Entrepreneurship Development Cell SDPC, KIM

innovation ecosystem

Innovation Ecosystem

Entrepreneurship Cell

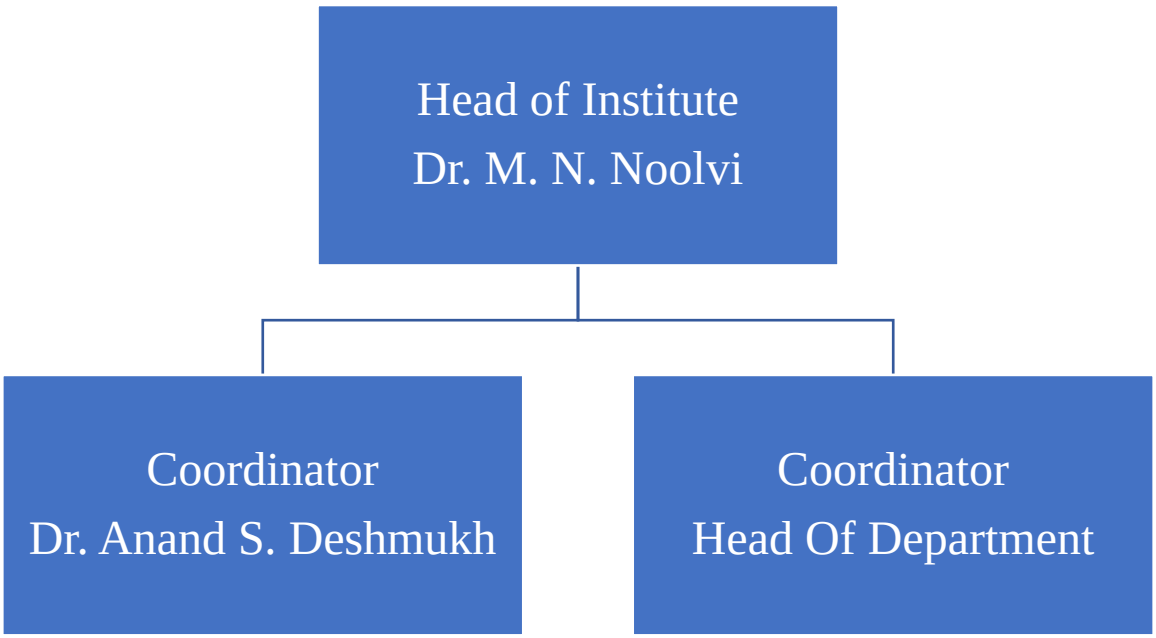
Overview:

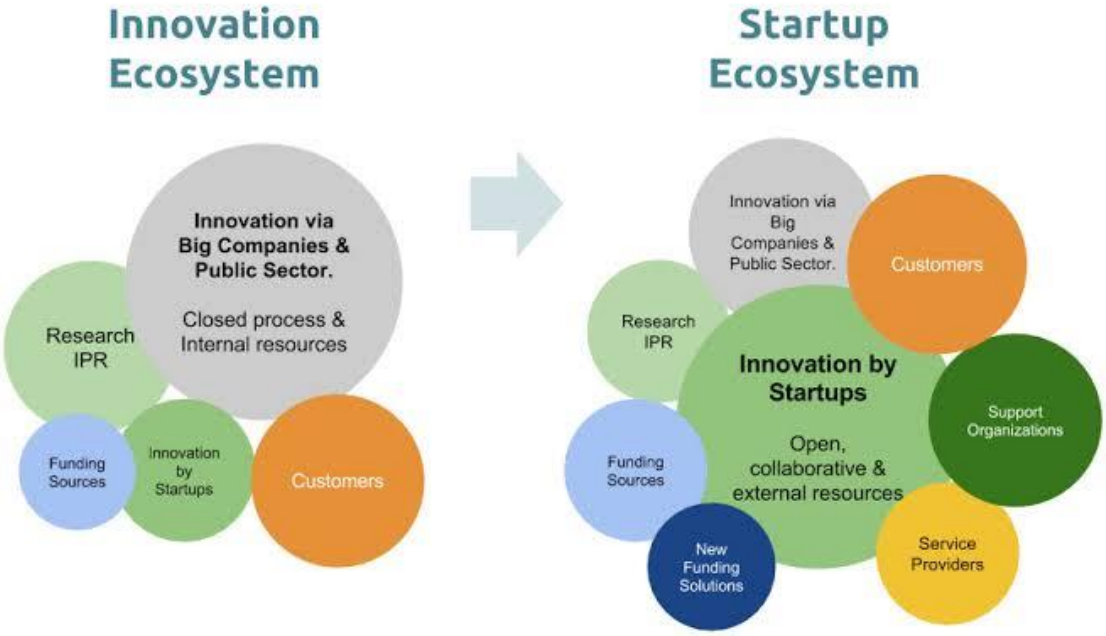
The Entrepreneurship Cell popularly known as EDC, at SDPC, Kim Campus is aimed at fostering entrepreneurial skills among the students on campus.
In the process of identifying, nurturing, training and establishing start-ups, EDC is involved in a wide range of activities.

Vision:

EDC is a consortium dedicated to find the entrepreneur in the students of the SDPC, Kim. EDC connects students with solid entrepreneurial skills, in the campus, to form a close-knit network, working together to spread the word of entrepreneurship. In EDC, the belief is simple; Entrepreneurship is not just a "you" and "me" game. It's an "us" game which takes off successfully only when people come together. EDC promotes openness of knowledge, network, contacts and opportunities. Since its inception on 1st May 2012, it has successfully conducted several competitions of challenging formats, workshops, guest lectures and it has also provided mentors to several "now-successful" start-ups on campus.

Organizational Structure:





Institution has created an eco-system for innovations including incubation centre (Shree Dhanvantary Pharmaceutical Analysis & Research Centre (SDPARC)) and other initiatives for creation and transfer of knowledge. The college has Research Committee to monitor and address issues of research activities under the chairmanship of M. N. Noolvi, Professor and Principal, senior professor Dr. Pallavi KJ & Dr. Suresh Jain and associate professors Dr. Sushil Raut, Dr. Uttam A. More. The incubation facility at the institute is beneficial to both nurture new companies in the region and support the training (skill development) and gainful employment of college students. Institute constituted research advisory committee in 2012 and revised committee members in 2014. Research Advisory Committee provides advisory regarding pertaining of new research project and grants. It also advises the faculty to undertake new and innovative research project and assist them in writing for new research proposal and grants. Various projects and funds were received through the Research Advisory Committee.

Functions of the committee:

The main function of Research Committee is to encourage faculty members to write research proposals and submit to various funding agencies or industries. It motivates faculty and students to publish research work in high impact peer-reviewed journals. Also motivates to present their research work in national and international conferences. To sign MOU for collaborative research with universities and industries it also helps to provide seed fund to transform an idea into a product.

Outcomes:

- Faculty members received research grant from GUJCOST (24.45 lakhs) and BRNS (67.37 lakhs)
- One of the faculty (Dr. Anand Deshmukh) won the second prize (3.00 lakhs) for his project on safe and economic biodegradable hydrogels for water conservation in agriculture using green technology from vibrant Gujarat Startup Summit 2016.
- Faculty members received industrial projects from Good Health Pvt. Ltd. GreenKem Organics Pvt Ltd., CPA Pharma LLP, Nanotherapeutics etc.
- With the help if incubation facility "diet-o-fit" product developed for CPA Pharma LLP and many more product/processes developed.
- Faculty members filed 12 Indian patents for their research work.
- Faculty members Published their research work in high impact Peer-reviewed journals.
- Faculty members are awarded PhD (04) enrolled for PhD (08).
- Signed MOU with several international universities (Texas State US, Lamar University-Texas, Jinan University-China, University of KwaZulu-Natal- South Africa, University of Ulsan-South Korea), and pharmaceutical industries.
- Signed MoU with Jinan University China for the research project with amount of RMB 9000000 (9 Million)
- SDPARC, Linkages and MoUs All Students of final year B. Pharm and M. Pharm undergo industrial training for one month successfully.
- Several research awards have been received by faculty from various professional and research organization.
- Alumni of the institute have started their marketing firms, Pharmacies/Drug stores, Wholesale and other allied pharmacy related business.
- With these R & D activities institute received SIRO-DSIR approval.

Awards Received by faculty members:

- Received 2 Awards by **Dr. M. N. Noolvi** for his excellent teaching and scientific skill Dr. APJ Abdul Kalam Awards for **Teaching Excellence** & Dr. APJ Abdul Kalam Awards for **Scientific Excellence** on 21 October, 2017 from MARINA LABS.
- Received 1 Award by **Dr. Uttam A. More** for his research work Dr. APJ Abdul Kalam Awards for **Young Scientists** on 21st October, 2017 from MARINA LABS.

Dr. M. N. Noolvi

Dr. Uttam A. More

- Received 3 Lakhs to **Dr. Anand S. Deshmukh** for his idea on "The wet soil An economic approach for water conservation" from Vibrant Gujarat Start Up Summit 2016, with platform of ICREATE, (International Centre for Entrepreneurship and Technology), 21-22 October, 2016.

