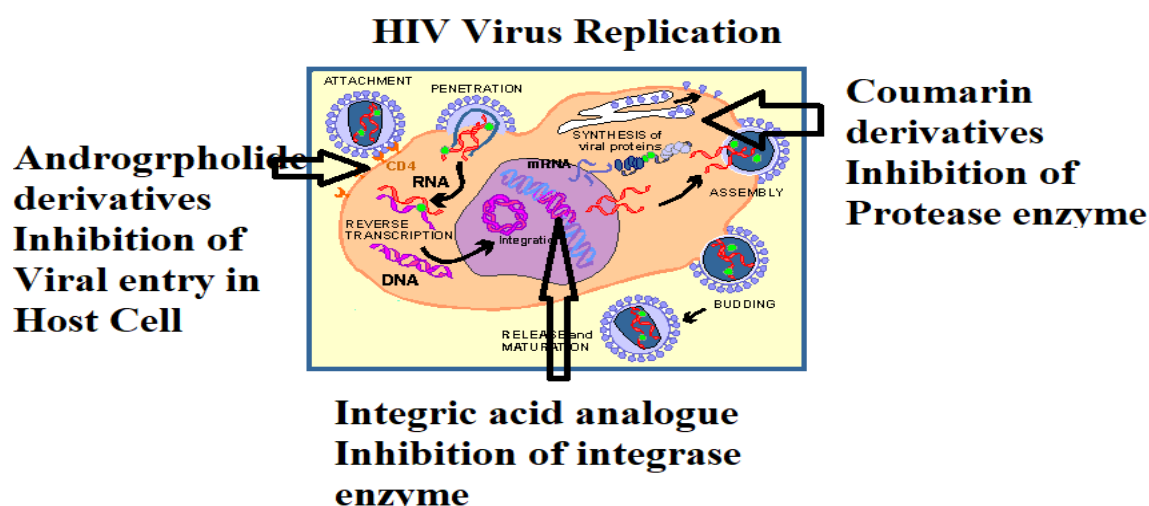
New molecules have been synthesized in our laboratory for anti-HIV activity evaluation.

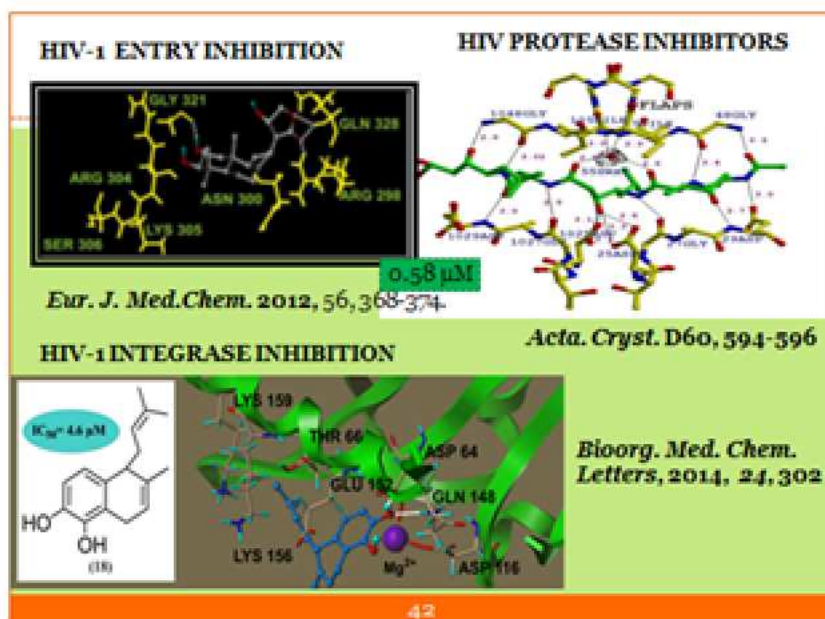
Cytotoxicity of these molecules was evaluated in TZM-bl cells using MTT assay. Anti-HIV activity was evaluated in TZM-bl cell based virus infectivity assay. Some molecules showed anti-HIV activity with IC_{50} values of 5.0 (TI= 11) -4.6 (TI= 46) μ M. Our synthetic compounds showed anti-HIV activity similar to integric acid, the natural fungal metabolite with anti-HIV activity. The activity profile of these molecules warrants further development.

- Similarly, we have achieved the semisynthesis of 3,19-benzylidene and 14-ester derivatives of andrographolide (Andro). Andro and its two derivatives show IC_{50} values less than 1μ M in HIV infectivity assay and these molecules were also evaluated for their efficacy to inhibit gp120-mediated cell-based fusion using HL2/3 HeLa derived cells and TZM-bl cells. Further, these compounds were docked into the V3 loop region of gp120 HIV-1 envelope protein (PDB id: 2B4C) using the software Sybyl-X 1.2 (Tripos Ltd. St. Louis, MO, USA) to study the molecular interactions. These molecules showed good docking scores which are comparable to their IC_{50} values.