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Vibrant GUJARAT StartUp Igniting the future | Summit 2016

icreate International Centre for Entrepreneurship and Technology

Dr. Anand S. Deshmukh

- Received 1 Award by Dr. M. N. Noolvi for his teaching skills & research work "Best Academician of the Year" on 11th August, 2018 from ICCI.

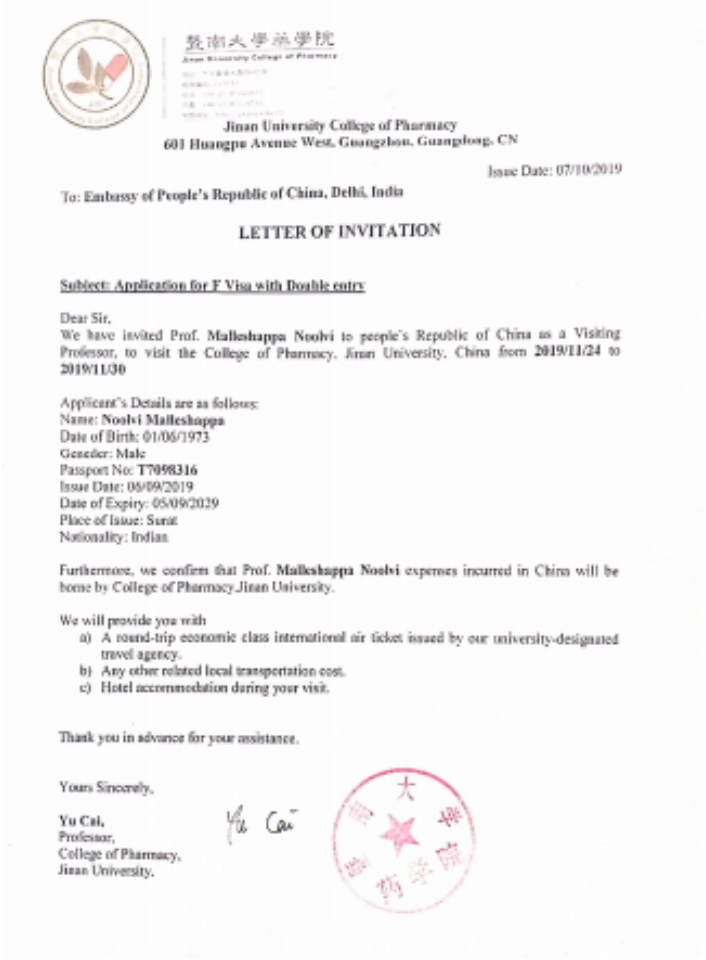
ICCI INTEGRATED CHAMBERS OF COMMERCE AND INDUSTRY

- India-South Africa Joint proposals, DST, between our college and Kwazulu-Natal university, South Africa, Proposal Title: "Investigations of Peptide Based CNT Guided Delivery Device for Cancer Therapy"

- Received Best Researcher and Academician Award to **Dr. Suresh Kumar Jain** from VDGOOD.


- Prof. M. N. Noolvi invited as guest speaker at china, Asia pacific Pharmaceutical science summit forum.


Invited Speaker
Dr. M. N. Noolvi at China
9th-10th January 2019



暨南大学药学院
Jinan University College of Pharmacy

Jinan University College of Pharmacy
601 Huangpu Avenue West, Guangzhou, Guangdong, CN

Issue Date: 07/10/2019

To: **Embassy of People's Republic of China, Delhi, India**

LETTER OF INVITATION

Subject: Application for F Visa with Double entry

Dear Sir,
We have invited Prof. **Malleshappa Noolvi** to people's Republic of China as a Visiting Professor, to visit the College of Pharmacy, Jinan University, China from **2019/11/24** to **2019/11/30**

Applicant's Details are as follows:
Name: **Noolvi Malleshappa**
Date of Birth: 01/06/1973
Gender: Male
Passport No: **T7098316**
Issue Date: 05/09/2019
Date of Expiry: 05/09/2029
Place of Issue: Surat
Nationality: Indian

Furthermore, we confirm that Prof. **Malleshappa Noolvi** expenses incurred in China will be borne by College of Pharmacy Jinan University.

We will provide you with
a) A round-trip economic class international air ticket issued by our university-designated travel agency.
b) Any other related local transportation cost.
c) Hotel accommodation during your visit.

Thank you in advance for your assistance.

Yours Sincerely,

Yu Cai,
Professor,
College of Pharmacy,
Jinan University.

Invitation Letter (Jinan University China)

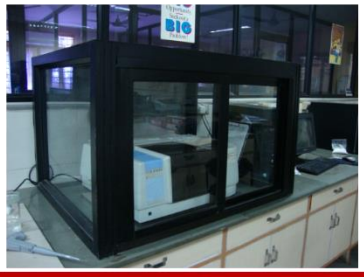
R & D Facility

R & D FACILITY


HPLC


GC


AAS

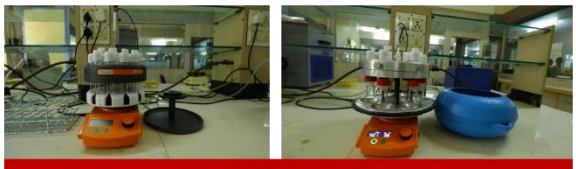

FT-IR


Dissolution Test


Distillation Unit

R & D FACILITIES


Heidolph Rota Evaporator


Parallel Synthesizer

Scale-up Reactor


Research Lab-II

Entrepreneurship Development Cell SDPC, KIM

innovation ecosystem

R & D FACILITIES

DDPRL

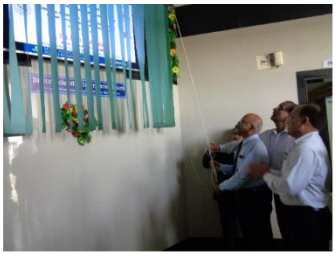
Training Room

Research Lab-I

GC

HPCL

Cold Centrifuge



Digital Scientific Information Board

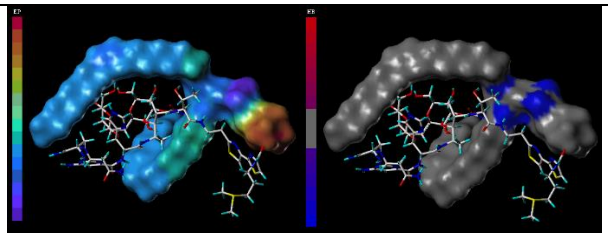
GUJCOST Sponsored Lab

- Interlink with international & national companies
  Tie-up with these companies our R & D center commercialized various formulations & API synthesis process/methods, tech transfer details.

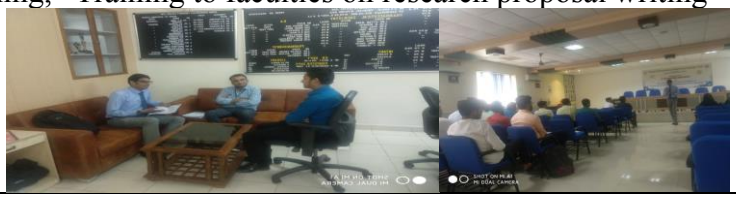
Linkage with Industry

Innovation Made:

1.	Company Name: CPA Pharma LLP – Surat India Project leader: Dr. M. N.Noolvi Assistant: Dr. Uttam A. More, Mr. Stephen Avvaru R & D work: Process Chemistry, API Synthesis "Pantoprazole" the synthetic route for pantoprazole was changed using synthon approach and same process was commercialized to CPA Pharma LLP – Surat India
2.	Company Name: CPA Pharma LLP – Surat India Project leader: Dr. M. N. Noolvi & Dr. Anand Deshmukh Assistant: Ms. Payal Jain R & D work: Product Development, "DIET-O-FIT" DIET-O-FIT is a perfect blend of balanced nutrition, packed with high quality soy protein isolate, carbohydrates, fibers, vitamins, antioxidants, low calorie sugars, poly-unsaturated fatty acids and selected plant extract serving low in calorie essential nutrients. It Provides an ideal way to maintain a balanced calorie intake by avoiding unnecessary Fat consumption. The added plant extract additionally aid in managing basal metabolic rate (BMR) http://www.cpapharma.com/product/diet-o-fit/ 
3.	Company Name: Good Health Pvt Ltd, Sector 15A, Noida Project leader: Dr. Basavaraj Assistant: Mr. Washim Hussain R & D work: Product Development, "Unique Parenteral formulation"
4.	Company Name: Oniosome Healthcare Pvt. Ltd. Mohali. Project leader: Dr. M. N.Noolvi Assistant: Dr. Uttam A. More R & D work: Since our research lab is having in silico molecular modeling software with the help of that small project was carried out entitled "Interaction between Phospholipid and Bleomycin A2"

	
5.	Company Name: Krishna Bio-Organic Agro Project leader: Dr. Anand Deshmukh Assistant: Ms. Payal Jain R & D work: Formulation, "Bio-waste Based Novel, Safe, Green and Economic Hydrogels" Availability of water for agricultural is a major challenge in rural lands of many developing countries like India, South African and Asian continents. Here availability of potable water for drinking and agriculture greatly depends upon rain water with a scarce supply by groundwater sources. Recent reports of WHO and UNICEF suggests that 84% of the people globally, who don't have access to improved water, live in rural areas, where they live principally through subsistence agriculture. The measures of government in such countries can only be effective if possible water harvesting plans are laid at the grass root levels starting from villages and small towns, where agriculture is the main source of income and survival. Further, as a solution to situation, use of Acrylic hydrogels is widely acknowledged. But again these Acrylic hydrogels are well known for their toxic effect on the ecosystem. And for many developing countries with poor economies, these acrylic hydrogels are the only available choices for managing agricultural needs with poor water resources as in arid areas. Keeping this in mind, we propose here a feasible and practical means of developing ecofriendly, biodegradable, economic, yet effective hydrogel system using the easily available bio-wastes (such as coconut coir, sugarcane bagasse or fibrous cereal bran) in conjunction with natural polysaccharides and bio-safe cross-linkers in accordance to the concepts of green chemistry. These hydrogels help in conserving water, preventing toxicity to farming land, better crop yield, enhancing soil quality and prevention of leaching of nutrients. In addition, this technology of hydrogel synthesis is simple, yet easy to scale up and does not require expensive equipment/instrumental set up, which is a desirable feature in view of the economic viability of rural areas of the developing countries. This project helps in reducing the use of hazardous synthetic polymer-based hydrogels and their leach outs in land and water. The project is also planned to be extended for delivery of plant nutrients and natural biocid.