➤ Summary of our anti-HIV research:

Mode of action of anti-HIV activity our molecules



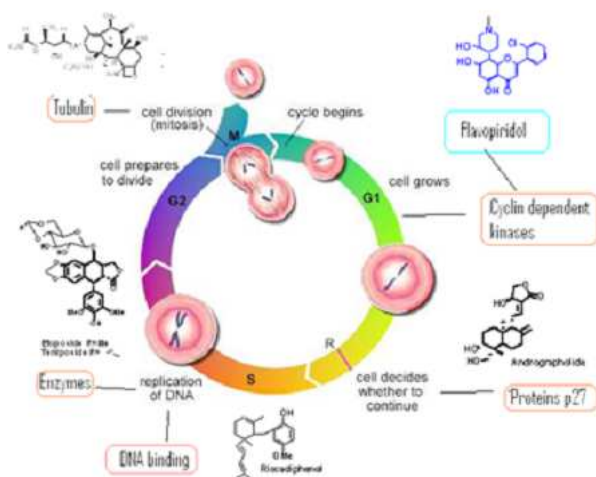


Anti-HIV activity was evaluated at **BARC Mumbai** and **National Institute of Immunology, New Delhi**.

➤ **Synthesis and Development of New Anti-cancer Agents**

We have designed and synthesized new molecules and evaluated their anticancer activity. For example, Retinoic acid (*all-trans*) and its analogues (retinoids) modulate various biological functions such as cell differentiation, proliferation, and embryonic development in vertebrates. The most important activities of retinoids are certainly the effects on the differentiation and proliferation of many types of cells and include the treatment of the neoplastic disorders. Recently, *trans*-retinoic acid and isotretinoin® have revolutionized the treatment of acute promyelocytic leukemia (APL) by causing terminal differentiation of the malignant cells. Further, the inhibitory effect of retinoids on IL-6 production suggests their possible usefulness in various IL-6 associated diseases including psoriasis and rheumatoid arthritis.

A major breakthrough came with the discovery of the nuclear retinoic acid receptors (RARs) and (RXRs), which have all-*E* and 9-*Z*-retinoic acids as ligand molecules respectively. Retinoids bind to these proteins, then the ligand/ protein- complex binds to DNA and the transcription of the retinoid responsive genes is activated (or depressed). Tamibarotene® (AM 80) and tazarotene® are novel synthetic retinobenzoic acid derivatives with considerable activity against acute promyelocytic leukemia. We have achieved synthesis of new molecules more active than AM 80.

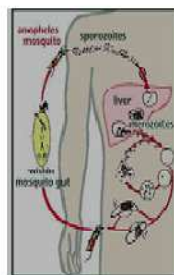


Summary of mode of antitumour activity of our compounds:

➤ *Development of New Antimalarials*

In the programme on synthesis and development of new antimalarials based on structure: activity studies of antibiotic aplasmomycin, simple monoterpene molecules are found to possess antimalarial activity against *Plasmodium berghei* *in vivo* and *Plasmodium falciparum* *in vitro* both in chloroquine sensitive and resistant strains. Similarly amine peroxides, conjugated diene derivatives of terpenes and benzylidene derivatives of diterpenes displayed potent anti-malarial activity. We have developed one pot synthesis of new artemisinin derivatives.

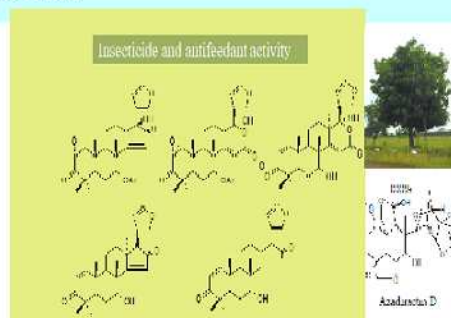
Developments of new Anti-malarials and Insecticide Molecules



We have isolated and identified five new compounds from Neem. Achieved semisynthetic modifications of tetranortriterpenoids of Neem to improve activity and assisted industry to commercialize Neem based products

We have achieved synthesis of new anti-malarials.

FIVE NEW TETRANORTRITERPENOIDS FROM NEEM OIL.

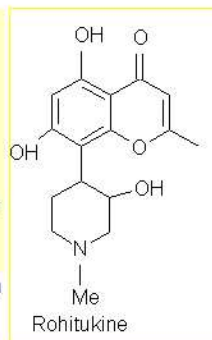
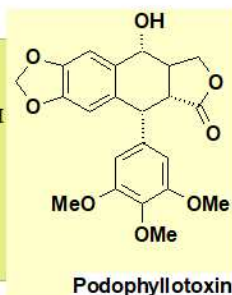
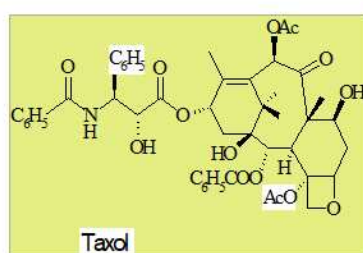


Kojala V, Dhat et al. *Phytochemistry*, 20, 5065, 1980
 Kojala V, Dhat et al. *J. Natural Products*, 1177-1179, 2002.
 Kojala V, Dhat, et al. *Chemistry and Biodiversity*, 6, 977-982, 2009.

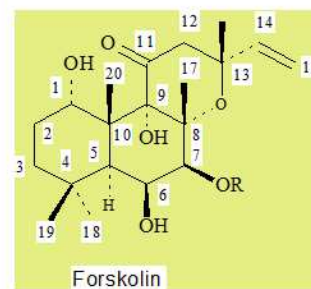
Assisted GoDrej Agrovet for formulation and commercialization of Neem based Products.

Our Efforts

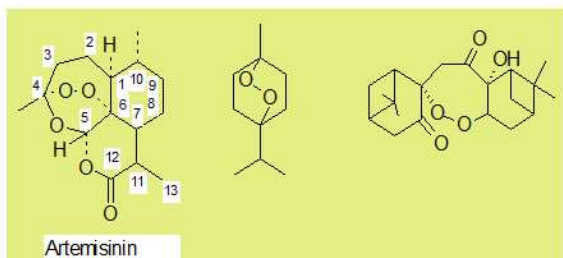
Antitumor



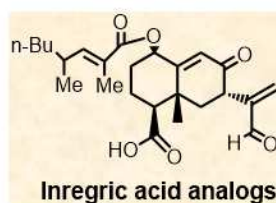
Adenylate cyclase stimulant



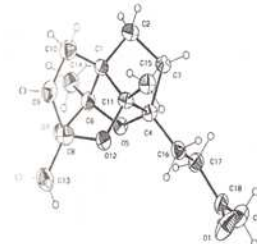
Antimalarial



Anti-HIV



Antibacterial



(Collaboration:

- i. Dr. Satish Gupta (FNA), National Institute of Immunology, New Delhi and Dr. M. V. Hosur, BARC, Mumbai; Development of new Anti-HIV molecules;
- ii. Prof. V. Bhasin, University of Delhi and Dr. Shukla Biswas and Dr. Neena Valecha, Malaria Research Center, New Delhi, for Development of new Anti-malarial molecules;
- iii Dr. A. Juvekar, Tata Memorial Centre for advanced Treatment, Research and Education, Mumbai: Development of new Antitumor molecules).

➤ **Bioinformatics, computer-aided design:** Computer aided design and synthesis of new molecules having **antitumor, antiviral, anti-malarial, herbicidal and perfumery** activities was achieved. . Docking studies are performed using Sybyl X 1.2 software and

surflex docking program. The docking scores of some analogues were found to be better than the parent molecule.

❖ **Development of Agrochemicals:** New process for synthesis of ethofenprox[®], pyriproxyfen[®], and *Neem* formulations were standardized and transferred to Godrej Agrovet company for further scale up and commercialization. Abundant plants from Euphorbiaceae, Rutaceae and Meliaceae were screened for insecticidal, antifeedant, insect growth regulator and herbicidal activities. Five new tetranortriterpenoids have been identified from *Neem* in our laboratory.

(**Collaboration:** Godrej Agrovet and Dr. V. Tare, Dr. Deshpande, National Chemical Laboratory, Pune: Development of new molecules for insect control).

❖ **Development of perfumery and flavor molecules,** Several molecules have been synthesized or isolated from nature for perfumery, flavor and cosmetic applications. Some natural molecules are modified for value addition.

❖ **Chirality:** It is well known that many pharmaceutical and perfumery molecules have bioactivity difference between enantiomers. Therefore, it is very important to obtain enantiomerically pure compounds. Thus, there is a growing demand for economical methods for asymmetric synthesis or kinetic resolution to obtain enantiomerically pure bioactive molecules. We have developed several methods for asymmetric synthesis of chiral bioactive molecules. Asymmetric synthesis of several perfumery molecules has been achieved using chiral catalysts, including chiral LBA and chiral acid catalysts.

❖ **Sponsored Projects:** Several sponsored research projects from central funding agencies as well as industries were completed.

- Assistance was provided to some industries in their research and development programs. These include synthesis of drugs/intermediates, agrochemicals and perfumery molecules and identification of biologically active natural products

➤ **Research Assistance to Industries**

- **S. H. Kelkar and Co. Pvt. Ltd.**

Development of new molecules for Perfumery and cosmetic applications. Design of simplified and green procedures for production of perfumery chemicals.

- **Godrej Agrovet**

Development of *Neem* based products.

Computer aided design, synthesis and evaluation of new herbicides.

Improvement in the synthesis of Herbicides.

- **Sunmoon Chemicals**

Asymmetric Syntheses of taxol[®] (antitumor agent) and taxotere[®] side chains.

Design of simplified procedures for production of these important antitumor molecules.