	
6.	Company Name: Greenkem Organics, Ahmedabad Project leader: Dr. M. N. Noolvi Assistant: Dr. Uttam A. More, Mr. Stephen Avvaru, Mr. Ankit Vaghasiya R & D work: Process Chemistry, API Synthesis "Albendazole"
7.	Company Name: Onpharno Project leader: Dr. M. N. Noolvi & Dr. Anand Deshmukh Assistant: Mr. Stephen Avvaru, Mr. Ankit Vaghasiya R & D work: Product Development, "Dermatological product development"
8.	Company Name: Zydus Cadila Project leader: Dr. M. N. Noolvi & Dr. Suresh Jain Assistant: Mr. Sanket Gandhi R & D work: Training, "Students Training & placement"
9.	Company Name: Sun Pharma Project leader: Dr. M. N. Noolvi & Dr. Suresh Jain Assistant: Mr. Sanket Gandhi R & D work: Training, "Faculty Training" 

10.	Company Name: Triokaa Project leader: Dr. M. N. Noolvi & Dr. Suresh Jain Assistant: Mr. Rohan Barse R & D work: Training, "Training to faculties on research proposal writing" 
11.	Company Name: Onpharno Project leader: Dr. M. N. Noolvi Assistant: Mr. Rohan Barse R & D work: "New Cosmetic formulation development for dermal application" 

Sponsoring agencies for R & D Projects

Name of Principal Investigator	Project Titles	Amount sanctioned (Lakhs)	Sponsoring Agency
 Dr. M. N. Noolvi	Design and synthesis of radiolabeled heterocycles as aromatase inhibitors: a novel approach for breast cancer diagnosis and therapy	25.89 (On going)	*Board of Research in Nuclear Sciences (BRNS)*, Trombay, Mumbai
	Development of small molecule of protein tyrosine kinase inhibitors: a hope for cancer therapy	5.00 (Completed)	Gujarat Council on Science & Technology (GUJCOST)
 Dr. Anand S. Deshmukh	Electron beam irradiation induced graft polymerization of polysialic acid onto polycaproactone for effective and biocompatible encapsulation of therapeutic agents	16.93 (Completed)	*Board of Research in Nuclear Sciences (BRNS*), Trombay, Mumbai
	Bio-waste based novel, safe, green and economic hydrogels	Sanctioned	The Federation of Indian Chambers of Commerce and Industry (FICCI), New Delhi
 Dr. Uttam A. More	Design and synthesis of radiolabeled heterocyclics as potential diagnostic imaging agents for neurodegenerative disorders	24.55 (On going)	*Board of Research in Nuclear Sciences (BRNS*), Trombay, Mumbai

 Dr. Bhavesh V. Akbari	Development and evaluation of biodegradable polymeric system based long acting depot formulation of (LHRH) agonist goserelin acetate.	5.00 (Completed)	Gujarat Council on Science & Technology (GUJCOST)
 Mr. Samaresh Pal Roy	To investigate the antidepressant and anxiolytic effects of *Mimosa Pudica* extracts and *Curcuma longa* extracts on chronic administration of some synthetic drugs in rats	4.20 (Completed)	Gujarat Council on Science & Technology (GUJCOST)
 Dr. Hasumati A. Raj	Development and isolation of bioactive component from endophytic fungi of *Musa Paradisiaca* as antidiabetic agent	4.00 (Completed)	Gujarat Council on Science & Technology (GUJCOST)
 Dr. Gautam Sonara	Design and development of polyherbal formulation for skin repigmentation therapies in vitiligo	2.50 (Completed)	Gujarat Council on Science & Technology (GUJCOST)

 Dr. Manish Goyani	Synthesis of chitosan derivatives for antimicrobial, antifungal and antitumor activity	2.50 (Completed)	Gujarat Council on Science & Technology (GUJCOST)
 Dr. Nirav K. Gheewala	Evaluation of endophytes for their antimicrobial activity from indigeneous medicinal plants in south Gujarat	2.25 (On going)	Gujarat Council on Science & Technology (GUJCOST)
 Dr. Meghna Patel	Development of new pro drugs for HIF-1 inhibitions: A new hope for cancer therapy.	1.50 (On going)	Gujarat Council on Science & Technology (GUJCOST)

- Constituted research advisory committee in 2012 and revised in 2014 under chairmanship of Prof. Tejraj M. Aminabhavi.

Advisory Committee, SDPC, Kim, Surat

Prof. Tejraj M. Aminabhavi — Chairman
PhD (The University of Texas, Austin, USA)
Polymer Science and Engineering Discipline
Editor, Chemical Engineering Journal (Elsevier, New York) and Emeritus Professor, College of Pharmacy, Dharwad, India.

Prof. Walter E. Rudzinski — Member
PhD (The University of Arizona, Tucson, USA)
Professor, Texas State University, USA.

Prof. Kap Seung Yang — Member
PhD (North Carolina State University, Raleigh, North Carolina, USA)
Professor, Department of Polymer & Fiber System Engineering and
Director of Alan G. MacDiarmid Energy Research Institute at Chonnam National University.

Prof. Han Mo Jeong — Member
PhD (Seoul National University, Gwanak, South Korea)
Professor, Department of Chemistry,
University of Ulsan, Ulsan, South Korea.

Prof. Hyung IL Lee — Member
PhD (Carnegie Mellon University, Pittsburgh, USA)
Professor, Department of Chemistry, University of Ulsan, Ulsan, South Korea.

Dr. Mallikarjuna N. Nadagouda — Member
PhD (Gulbarga University, Gulbarga, India)
Physical Scientist, National Risk Management Laboratory US
Environmental Protection Agency (US EPA).

Dr. Sudipta Chakraborty — Member
PhD (Mumbai University, Mumbai, India)
Scientific Officer-F (Group Leader, Radiochemical Group)
Bhabha Atomic Research Centre, Mumbai, India.

Dr. Padmakar V. Kulkarni — Member
PhD (Rensselaer Polytechnic Institute, Troy, New York, USA)
Adjunct Professor in Radiology, department of UT Southwestern Medical Center, Dallas.

Dr. M. Surianarayanan — Member
PhD (Kanagawa Industrial Technology Research Institute, Kanaga Wa-Ken, Japan)
Cell for Industrial Safety and Risk Analysis,
Chemical Engineering Department, CLRI (CSIR), Chennai, India

Prof. Kuei-Hsien Chen — Member
PhD (Harvard University, USA)
Research Fellow & Deputy Director, Institute of Atomic & Molecular Sciences,
Academia Sinica, National Taiwan University, Taipei, Taiwan.

- Institute has singed **5 MOU's with international universities** and has good outer world connections.
    - MOU with Texas State University USA
    - MOU with University of Ulsan South Korea
    - MOU with University of KN South Africa
    - MOU with Lamar University, Beaumont, Texas, USA
    - MOU with Jinan University, China

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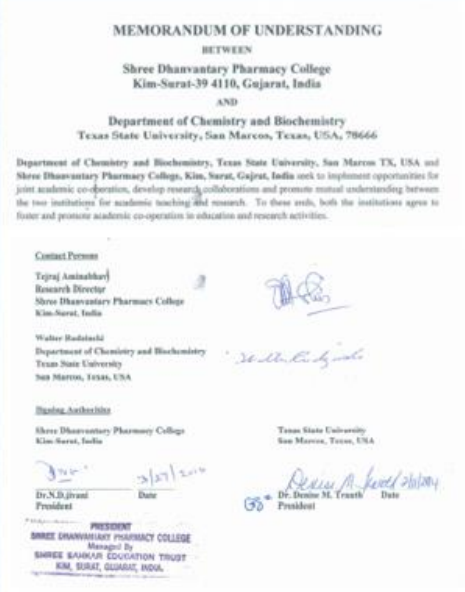
MOU WITH TEXAS STATE UNIVERSITY USA



MEMORANDUM OF UNDERSTANDING

BETWEEN

Shree Dhanvantary Pharmacy College
Kim-Surat-39 4110, Gujarat, India

AND

Department of Chemistry and Biochemistry
Texas State University, San Marcos, Texas, USA, 78666

Department of Chemistry and Biochemistry, Texas State University, San Marcos TX, USA and Shree Dhanvantary Pharmacy College, Kim, Surat, Gujrat, India seek to implement opportunities for joint academic co-operation, develop research collaborations and promote mutual understanding between the two institutions for academic teaching and research. To these ends, both the institutions agree to foster and promote academic co-operation in education and research activities.