- **BioAmber, USA**

Synthesis of various esters of bio-succinic acid from BioAmber,

Evaluation of cosmetic properties and commercial potential of these esters.

- **Gujarat Themis Biochemicals Limited**

Development of new process for Rifabutin.

- **Ranbaxy Laboratories**

Synthesis of new quinolone and naphthyridine analogues for evaluation of antibacterial activity.

- **Arya Business Combine**

Forskolin estimation in *Coleus forskohlii*

- **Prasad Organics**

Identification of rose glycol

➤ **Recent Projects executed at Indian Institute of Technology, Bombay**

1) **Title: Computer aided design, synthesis and crystallographic evaluation of HIV protease inhibitors.**

Agency: Board of Research in Nuclear Sciences (BRNS)

Sanction No: 2000/37/8/BRNS 687 (3/10/2000)

Duration: 2 years May-2000-June 2002

Summary: New molecules were designed based on computer model of HIV protease enzyme and were synthesized in laboratory. These compounds were evaluated by co-crystallization with HIV protease enzyme and X-ray crystallographic evaluations. They were also evaluated *in-vitro* for enzyme inhibitory activity. Some new compounds have been found to be HIV protease inhibitors.

2) **Title: Synthesis of novel spiroketals and biological evaluations.**

Agency: Council of Scientific and Industrial Research (CSIR)

Sanction No: 01 (1633) EMR II 15.06.2000 (Sep 2000)

Duration: 2 years Sept 2000- August 2002

Summary: New spiroketals were synthesized by cyclization in the presence of acidic zeolites. Their biological activities for antimicrobial and insecticidal were evaluated.

3) **Title: Discovery and development of bioactive natural products.**

Agency: Council of Scientific and Industrial Research (CSIR)

Sanction No: 9/87 (285) /2000 EMR I

Duration: 2 years June 2000- May 2002.

Summary: Medicinal plants from Zingiberaceae and Rutaceae families were grown in hydroponic media and investigated for elicitation of new compounds after stimulation. The structure elucidation and applications of elicited molecules were investigated.

4) **Title: Synthesis of Rifabutin**

Agency: Gujarat Themis Biochemicals Limited

Duration: 9 Months, 1/3/2002 to 1/12/2002

Summary: Process development for manufacture of Rifabutin from Rifamycin has been standardized.

5) Title: Development of biopesticides from abundant plant sources

Agency: Indian Council of Forestry Research, Dehra Dun (UP)

Sanction No: 37-2/96- ICFRE dated 10.12.96

Duration: 3 years June 1993- May 1996

Summary: Abundant plants from Rutaceae were screened for various biological activities such as insecticidal, antifeedant, antifertility activities.

6) Title: Asymmetric synthesis of natural products through applications of chiral sulfoxides

Agency: Council of Scientific and Industrial Research (CSIR)

Sanction No: SP/SI/GO8/96

Duration: 3 years June 1993- May 1996

Summary: Synthesis of chiral sulfoxides and their uses in asymmetric synthesis of bioactive natural products were investigated. The bioactive molecules included lignans, β -aminoacids, β -phenyl-ethanolamines, terpenoids.

7) Title: Synthesis and application of new chiral reagents- asymmetric synthesis.

Agency: Board of Research in Nuclear Sciences (BRNS)

Sanction No: 37/12/89-G (June 2, 1992)

Duration: 3 years June 1992- May 1995

Summary: New chiral phosphine and crown ether were synthesized starting from simple chiral molecules. The utility of these reagents were evaluated in asymmetric synthesis of useful molecules.

8) Title: Use of modified zeolites in the synthesis of terpenoids, heterocycles and fine chemicals

Agency: Council of Scientific and Industrial Research (CSIR)

Sanction No: 01/(1278)/93/EMR II

Duration: 3 years June 1993- May 1996

Summary: The syntheses of new isoindoles, spiroketals, cyclohexenones, terpenoids etc. have been achieved using modified acidic zeolites.

9) Title: Synthesis of amine peroxides and evaluation of antimicrobial activity.

Agency: Indian Council of Medical Research (ICMR)

Sanction No: 22/7/93/EMR II

Duration: 3 years (July 1993 to June 1996)

Summary: Several new amine peroxides were synthesized and evaluated for antimicrobial activity. Some of the amine peroxide displayed good antimicrobial activity.

10) **Title:** Computer aided design, synthesis and evaluation of new herbicides.

Agency: Godrej Agrovet

Duration: 5 years (July 1996 to July 2001)

Summary: Computer aided design was achieved for new inhibitors of the enzyme acetolactate synthase. These molecules were synthesized in laboratory and evaluated for herbicidal activity against monocotyledon and dicotyledon herbs.

11) **Title:** Development of tissue culture facility for biotechnological applications.

Agency: The ministry of Human Resource Development (Thrust Areas in technical Education)

Duration: 5 years (June 1996- May 2001)

Summary: The facility has been set up in the biotechnology center for animal tissue culture.

12) **Title:** Synthesis of new quinolone and naphthyridine analogues.

Agency: Ranbaxy Laboratory

Duration: 1 year. (2000)

Summary: New antibacterial quinolone analogues were synthesized starting from simple materials.

➤ **Publications (in National and International Refereed Journals)**

Publications in refereed national/international journals 110, **Patents 25, Books 6**, Presentations: 125+ Lectures in international conferences, invited lectures in national meetings; 40+ other invited lectures at local symposia/workshops/continuing education programmes; and presentations (lectures and posters) by co-workers.

ORCID Id- ORCID.org/0000/0001/8537-4623; Researcher ID D-9723-2015, i(10)h-index 62 (Google Scholar); Citations 3488.

(a) **Full Papers**

1. Sujata V. Bhat*, Rohan S. Pawar and P. Rajakannu, **2020**, Facile One-Pot Synthesis and Crystal Structure of 2:1 Adducts of Myrcene (or Ocimene) with Benzoquinones, Letters in Organic Chemistry, DOI:10.2174/1570178617666200227110001
2. Sujata V. Bhat, Manisha O. Gupta, Jyoti K. Yadav and Kedar R. Vaze, **2020** Efficient green protocol for acetylation and tandem Ene-cyclization-acetylation using acetic anhydride camphor-10-sulfonic acid and graphite, Monatshefte für Chemie, manuscript under review
3. Ravindra D. Gaikwad, Monica D. Rane, and Sujata V. Bhat, **2017**, Facile asymmetric synthesis of (6*R*)-4-hydroxy-6-substituted δ -lactones, *Tetrahedron Asymm.* **28**, 181–185.

4. Ravindra D. Gaikwad, Shilpi S. Kabiraj, and Sujata V. Bhat, **2016**, High level of stereoselectivity in the pH sensitive epoxidation and one-pot biomimetic cyclization of olefinic alcohols with camphor and oxone[®], *Flavor and Fragrance J.***31**, 350-355.
5. Sylvania Fernandes and Sujata V. Bhat, **2015**, Efficient catalyst for tandem solvent free enantioselective Knoevenagel-formal [3+3] cycloaddition and Knoevenagel-hetero-Diels–Alder reactions, *RSC Advances*, **5**, 67706-67711.
6. Vijaykumar Gupta, Shilpi Kabiraj, Monica Rane and Sujata V. Bhat, **2015**, Environmentally benign syntheses of hexahydro-cyclopenta(b)furan and 2-oxabicyclo[3.2.1]octane derivatives, *RSC Advances*, **5**, 22951 – 22956,
7. Soni Singh, Reena P. Khandare, Manish Sharma, Virendra K. Bhasin and Sujata V. Bhat, **2014**, Monoterpene citral derivatives as potential antimalarials, *Natural Products Communications*, **9**, 299-302.
8. Sylvania Fernandes and Sujata V. Bhat, **2014**, Efficient syntheses of new 2,2'-disubstituted-2,3-dihydrofuran derivatives and natural polyketide analogues, *Synthetic communications*, **44**, 2892-2898.
9. Rohan Pawar, T. Das, S. Mishra, B. Pancholi, Nutan, S. K. Gupta and Sujata V. Bhat, **2014**, Anti-HIV activity of newly synthesized Labdane analogues with *o*-quinol moiety by inhibiting HIV-1 integrase, *Bioorganic Medicinal Chemistry*, **24**, 302-307.
10. Gauri More and Sujata V. Bhat, **2013**, facile asymmetric synthesis of (*S*)-(+)-4-hydroxy ionone and (*S*)-(+)-4-hydroxy Damascone: chiral flavorants and synthons, *Tetrahedron Lett.*, **54**, 4148-4149.
11. Mayur M. Uttekar, J. Das, R. S. Pawar, B. Bhandari, V. Menon, Nutan, S. K. Gupta and Sujata V. Bhat, **2012**, Anti-HIV activity of semisynthetic derivatives of andrographolide and computational study of HIV-1 gp120 fusion protein binding, *Eur. J. Med. Chem.* **56**, 358-374.
12. Gauri More, Monica Rane and Sujata V. Bhat, **2012**, Efficient Prins cyclization in environmentally benign method using ion exchange resin catalyst, *Green Chemistry Letters and Reviews*, **5**, 13-17
13. Soni A. Singh and Sujata V. Bhat, **2011**, Synthesis and antimicrobial potential of 3-hydroxy-2-methylene-3-phenyl-propionic acid derivatives, *Acta Pharmaceutica*, **61**, 447-455.
14. Soni A. Singh, Y. Potdar, R. Pawar and Sujata V. Bhat, **2011**, Antibacterial potential of monoterpene citral, *Natural Products Communications*, **6**, 1221-1224.
15. Sangeetha Vasudevan and S. V. Bhat, **2011**, Biotransformation of isoeugenol catalyzed by growing cells of *Pseudomonas putida*, *Biotransformation and Biocatalysis*, **29**, 147-150.
16. R. P. Khandare, K. R. Vaze and Sujata V. Bhat, **2011**, Antitumour activity of new retinobenzoic acid analogues, *Chemistry Biodiversity*, **8**, 841-849.
17. V. Menon and Sujata V. Bhat, **2010**, Antitumour activity of semisynthetic derivatives of andrographolide, *Natural Products Communications*, **5**, 717-720.
18. Soni A. Singh, S. Kabiraj, R. Khandare, S. P. Nalawade, K. B. Upar and Sujata V. Bhat, **2010**, Amberlyst-15 catalyzed efficient cyclization of unsaturated alcohols: green synthesis of oxygen heterocycles, *Synthetic Communications*, **40**, 74-80.
19. S. Mishra, K. B. Upar and Sujata V. Bhat, **2009**, Facile asymmetric synthesis of spongianone analogue through biomimetic cyclization, *Tetrahedron Lett.*, **50**, 6402-6403.