Contact Persons

Tejraj Aminabhavi
Research Director
Shree Dhanvantary Pharmacy College
Kim-Surat, India

Walter Rudzinski
Department of Chemistry and Biochemistry
Texas State University
San Marcos, Texas, USA

Signing Authorities

Shree Dhanvantary Pharmacy College
Kim-Surat, India

Dr.N.D.Jivani
President
Date

PRESIDENT
SHREE DHANVANTARY PHARMACY COLLEGE
Managed By
SHREE SAHKARI EDUCATION TRUST
KIM, SURAT, GUJARAT, INDIA.

Texas State University
San Marcos, Texas, USA

Dr. Denise M. Trauth
President
Date

MOU WITH UNIVERSITY OF ULSAN SOUTH KOREA

MEMORANDUM OF UNDERSTANDING

BETWEEN

Shree Dhanvantary Pharmacy College

Kim, Surat-39 4110, Gujarat, India

AND

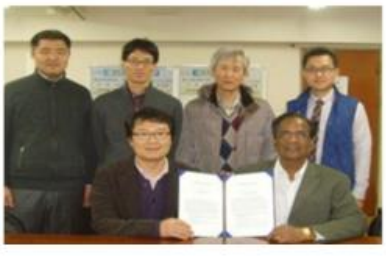
Department of Chemistry, University of Ulsan, South Korea

Department of Chemistry, University of Ulsan, located in Ulsan, SOUTH KOREAand Shree Dhanvantary Pharmacy College, Kim, Surat, Gujrat, India seek to implement opportunities for joint scholarship to facilitative academic co-operation; to develop research collaboration and to promote mutual understanding as well as applying joint research funds between the two countries. To these ends, the institutions agree to foster and promote academic co-operation in education and research between the two institutions. This memorandum of understanding (MOU) provides a general framework for the development of such collaboration including joint research projects between the two countries and holding of international seminars. A subsequent implementation agreement will specify institutional activities, which will be agreed upon and developed by Shree Dhanvantary Pharmacy College, Kim-Surat, India andDepartment of Chemistry, University of Ulsan, at a future date. This will include deputation of students for Ph.D training or post-doctoral research.

Signing Authorities Signature Date

1)Indian: TejrajAminabhavi, Ph.D.
Director of Research,
Shree Dhanvantary Pharmacy College
Kim-Surat, India
Dec. 18, 2013

2)Korean:Youngil Lee, Professor,
Department of Chemistry (Department Chair)
University of Ulsan
Ulsan 680-749
Korea (South)
TEL:+82-(0)52-259-2341
FAX:+82-(0)52-259-2348
Dec. 18, 2013



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MOU WITH UNIVERSITY OF KN SOUTH AFRICA

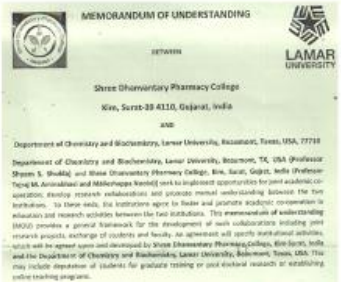
UNIVERSITY OF
KWAZULU-NATAL

Signing Authorities	Signature	Date
1) Indian : Dr M. N. Noolvi Principal, Department of Pharmaceutical Chemistry Shree Dhanvantary Pharmacy College Kim, Ujpad, Surat Gujarat, India		07/01/2014
2) South Africa : Dr. Rajshekar Karpoormath Dept. of Pharmaceutical Chemistry University of KwaZulu-Natal, Discipline of Pharmaceutical Sciences, Westville Campus, Durban-4000 South Africa		07/01/2014

MOU WITH LAMAR UNIVERSITY, BEAUMONT, TEXAS, USA

Signing Authorities	Signature	Date
1). Indian: Dr.N.D.Jivani President Shree Dhanvantary Pharmacy College Kim-Surat, India		
2). United States: Department of Chemistry & Biochemistry Lamar University, Beaumont, Texas, USA		
Dr. Yejraj Aminabhavi (Indian side)		28/11/2017
Dr. Shyam S. Shukla (American side)	Shyam S. Shukla	29/11/2017

LAMAR UNIVERSITY



MEMORANDUM OF UNDERSTANDING

LAMAR UNIVERSITY

Shree Dhanvantary Pharmacy College

Kim, Surat-39 4110, Gujarat, India

AND

MOU WITH JINAN UNIVERSITY, CHINA

暨南大學
JINAN UNIVERSITY

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- Two M. Pharm students Mr. Chirag Gohil and Ms. Kirti Patel visited university of Kwazulu Natal South Africa under student exchange program to complete their M. Pharm research work.

STUDENT EXCHANGE PROGRAM

Mr. Chirag Gohil students of SDPC Visited to University of Kwazulu Natal, South Africa.

Outer World Connection

UNIVERSITY OF KWAZULU-NATAL

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Entrepreneurship Development Cell SDPC, KIM

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Funding Agency

https://brns.res.in/index.php

https://gujcost.gujarat.gov.in/

https://www.greenkem.org/

https://goodhealth.com

https://vgstartup.com/

http://ficci.in/

https://gujcost.gujarat.gov.in/

Entrepreneurship Development Cell SDPC, KIM

innovation ecosystem

Institute h-index and citation from scopus

Shree Dhanvantary Pharmacy College

Follow this affiliation

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KIM [East], Near Railway Station, Dhanvantary College Road,Taluka : Olpad, Surat
GJ, India
Affiliation ID: 60116042
Other name formats: Shree Dhanvantary Pharmacy College | Shree Dhavantary Pharmacy College | Shree Dhanvanvantary Pharmacy College | Dhanvantary College Of Pharmacy | Shri Dhanvantary Pharmacy College | Shree Dhanvantry Pharmacy College | View all

Documents, affiliation only
80

Authors
58

This is an overview of citations for the documents you've selected.

Document *h*-index : 16 View *h*-graph

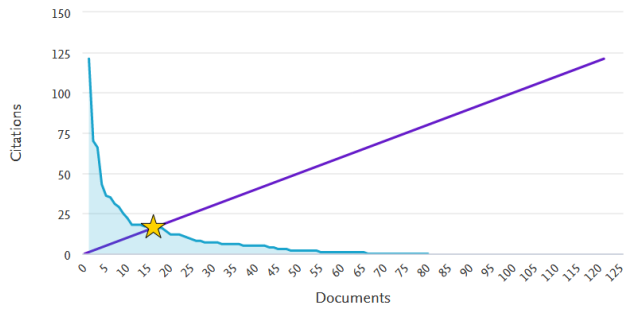
80 cited documents + Save to list

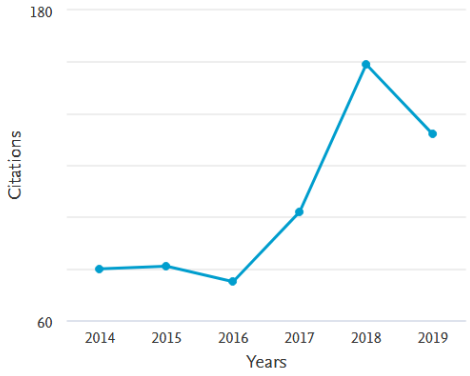
Date range: 2014 to 2019 Exclude self citations of all authors Exclude citations from books Update

These documents *h*-index

16

Of the documents considered for the *h*-index, 16 have been cited at least 16 times



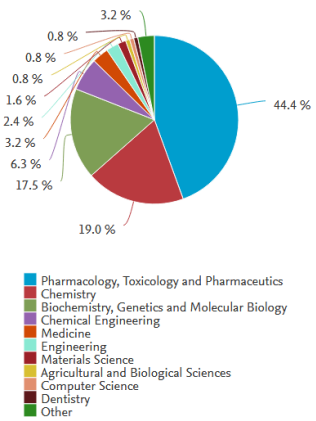


Documents by subject area | Collaborating affiliations | Documents by source

Sort by: Document count (high-low)

Pharmacology, Toxicology and Pharmaceu...	56	Agricultural and Biological Sciences	1
Chemistry	24	Computer Science	1
Biochemistry, Genetics and Molecular Bio...	22	Dentistry	1
Chemical Engineering	8	Economics, Econometrics and Finance	1
Medicine	4	Energy	1
Engineering	3	Environmental Science	1
Materials Science	2	Physics and Astronomy	1