20. K. B. Upar, S. Mishra, R. Khandare, S. P. Nalawade, and Sujata V. Bhat, **2009**, Efficient enantioselective synthesis of sclareolide and tetrahydroactinidiolide through biomimetic cyclization, *Tetrahedron Asymmetry*, 20,1637-1640.
21. A. Shivkumar and Sujata V. Bhat, **2009**, Asymmetric Synthesis of β -phenylethanolamines through the applications of chiral sulfoxide, *Synthetic Communications*, 39, 18, 3338-3347.
22. H. Gurulingappa, Y. R. Jorapur, S. Madhavi, V. Tare, P. Pawar, V. Tungikar and Sujata V. Bhat, **2009**, Larvicidal activity of epoxidation and reduction products of limonoids from *Chemistry and Biodiversity*, 6, 897-902.
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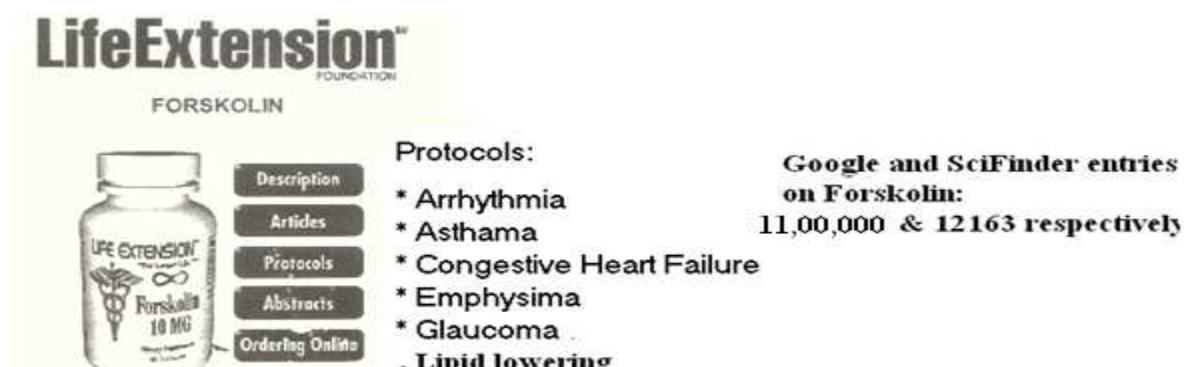
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Annexure 1
Exporters /suppliers or Forskolin from India



The image shows a product advertisement for LifeExtension FORSKOLIN. On the left is a white plastic bottle with a label that reads 'LIFE EXTENSION The Life ∞ Forskolin 10 MG'. To the right of the bottle are five dark grey buttons with white text: 'Description', 'Articles', 'Protocols', 'Abstracts', and 'Ordering Online'. Further right, under the heading 'Protocols:', there is a list of conditions: '* Arrhythmia', '* Asthama', '* Congestive Heart Failure', '* Emphysima', '* Glaucoma', and '* Lipid lowering'. To the right of this list, it says 'Google and SciFinder entries on Forskolin: 11,00,000 & 12163 respectively'.

(10%, 20%, 40%, 98% forskolin and 1,9-dedeoxy forskolin)