Shree Dhanvantary Pharmacy College



Publication

[1] H.M. Patel, V. Bhardwaj, P. Sharma, M.N. Noolvi, S. Lohan, S. Bansal, A. Sharma, Quinoxaline-PABA bipartite hybrid derivatization approach: Design and search for antimicrobial agents, Journal of Molecular Structure 1184 (2019) 562-568.
[2] Q. Ma, Y. Ouyang, F. Meng, M.N. Noolvi, S.P. Avvaru, U.A. More, T.M. Aminabhavi, M. Du, H. Liu, Y. Zhuang, M. Pang, T. Cai, Y. Cai, A review of pharmacological and clinical studies on the application of Shenling Baizhu San in treatment of Ulcerative colitis, Journal of Ethnopharmacology 244 (2019).
[3] V. Chauhan, V. Patel, B. Akbari, R. Barse, Development and evaluation of biodegradable polymeric based long acting in situ forming microparticles of lhrh agonist goserelin acetate, Indian Journal of Pharmaceutical Education and Research 53(2) (2019) 216-224.
[4] H. Patel, K. Dhangar, Y. Sonawane, S. Surana, R. Karpoormath, N. Thapliyal, M. Shaikh, M. Noolvi, R. Jagtap, In search of selective 11β-HSD type 1 inhibitors without nephrotoxicity: An approach to resolve the metabolic syndrome by virtual based screening, Arabian Journal of Chemistry 11(2) (2018) 221-232.
[5] S.P. Avvaru, M.N. Noolvi, T.M. Aminbhavi, S. Chkraborty, A. Dash, S.S. Shukla, Aromatase inhibitors evolution as potential class of drugs in the treatment of postmenopausal breast cancer women, Mini-Reviews in Medicinal Chemistry 18(7) (2018) 609-621.
[6] P. Tanvi, V. Jain, Pharmacognostic standardization of Oldenlandia corymbosa, International Journal of Pharmaceutical Research 9(1) (2017) 22-25.
[7] M.A. Shah, H. Patel, H. Raj, Methods for the estimation of ellagic acid and curcumin in antidiabetic herbal formulations - A review, Eurasian Journal of Analytical Chemistry 12(4) (2017) 295-311.
[8] H.M. Patel, R. Pawara, A. Ansari, M. Noolvi, S. Surana, Design and synthesis of quinazolinones as EGFR inhibitors to overcome EGFR resistance obstacle, Bioorganic and Medicinal Chemistry 25(10) (2017) 2713-2723.
[9] H.M. Patel, M.N. Noolvi, N.S. Sethi, A.K. Gadad, S.S. Cameotra, Synthesis and antitubercular evaluation of imidazo[2,1-b][1,3,4]thiadiazole derivatives, Arabian Journal of Chemistry 10 (2017) S996-S1002.
[10] R. Kashyap, Role of secondary metabolites and medicinal plants tested for healing of gastric ulcer – A review, International Journal of Pharmaceutical Research 9(1) (2017) 5-15.
[11] S.M. Kamble, H.M. Patel, S.N. Goyal, M.N. Noolvi, U.B. Mahajan, S. Ojha, C.R. Patil, In silico evidence for binding of pentacyclic triterpenoids to keap1-nrf2 protein-protein binding site, Combinatorial Chemistry and High Throughput Screening 20(3) (2017) 215-234.
[12] S.D. Joshi, U.A. More, S.R. Dixit, S.V. Balmi, B.G. Kulkarni, G. Ullagaddi, C. Lherbet, T.M. Aminabhavi, Chemical synthesis and in silico molecular modeling of novel pyrrolyl benzohydrazide derivatives: Their biological evaluation against enoyl ACP reductase (InhA) and Mycobacterium tuberculosis, Bioorganic Chemistry 75 (2017) 181-200.

[13] A.S. Deshmukh, P.N. Chauhan, M.N. Noolvi, K. Chaturvedi, K. Ganguly, S.S. Shukla, M.N. Nadagouda, T.M. Aminabhavi, Polymeric micelles: Basic research to clinical practice, International Journal of Pharmaceutics 532(1) (2017) 249-268.
[14] T.M. Aminabhavi, S.P. Dharupaneedi, U.A. More, The role of nanotechnology and chitosan-based biomaterials for tissue engineering and therapeutic delivery, Chitosan Based Biomaterials2017, pp. 1-29.
[15] V. Abbot, P. Sharma, S. Dhiman, M.N. Noolvi, H.M. Patel, V. Bhardwaj, Small hybrid heteroaromatics: Resourceful biological tools in cancer research, RSC Advances 7(45) (2017) 28313-28349.
[16] V. Thakor, M. Poddar, S. Dey, S.N. Manjula, S.V. Madhunapantula, R. Pawara, H.M. Patel, M.N. Noolvi, Exploring the anti-breast cancer potential of flavonoid analogs, RSC Advances 6(82) (2016) 79166-79179.
[17] H.M. Patel, M.N. Noolvi, A.A. Shirkhedkar, A.D. Kulkarni, C.V. Pardeshi, S.J. Surana, Anti-convulsant potential of quinazolinones, RSC Advances 6(50) (2016) 44435-44455.
[18] A. Patel, D. Shah, T.R. Desai, M.N. Noolvi, Mucoadhesive buccal films based on chitosan and carboxymethylated feronia limonia fruit pulp mucilage interpolymer complex for delivery of opioid analgesics, Asian Journal of Pharmaceutics 10(2) (2016) 137-143.
[19] M.N. Noolvi, H.M. Patel, S. Kamboj, S.S. Cameotra, Synthesis and antimicrobial evaluation of novel 1,3,4-thiadiazole derivatives of 2-(4-formyl-2-methoxyphenoxy) acetic acid, Arabian Journal of Chemistry 9 (2016) S1283-S1289.
[20] P. Nazema, A. Patel, Role of triptans in the management of acute migraine: A review, Asian Journal of Pharmaceutics 10(4) (2016) S437-S443.
[21] V.C. Jain, B.V. Akbari, G. Sonara, K. Viradiya, H. Bhenjaliya, Design and development of polyherbal cream for skin repigmentation therapies in vitiligo, International Journal of Pharmaceutical Research 8(4) (2016) 76-79.
[22] V. Bhardwaj, M.N. Noolvi, S. Jalhan, H.M. Patel, Synthesis, and antimicrobial evaluation of new pyridine imidazo [2,1b]-1,3,4-thiadiazole derivatives, Journal of Saudi Chemical Society 20 (2016) S406-S410.
[23] P. Adil, D. Shah, T.R. Desai, M.N. Noolvi, Development and evaluation of chitosan and aloe vera gel mucilage interpolymer complex-based mucoadhesive buccal films of tramadol hydrochloride, Asian Journal of Pharmaceutics 10(1) (2016) S43-S49.
[24] S.U. Upadhyay, V.C. Jain, U.M. Upadhyay, HPTLC fingerprinting of different extracts and estimation of phytoconstituents of Ajuga bracteosa, International Journal of Pharmaceutical Research 7(2) (2015) 119-128.
[25] S.P. Roy, T. Kannadasan, R. Gupta, Screening of hepatoprotective activity of Madhuca longifolia bark on D-Galactosamine induced hepatotoxicity in rats, Biomedical Research (India) 26(2) (2015) 365-369.
[26] M. Poddar, T.M. Aminabhavi, M. Patel, N. Singh, M.N. Noolvi, HIF inhibitors: New hope for cancer therapy, Letters in Drug Design and Discovery 12(9) (2015) 736-753.
[27] H.M. Patel, B. Sing, V. Bhardwaj, M. Palkar, M.S. Shaikh, R. Rane, W.S. Alwan, A.K. Gadad, M.N. Noolvi, R. Karpoormath, Design, synthesis and evaluation of small molecule imidazo[2,1-b][1,3,4]thiadiazoles as inhibitors of transforming growth factor-β type-I receptor kinase (ALK5), European Journal of Medicinal Chemistry 93 (2015) 599-613.

[28] H.M. Patel, P. Bari, R. Karpoormath, M. Noolvi, N. Thapliyal, S. Surana, P. Jain, Design and synthesis of VEGFR-2 tyrosine kinase inhibitors as potential anticancer agents by virtual based screening, RSC Advances 5(70) (2015) 56724-56771.
[29] H. Patel, Y. Sonawane, R. Jagtap, K. Dhangar, N. Thapliyal, S. Surana, M. Noolvi, M.S. Shaikh, R.A. Rane, R. Karpoormath, Structural insight of glitazone for hepato-toxicity: Resolving mystery by PASS, Bioorganic and Medicinal Chemistry Letters 25(9) (2015) 1938-1946.
[30] J. Ma, A.L. Porter, T.M. Aminabhavi, D. Zhu, Nano-enabled drug delivery systems for brain cancer and Alzheimer's disease: Research patterns and opportunities, Nanomedicine: Nanotechnology, Biology, and Medicine 11(7) (2015) 1763-1771.
[31] T.M. Aminabhavi, M.N. Nadagouda, U.A. More, S.D. Joshi, V.H. Kulkarni, M.N. Noolvi, P.V. Kulkarni, Controlled release of therapeutics using interpenetrating polymeric networks, Expert Opinion on Drug Delivery 12(4) (2015) 669-688.
[32] C.M. Setty, A.S. Deshmukh, A.M. Badiger, Hydrolyzed polyacrylamide grafted carboxymethylxyloglucan based microbeads for pH responsive drug delivery, International Journal of Biological Macromolecules 67 (2014) 28-36.
[33] C.M. Setty, A.S. Deshmukh, A.M. Badiger, Hydrolyzed polyacrylamide grafted maize starch based microbeads: Application in pH responsive drug delivery, International Journal of Biological Macromolecules 70 (2014) 1-9.
[34] C.M. Setty, A.S. Deshmukh, A.M. Badiger, Influence of process parameters on the performance of hydrolyzed polyacrylamide grafted maize starch based microbeads, International Journal of Pharmaceutical Research 6(2) (2014) 85-93.
[35] M.P. Patel, M.R. Patel, R. Hasumati, M.N. Noolvi, N. Shah, Simultaneous estimation of amlodipine besylate and indapamide by dual wavelength spectrophotometric method for combined pharmaceutical dosage form, Indian Drugs 51(4) (2014) 50-54.
[36] H.M. Patel, M.N. Noolvi, P. Sharma, V. Jaiswal, S. Bansal, S. Lohan, S.S. Kumar, V. Abbot, S. Dhiman, V. Bhardwaj, Quantitative structure-activity relationship (QSAR) studies as strategic approach in drug discovery, Medicinal Chemistry Research 23(12) (2014) 4991-5007.
[37] R. Gupta, T. Kannadasan, S.P. Roy, Review on potential plant based drugs for hepatoprotective activity, Journal of Chemical and Pharmaceutical Sciences 7(2) (2014) 109-112.
[38] R. Gupta, T. Kannadasan, S.P. Roy, Screening of hepatoprotective activity of Mimusops elangi fruit on d-galactosamine induced hepatotoxicity in rats, Journal of Chemical and Pharmaceutical Sciences 7(3) (2014) 229-232.
[39] S.K. Das, P.V. Pansuriya, S.T. Shukla, K.J. Gohil, S.P. Roy, A. Choudhury, V.N. Sutariya, Preclinical evaluation of Vallaris solanacea (roth) kuntze stem for its antiulcer and antioxidant activity in wistar albino rats, Oriental Pharmacy and Experimental Medicine 14(1) (2014) 7-13.
[40] S.P. Roy, R. Gupta, D. Bhadra, T. Kannadasan, A review on some indigenous medicinal plants with hepatoprotective activity, Journal of Chemical and Pharmaceutical Sciences 6(2) (2013) 85-92.
[41] H.M. Patel, M.N. Noolvi, A. Goyal, B.S. Thippeswamy, 2,5,6-Trisubstituted imidazo[2,1-b][1,3,4]thiadiazoles: Search for antihyperlipidemic agents, European Journal of Medicinal Chemistry 65 (2013) 119-133.
[42] P.A. Kasad, Photolytic-Thermal Degradation study and method development of Rivaroxaban by RP-HPLC, International Journal of PharmTech Research 5(3) (2013) 1254-1263.

[43] V. Kanani Vineeta, K.S. Muralikrishna, Development and validation of UV spectrophotometric method for estimation of Dapoxetine HCL in bulk and dosage Form, International Journal of Drug Development and Research 5(1) (2013) 161-167.
[44] S.D. Joshi, K. Manish, A. Badiger, Synthesis and evaluation of antibacterial and antitubercular activities of some novel imidazo[2,1-b][1,3,4]thiadiazole derivatives, Medicinal Chemistry Research 22(2) (2013) 869-878.
[45] V. Bhardwaj, P. Sharma, M.N. Noolvi, H.M. Patel, S. Chauhan, M.S. Chauhan, K. Sharma, Thermo-physical examination: Synthesized 2-furano-4(3H)-quinazolinone and open quinazolinone (diamide) anticancer analogs with sodium dodecyl sulfate, Thermochimica Acta 573 (2013) 65-72.
[46] V. Bhardwaj, P. Sharma, M.N. Noolvi, H.M. Patel, S. Bansal, S. Lohan, G. Badola, Certain 2-furano-4(3H)-quinazolinone analogs: Synthesis, characterization and pharmacological evaluation, Letters in Drug Design and Discovery 10(4) (2013) 360-368.
[47] A. Bhanot, R. Sharma, S. Singh, M.N. Noolvi, S. Singh, In vitro anti cancer activity of ethanol extract fractions of aerva lanata L, Pakistan Journal of Biological Sciences 16(22) (2013) 1612-1617.
[48] H.J. Vekaria, M. Yogesh, K. Patel, Development and validation of HPTLC method for simultaneous estimation of cinitapride and omeprazole in combined dosage form, Der Pharmacia Lettre 4(5) (2012) 1467-1474.
[49] H. Vekaria, K.S. Muralikrishna, M. Sorathiya, Development and validation of HPTLC method for simultaneous estimation of montelukast sodium and fexofenadine hydrochloride in combined dosage form, Der Pharmacia Lettre 4(3) (2012) 755-762.
[50] V. Shah, H. Raj, Development and validation of derivative spectroscopic method for simultaneous estimation of cefixime trihydrate and azithromycin dihydrate in combined dosage form, International Journal of Pharma and Bio Sciences 3(3) (2012) P14-P25.
[51] P.R. Samaresh, R. Gupta, T. Kannadasan, Hepatoprotective activity of Ethanolic extract of Madhuca longifoilia leaves on D-galactosamine induced liver damage in rats, Journal of Chemical and Pharmaceutical Sciences 5(4) (2012) 205-209.
[52] D. Prajapati, H. Raj, Simultaneous estimation of mefenamic acid and dicyclomine hydrochloride by RP-HPLC method, International Journal of Pharma and Bio Sciences 3(3) (2012) P611-P625.
[53] M.R. Patel, G.F. Patel, J.R. Patel, Development and validation of Spectrophotometric methods for simultaneous estimation of Indapamide and Amlodipine besylate in combined dosage form, Research Journal of Pharmacy and Technology 5(9) (2012) 1213-1217.
[54] M.N. Noolvi, H.M. Patel, M. Kaur, Benzothiazoles: Search for anticancer agents, European Journal of Medicinal Chemistry 54 (2012) 447-462.
[55] M.N. Noolvi, H.M. Patel, S. Kamboj, A. Kaur, V. Mann, 2,6-Disubstituted imidazo[2,1-b][1,3,4]thiadiazoles: Search for anticancer agents, European Journal of Medicinal Chemistry 56 (2012) 56-69.
[56] M.N. Noolvi, H.M. Patel, S. Kamboj, A QSAR analysis of 2-phenoxy-N-substituted acetamide analogues as hypoxia-inducible factor-1(HIF-1) inhibitors: A rational approach to anticancer drug design, Medicinal Chemistry 8(4) (2012) 599-614.

[57] L. Nagesh, S. Sivasamy, K.S. Muralikrishna, K.G. Bhat, Antibacterial potential of gall extract of Quercus infectoria against Enterococcus faecalis-an in vitro study, Pharmacognosy Journal 4(30) (2012) 47-50.
[58] Y.G. Makani, H.A. Raj, Development and validation of first order derivative spectrophotometric method for simultaneous estimation of omeprazole and cinitapride in pharmaceutical dosage form, International Journal of Pharma and Bio Sciences 3(3) (2012) P70-P80.
[59] A.S. Deshmukh, C.M. Setty, A.M. Badiger, K.S. Muralikrishna, Gum ghatti: A promising polysaccharide for pharmaceutical applications, Carbohydrate Polymers 87(2) (2012) 980-986.
[60] I.M. Bagban, S.P. Roy, A. Chaudhary, S.K. Das, K.J. Gohil, K.K. Bhandari, Hepatoprotective activity of the methanolic extract of Fagonia indica Burm in carbon tetra chloride induced hepatotoxicity in albino rats, Asian Pacific Journal of Tropical Biomedicine 2(3 SUPPL.) (2012) S1457-S1460.
[61] R. Shukla, S.J. Surana, A.U. Tatiya, S.K. Das, Investigation of hepatoprotective effects of piperine and silymarin on D-galactosamine induced hepatotoxicity in rats, Research Journal of Pharmaceutical, Biological and Chemical Sciences 2(3) (2011) 975-982.
[62] R.J. Mandade, S.A. Sreenivas, D.M. Sakarkar, A. Choudhury, Pharmacological effects of aqueous-ethanolic extract of Hibiscus rosasinensis on volume and acidity of stimulated gastric secretion, Asian Pacific Journal of Tropical Medicine 4(11) (2011) 883-888.
[63] A.B. Desai, V.G. Kagathara, H. Joshi, A.T. Rangani, H. Mungra, Evaluation of Antiamnesic effect of Solasodine in Mice, International Journal of PharmTech Research 3(2) (2011) 732-740.
[64] B.V. Akbari, B.P. Valaki, V.H. Maradiya, A.K. Akbari, G. Vidyasagar, Development and evaluation of Orodispersible tablets of Rosuvastatin Calcium-HP-β-CD inclusion complex by using different superdisintegrants, International Journal of Pharmacy and Technology 3(1) (2011) 1842-1859.
[65] M.G. Saralaya, P. Patel, M. Patel, S.P. Roy, A.N. Patel, Antidiarrheal activity of methanolic extract of Moringa oleifera lam roots in experimental animal models, International Journal of Pharmaceutical Research 2(2) (2010) 35-39.
[66] S.P. Roy, D. Shirode, T. Patel, C.S. Shastry, N. Gheewala, G. Sonara, S. Ramachandra Setty, S.V. Rajendra, Antioxidant and hepatoprotective activity of Madhuca longifolia (koenig) bark against CCl4 - induced hepatic injury in rats: In vitro and In vivo studies, Research Journal of Pharmaceutical, Biological and Chemical Sciences 1(1) (2010) 1-10.
[67] G.F. Patel, N.R. Vekariya, R.B. Dholakiya, Estimation of Aspirin and Atorvastatin Calcium in combine dosage form using derivative spectrophotometric method, International Journal of Pharmaceutical Research 2(1) (2010) 62-66.
[68] R.R. Parmar, H.A. Bhuva, A.A. Joshi, R.B. Jadhav, Optimization of extraction method for recovery of antioxidant phenolics from loranthaceae mistletoes, Asian Journal of Chemistry 22(5) (2010) 3851-3855.
[69] S.D. Chavan, N.L. Shetty, M. Kanuri, Comparative evaluation of garlic extract mouthwash and chlorhexidine mouthwash on salivary Streptococcus mutans count-An in vivo study, Oral Health and Preventive Dentistry 8(4) (2010) 369-374.
[70] K. Barot Hitesh, G. Mallika, B. Sutariya Bhavin, S. Jitendra, L.V.G. Nargund, Synthesis of Nitrogen Mustards of fluoro- benzothiazoles of pharmacological interest, Research Journal of Pharmaceutical, Biological and Chemical Sciences 1(1) (2010) 124-129.