1. ADVANCE CHEMICAL PROCESSOR
2. APEKSHA RESEARCH CENTRE PVT.LTD.
3. ATATASMART HERBS (P) LTD
4. AXIOGEN BIOTECH
5. BRLB INTERNATIONAL
6. CHEMTRANS INNOVATIONS (P) LTD
7. EXOTIC NATURAL
8. FLAVOUR TROVE
9. GENESIS LABS LTD
10. INDFRAG LTD
11. INDO PHYTOCHEM PHARMACEUTICALS
12. INDO WORLD TRADING CORPORATION
13. MOKSHA RESOURCES LTD
14. MULTIBIZ NATURAL PRODUCTS
15. NATEX PRODUCTS
16. NATURAL REMEDIES (P) LTD
17. NOCARE NATURAL LTD
18. NOVA INTERNATIONAL
19. PALLAVI
20. PGS HERBS AND AROMATICS
21. PIONEER ESSENTIAL OIL (P) LTD
22. SAMI LABORATORIES (P) LTD
23. SHERVAROYS LIFE SCIENCES
24. SHRAWAN EXIM VENTURES
25. SK HERBAL AND BIO EXTRACT
26. SOMU CHEMICALS AND PRARMACEUTICALS (P) LTD
27. UNI EXPORTS
28. VENBIOTECH (P) LTD
29. VIDYA HRRBS
30. WIKRAM SANADI
31. YESHUA BIO-TECH

Annexure 2

Recent Invited lectures

- 1) **Sujata V. Bhat, 2019**, Computer-Aided design and development of New Anti-HIV Molecule, International Conference, Orchid Hotel, Mumbai, ,17-18th th January.
- 2) **Sujata V. Bhat, 2018**, Recent developments in Antimalarial drugs, Seminar on tropical diseases, Challenges and Advances, Avishkar Training Workshop, Mumbai University, 28 December.
- 3) **Sujata V. Bhat, 2016**, Recent developments in Antimalarial drugs, Seminar on tropical diseases, Challenges and Advances, *Vivekanand Education Society's college of Pharmacy*,16th January.
- 4) **Sujata V. Bhat, 2016**, Applications of Asymmetric Synthesis in Pharmaceutical Industry, Seminar on ' Selective Approached in Pharmaceutical Chemistry and Drug Discovery, *Bharati Vidyapeeth's College of Pharmacy*, 19th March.
- 5) **Sujata V. Bhat, 2015**,Novel bio-active molecules for pharmaceutical and perfumery applications, National Symposium 'Emerging Trends in Chirality, Medicinal Chemistry & Perfumery', *V. G. Vaze College*, 5th February.
- 6) **Sujata V. Bhat, 2014**,Glorious 50 Years of Research and Teaching,In-House Symposium, *Indian Institute of Technology, Bombay*, 16th October.
- 7) **Sujata V. Bhat, 2013**,Bioactive Natural Products, Forskolin, Felicitation ceremony, *Rotary Club*, Mumbai 6th March.
- 8) **Sujata V. Bhat, 2012**, Development of bioactive Natural Products, New anti-HIV and Antitumour agents, *Pharmaceutica*, 21st February.
- 9) **Sujata V. Bhat, 2011**, Development of new anti-HIV and antitumour molecules, National Conference on natural products, *Krishna University*, Machalipatmam, Andhra, 28th-29th November.
- 10) **Sujata V. Bhat, 2011**, Bioactive Phytochemicals, National Conference on the role of Chemistry in Health and Diseases, *Mithibai College and Indian Chemical Society*, Mumbai, 19th January.
- 11) **Sujata V. Bhat, 2011**,Attended *International Conference on Frontiers and Challenges in HIV/AIDS Research*, *Mumbai*, 5th February.
- 12) **Sujata V. Bhat, 2010**,Essential Oils, Flavors and Fragrances Symposium, Chair Person, *Indian Institute of Technology, Bombay*, 20th November.
- 13) **Sujata V. Bhat, 2010**,Bioactive Natural Products: Salient Features of Our Research, Lecture delivered at *Southern Cross University, Lismore, Australia*, 18th June.
- 14) **Sujata V. Bhat, 2008**, Quest for bioactive natural Products; February, *State level workshop on New developments in Natural Products*, Mumbai, December.
- 15) **Sujata V. Bhat, 2007**,:New Developments in Organic Synthesis; State Level Workshop I held at *Sinhgad College of Engineering, University of Pune*, 18th- 21st December.
- 16) **Sujata V. Bhat, 2006**, Recent Developments in the Chemistry of Forskolin; *10th International Symposium on Natural Product Chemistry, Karachi, Pakistan*, 6-9th January.
- 17) **Sujata V. Bhat, 2006**, Exciting Bioactive Molecules of Nature; *2nd International Symposium on Drug Discovery and Process Research, Belgaum, India* 10th-12th February.

- 18) **Sujata V. Bhat, 2005**, Exciting Bioactive Molecules, Outcome of Our Dedicated Research; 3rd International Symposium of Women in Science, *3rd world academy of sciences; Bangalore*, 22nd- 26th November.
- 19) **Sujata V. Bhat, 2005**, Herbal Products; National Symposium on Essential Oils and Isolates for *SMEs; Mumbai*, 2nd –3rd, December.
- 20) **Sujata V. Bhat, 2000**, Sectional President, Indian Council of Chemists, Delivered lecture on *Anti-hypertensive and Antitumour molecules*, December.