[71] B.V. Akbari, B.P. Patel, R.B. Dholakiya, B.G. Shiyani, D.J. Lodhiya, Development and evaluation of taste masked suspension of prokinetic agent by using ion exchange resin, International Journal of PharmTech Research 2(1) (2010) 240-245.
[72] B.V. Akbari, R.B. Dholakiya, B.G. Shiyani, D.J. Lodhiya, Design, development and characterization of mouth dissolving tablets of cinnarizine using super-disintegrants, International Journal of PharmTech Research 2(1) (2010) 97-105.
[73] N.R. Vekariya, G.F. Patel, H.S. Bhatt, M.B. Patel, R.B. Dholakiya, G.K. Ramani, Application of TLC-densitometry method for simultaneous estimation of telmisartan and amlodipine besylate in pharmaceutical dosage form, International Journal of PharmTech Research 1(4) (2009) 1644-1649.
[74] G.F. Patel, N.R. Vekariya, H.S. Bhatt, Application of TLC-densitometry method for simultaneous determination of lopinavir and ritonavir in capsule dosage form, Oriental Journal of Chemistry 25(3) (2009) 727-730.
[75] D.J. Lodhiya, D.J. Mukherjee, R.B. Dholakiya, B.V. Akbari, B.G. Shiyani, H.N. Lathiya, Gastroretantive system of atenolol using HPMC K15, International Journal of PharmTech Research 1(4) (2009) 1616-1620.
[76] A. Paharia, A.K. Yadav, G. Rai, S.K. Jain, S.S. Pancholi, G.P. Agrawal, Eudragit-coated pectin microspheres of 5-Fluorouracil for colon targeting, AAPS PharmSciTech 8(1) (2007) E1-E7.
[77] K.L. Krishna, M. Paridhavi, S.S. Agrawal, Physico-chemical standardization of Sufoof-e-Suzak Qawi an Unani polyherbomineral formulation, Indian Drugs 44(3) (2007) 220-223.
[78] D. Gogna, S.K. Jain, A.K. Yadav, G.P. Agrawal, Microsphere based improved sunscreen formulation of ethylhexyl methoxycinnamate, Current Drug Delivery 4(2) (2007) 153-159.
[79] S.K. Jain, G.P. Agrawal, N.K. Jain, A novel calcium silicate based microspheres of repaglinide: In vivo investigations, Journal of Controlled Release 113(2) (2006) 111-116.
[80] A.K. Jain, S.K. Jain, A. Yadav, G.P. Agrawal, Controlled release calcium silicate based floating granular delivery system of ranitidine hydrochloride, Current Drug Delivery 3(4) (2006) 367-372.

Research collaboration outcomes

RSC Advances

PAPER

Exploring the anti-breast cancer potential of flavonoid analogs†

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In the course of our search for new antitumor agents for breast cancer, novel flavone derivatives were synthesized, characterized and examined for their antitumor activities against breast cancer cell lines. In initial screening, analogs **7a** [3-(5-amino-1,3,4-thiadiazol-2-yl)methoxy-2-phenyl-4*H*-chromen-4-one] and **7b** [3-(5-amino-1,3,4-thiadiazol-2-yl)methoxy-2-(4-methoxyphenyl)-4*H*-chromen-4-one] were found to be effective against the estrogen receptor negative cell line (MDA-MB 453), which was followed by their evaluation in five dose assays. In addition, mechanistic studies of **7a** and **7b** were performed by cytometric analysis and electrophoretic studies and it was observed that apoptosis is a mechanism of cell death, confirmed morphologically by acridine orange/ethidium bromide double staining and TUNEL analysis. Further *in vivo* evaluation of the anti-tumor activity of compound **7a** and **7b** by Ehrlich Ascites Carcinoma (EAC) model and related studies confirms the anti-breast cancer potential of flavonoid analogs.

1. Introduction

Breast cancer is the most commonly diagnosed malignancy among women with more than one million new cases diagnosed per year throughout the world.[1,2] Despite advances in the early detection of breast cancer and the advent of novel targeted therapies, breast cancer still remains a significant public health problem due to the involvement of multiple aberrant and redundant signaling pathways in the tumorigenesis and the development of resistance to the existing therapeutic agents. The currently available breast cancer therapies achieve meaningful clinical results in only 30–40% of the patients.[3] The efficacy of current chemotherapeutics is low and undesirable side effects are still unacceptably high.[4] Hence, the development of novel, efficient, and less toxic anti-breast cancer agents remains an important and challenging goal of medicinal chemists worldwide.

The female hormone estrogen stimulates breast cell division leading to the increase in risk of permanent damage to DNA.[5] Compounds that can regulate the apoptosis of cancer cells are of a high medical significance.[6] Natural products (NPs) have played a valuable role in the drug discovery and development.[7–9] Newman and Cragg[10] reported that in the case of cancer around 79% of FDA-approved drugs during a period of 1981–2010 are either natural products or their based/mimicked-compounds. NPs are chosen through evolutionary process *via* lead optimization to interact with various enzymes/proteins and thus represent biologically relevant regions of the vast chemical space.[11–13] Flavopiridol, a semisynthetic flavones analog, acts as CDK9 inhibitor, is FDA-approved orphan drug for acute myeloid leukaemia. It has been reported that myricetin, (flavonoid compound) could decrease pancreatic cancer growth *via* induction of cell apoptosis.[14] LY294002 (flavonoid analogue) entered clinical trials as a potential antineoplastic agent.[15] Effects of phytoestrogens in cancer prevention have been reported for decades.[16–18] Since then many molecular mechanisms underlying these effects have been identified. Targets of phytoestrogens comprise steroid receptors, steroid metabolising enzymes, elements of signal transduction and apoptosis pathways, and even the DNA processing machinery.[18] Phytoestrogens include chalcones (A), flavones (B) and isoflavones (C) which are non-steroidal compounds possessing anti-estrogenic activity (Fig. 1).[19]

In light of these findings and in continuation of our research for novel anti-cancer agents[20–23] in the present study, new series of flavone derivatives has been synthesized and screened *in vitro* for cytotoxicity by sulphorhodamine B assay. Five dose assay in estrogen receptor negative cell line (MDA-MB 453) and determination of IC_{50} by SRB assay was also performed. In addition, mechanistic study was done with cytometric analysis and electrophoretic determination of apoptosis. Further *in vivo* activity

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REVIEW ARTICLE

Aromatase Inhibitors Evolution as Potential Class of Drugs in the Treatment of Postmenopausal Breast Cancer Women

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Abstract: Aromatase inhibitors are class of drugs that inhibit aromatase, a rate limiting enzyme in the biosynthesis of estrogens from their corresponding androgens. Estrogens play a vital role in the development and growth of breast tumors especially in postmenopausal women apart from their important functions in cell homeostasis. The reduction of estrogen physiological concentration through aromatase inhibition is one of the most important therapeutic strategies against this cancer type. The third-generation aromatase inhibitors are now used as first-line therapy in the treatment of early and metastatic breast cancer in postmenopausal women. However the quest for new class of drugs still stays indispensable to evade the danger of conceivable rising resistances to existing drugs, toxicity and unwanted side effects due to chronic treatment. The current review deals with recent advances in understanding of aromatase, its mechanism and research in the development of various novel chemotypes as aromatase inhibitors. The new challenges and the fast changing trends in bringing rational approach in aromatase inhibitors to a different level like research in dual/multiple target enzyme inhibition strategies, radiolabeling of aromatase inhibitors as theranostic agents; the development of new computational models for complete understanding of aromatase enzyme and its substrate/ligand interactions will bring in holistic approach to comprehensive inhibition of aromatase and other relevant enzymes for effective treatment and monitoring of postmenopausal breast cancer.

Keywords: Aromatase inhibitors, estrogen, breast cancer, dual inhibitors, molecular modeling, radiolabeling.