Annexure 3

Recent Achievements by Students

- Soni A. Singh won **Gold medal** in Interuniversity Research Festival **AVISHKAR**, 15th-17th Feb. **2007** held at RTM University, Nagpur.
- Soni A. Singh won **Gold medal** in Interuniversity Research Festival **AVISHKAR**, 10th-12^h Jan. **2008** held at SNTD University, Mumbai.
- Soni A. Singh won **Gold medal** in Interuniversity Research Festival **ANVESHAN**, 14th-16th Mar. **2008** held at RTM University, Nagpur.
- Soni A. Singh won **Gold medal** in Interuniversity Research Festival **AVISHKAR**, 10th-12^h Jan. **2009** held at University of Pune.
- Soni A. Singh won **Gold medal** in Interuniversity Research Festival, National level, held at Kolkata, **2010**.
- Vidya Menon won **Gold medal** in Interuniversity Research Festival **AVISHKAR**, Jan. **2010** held at Solapur.
- Sangeetha Vasudevan won **Silver medal** in Interuniversity Research Festival **AVISHKAR**, Jan. **2011** held at Nasik.
- Gauri More won **1st prize** in National symposium in Emerging Trends in Life and Material Sciences, 25th Jan, **2012**. held at V. G. Vaze College, Mulund .
- Rohan Pawar won **Young Scientist Award, Indian Chemical Society, Chemist Convention, Chandigarh, Dec 2013**.
- Rohan Pawar won **Silver medal** in Interuniversity Research Festival **AVISHKAR**, Jan., **2014** held at Nanded.
- Bhanwarlal M. Sharma and Sujata V. Bhat, **2015**, Won **2nd Prize** in poster presentation. at National Symposium ‘Emerging Trends in Chirality, Medicinal Chemistry & Perfumery’, V. G. Vaze College, 5th February
- In addition the following students represented Mumbai University in Inter-University Research Competition AVISHKAR

- 1) Sylvia Fernandes,
- 2) Vijaykumar Gupta,
- 3) Mayur Uttekar,
- 4) Shilpi Kabiraj,
- 5) Sanjay Mishra,
- 6) Shrikant Nalawade

Annexure 4

Recently arranged Symposium and Short Term Courses

1) National Symposium on 'Emerging Trends in Chirality, Medicinal Chemistry and Perfumery', V. G. Vaze College, Mulund East, Mumbai

Background:

Natural product based drug discovery has encountered significant challenge during the last decade. Recent natural product based lead identifying strategies have successfully and rapidly integrated rational approaches that exploit and evolve the structural diversity provided in nature. The rational approaches include the application of structure and ligand (enzyme and receptor) based computer aided drug design (CADD). This symposium had focused on recent trends in Medicinal Chemistry, Chirality and Perfumery.

It is well known that many pharmaceutical and perfumery molecules have bioactivity difference between enantiomers. Therefore, it is very important to obtain enantiomerically pure compounds. Thus, there is a growing demand for economical methods for asymmetric synthesis or kinetic resolution to obtain enantiomerically pure bioactive molecules. One section of this symposium was devoted to Chirality.

Several natural and synthetic small molecules display important olfactory property. This symposium had also discussed novel trends in perfumery field as well.

Structure of the Symposium

Eminent Researchers from many parts of India attended the symposium and delivered lectures.

Many participants including students and researchers from various Research and Teaching institutes attended the conference. This symposium had helped in further enhancement of research and teaching activities in this prominent field. Students were encouraged to present research work as poster presentation.

2) Short Term Courses during Vacation

Modern Concepts in Pharmaceutical and Chemical Industries, V. G. Vaze College,

Report

These courses were successfully completed with enthusiastic students from Chemistry, Biotechnology, Pharma-analytical, Bio-analytical and Microbiology background from various colleges in Mumbai including some from Ratnagiri.

Through this course these students were exposed to **various aspects of Industries**. The technical as well as commercial aspects of **Natural Products, Pharmaceutical,**

Agrochemical, Perfumery and Cosmetic industries were discussed. The Indian and global scenario of these Industries were discussed. The lectures also included the separation and identification techniques including instrumentation such as NMR, IR, UV, GC, HPLC, digital polarimeter etc. In perfumery lecture various plants with their odour value and their cultivation methods were discussed. In the quality control and quality assurance lecture students were also made aware of good work environment and work ethics including team work, honesty, documentation and responsibility.

Afternoon sessions consisted of practical demonstrations, which included steam distillation of essential oils, plant extraction, simple solvent distillation, vacuum distillation, fractional distillation, thin layer and column chromatography, NMR, IR, UV, GC, HPLC and digital polarimeter instruments' functioning. On the last day students were taken to Industrial R and D and quality control departments of KEVA fragrances in Mulund West, Mumbai.

This course consisted of **sixteen lectures** including **seven lectures from eminent people from industries**, seven practical sessions and **one industrial visit**. On the whole it was very interactive course. **Employment opportunities in various industries** were also discussed. Last lecture encouraged students to become entrepreneur. The lecture and practical sessions were conducted effectively. **Students gave excellent feed back at the end of course.**