1. INTRODUCTION

An estimated 1.67 million new breast cancer cases were diagnosed in 2012 which makes it the second most common cancer among women in the world [1]. Around 70-80 per cent of postmenopausal breast cancer patients are found to be estrogen-dependent breast cancer cases [2]. Endogenous estrogens affect the cellular roles of genes involved in cell division, protein expression, cell communication [3] and play a vital role in the development and growth of breast tumors [4]. Ovaries and placenta are the major sources of estrogen biosynthesis and to a lesser degree in testes, liver, adrenal glands, breasts and fat cells. Androgens are known to be precursors for the synthesis of Estrogens.

1.1. Aromatase

Estrogens are biosynthesized from their corresponding androgens by aromatase or estrogen synthetase (CYP19A1; EC 1.14.14.1) a rate-limiting enzyme [5]. It is a microsomal membrane-bound cytochrome p-450 monooxygenase complex comprising of aromatase cytochrome p-450 arom and NADPH-cytochrome p-450 reductase. Cytochrome p-450 arom is a heme protein that binds the steroid substrate, molecular oxygen and catalyses oxidation. The reductase is a flavoprotein, found ubiquitously in endoplasmic reticulum, and responsible for transferring reducing equivalents from NADPH to cytochrome p-450 arom [4, 6]. The gene CYP19 expresses cytochrome p-450 arom, and the gene is located on chromosome 15 in humans. The human CYP19 gene includes nine coding exons, 2-10. Tissue-specific regulation of the aromatase gene in various tissues is determined by tissue-specific promoters. In placenta, p-450 arom transcripts contain promoter 1.1 or 1.2. Ovarian transcripts comprise of promoter PII [7, 8]. Aromatase activity in human adipose and ovarian granulosa cells is associated to complex multifactorial regulation and changes in aromatase activity are correlated with changes in the levels of mRNA encoding p-450 arom [9].

Aromatase cytochrome P450 is the rate limiting enzyme that catalyzes androgens conversion to estrogens in vertebrates [10]. It is the hallmark androgenic specificity that is C19 steroids with 4-ene-3-one system that sets aromatase

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REVIEW

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Small hybrid heteroaromatics: resourceful biological tools in cancer research

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Nowadays, hybrid drugs containing two or more covalently linked known potential pharmacophores are designed to simultaneously modulate multiple targets of multifactorial diseases to overcome the side effects associated with a single drug. In this review, an overview of the design strategies employed by various scientists over the past 20 years has been presented. The overview includes the synthesis of different chemical structure-based anticancer hybrids using molecular hybridization techniques. To tackle one of the world's most devastating diseases such as cancer, researchers have exploited the molecular hybridization (MH) technique to synthesize different anticancer hybrids, which include hybrids based on azole, camptothecin, chalcone, pyrrolobenzodiazepine (PBD), coumarin, colchicine, platinum, and some miscellaneous structures. The selection of two or more moieties for generating the hybrid drug is generally aided by the observed (or anticipated) synergistic or additive pharmacological activities of each single moiety. This eventually leads to the identification of novel and better active chemical entities with a superior profile as compared to the parent moieties. In addition to the design strategies, this review also highlights the structure–activity relationship (SAR), mechanism of action, and key features of the synthesized anticancer hybrids.

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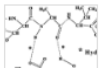
1. Introduction

Cancer is a cell cycle disease characterized by rapid, uncontrolled, and pathological proliferation of abnormal cells. It is one of the most formidable diseases in the world.[1,2] The most frequent forms of cancer are lung cancer, breast cancer, colorectal cancer, stomach cancer, and prostate cancer; among these, prostate cancer (male) and breast cancer (female)

Vikrant Abbot obtained his Bachelor's degree in Pharmacy from the Punjab Technical University in 2009. He started his professional career working as a Production Chemist at Comed Pharmaceuticals Ltd. Baddi for 2.5 years. Thereafter, he completed his Master's degree in Medicinal Chemistry from JUIT, Waknaghat in 2014. Then, he joined academics and is currently working as an Assistant Professor at ISF College of Pharmacy, Moga, Punjab. His present research interests include design and synthesis of small molecules with anticancer and antimicrobial profiles.

Poonam Sharma obtained her Master's in Philosophy in 2003 with a gold medal and completed her PhD in chemistry in 2006 from Himachal Pradesh University (India). She was awarded a UGC project fellowship for her PhD research. She was also awarded the Fast Track Young Scientist research project by DST in 2010. Presently, she is working as an Assistant Professor at the Jaypee University of Information Technology, Waknaghat, Solan (India). Her research revolves around physicochemical drug interactions, thermodynamics, heterocyclic bioactive analogs and topical drug delivery.





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Natural Polysaccharides in Drug Delivery and Biomedical Applications

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Chapter 3 - Sodium alginate in drug delivery and biomedical areas

Kiran Chaturvedi [1], Kuntal Ganguly [1], Uttam A. More [2], Kakarla Raghava Reddy [3], Tanavi Dugge [4], Balaram Naik [4], Tejraj M. Aminabhavi [1], Malleshappa N. Noolvi [2]

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Short communication

Chemical synthesis and in *silico* molecular modeling of novel pyrrolyl benzohydrazide derivatives: Their biological evaluation against enoyl ACP reductase (InhA) and *Mycobacterium tuberculosis*

Shrinivas D. Joshi [a], Uttam A. More [a, b], Sheshagiri R. Dixit [a], Sunil V. Balmi [a], Basavaraj G. Kulkarni [a], Geeta Ullagaddi [a], Christian Lherbet [c, d], Tejraj M. Aminabhavi [a]

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Original article

Design, synthesis and evaluation of small molecule imidazo[2,1-*b*][1,3,4]thiadiazoles as inhibitors of transforming growth factor-β type-I receptor kinase (ALK5)

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ABSTRACT

A new series of imidazo[2,1-*b*][1,3,4]thiadiazoles **5(a–g)**, **6(a–g)**, **9(a–i)** and **12(a–h)** were synthesized as transforming growth factor-β (TGF-β) type I receptor (also known as activin receptor-like kinase 5 or ALK5) inhibitors. These compounds were evaluated for their ALK5 inhibitory activity in an enzyme assay and their TGF-β -induced Smad2/3 phosphorylation inhibitory activity in a cell-based assay. Compound **6d**, 2-(5-((2-cyclopropyl-6-(4-fluorophenyl) imidazo [2,1-b][1,3,4]thiadiazol-5-yl)methylene)-4-oxo-2-thioxothiazolidin-3-yl) acetic acid, shows prominent ALK5 inhibition (IC_{50} = 0.0012 μM) and elective inhibition (91%) against the P38αkinase at10 μM. The binding mode of compound **6d** by XP docking studies shows that it fits well into the active site cavity of ALK5 by forming broad and tight interactions. Lipinski's rule and in silico ADME pharmacokinetic parameters are within the acceptable range defined for human use thereby indicating their potential as a drug-like molecules.

1. Introduction

Transforming growth factor-beta (TGF-β) is a ubiquitous cytokine that affects various biological processes such as regulation of cell proliferation, immune responses, growth, differentiation, angiogenesis, and apoptosis of different cell types [1]. TGF-β1 transduces signals through two highly conserved single transmembrane serine/threonine kinases, the type I and type II TGF-β receptors (TβR-I and TβR-II, respectively) [2]. TβR-II activates TβR-I upon formation of the ligand–receptor complex by hyperphosphorylating serine/threonine residues in the GS region of the TβR-I or activin-like kinase (ALK5), which creates a binding site for Smad proteins. The activated TβR-I in turn phosphorylates Smad2/Smad3 proteins at the C-terminal SSXS-motif thereby causing dissociation from the receptor and heteromeric complex formation with the Smad4 [3–5]. Smad complexes translocate to the nucleus, assemble with specific DNA-binding co-factors and co-modulators to finally activate transcription of an extracellular matrix component, and inhibitors of matrix-degrading proteases [6]. Therefore, it becomes evident that inhibition of ALK5 phosphorylation of Smad2/Smad3 could reduce TGF-β1-induced excessive accumulation of the extracellular matrix. Small molecules inhibitors of TGF-βR1 offer an attractive way to regulate the TGF-β pathway and can consequently find applications in the treatment of various diseases, especially, cancer [7]. Our on-going interest in the design and synthesis of novel anti-cancer agents [8–13], and recent reports by Hoelzemann and collaborators [14] suggesting the imidazo[2,1-*b*][1,3,4]thiadiazoles scaffold as a template to the design of inhibitors of ALK5; inspired us to synthesize and *in vitro* evaluated imidazo [2,1-*b*][1,3,4]thiadiazoles **5(a–g)**, **6(a–g)**, **9(a–i)** and **12(a–h)** for the ALK5 inhibitory activity in an enzyme assay and their TGF-β

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Patent Details

Sr. No.	Product / Process	Country	Year	Patent Application Number
1	In situ forming micro particle of Gosereline	India	2016	201621030794
2	Development of gosereline acetate long acting parenteral depot formulation	India	2016	201621030797
3	New benzothiazole coumarin derivatives A Process and user thereof	India	2016	201621034608
4	New coumarin derivatives A Process and user thereof	India	2016	201621034607
5	Formulation and evaluation of sodium alginate and HPMC K4M based in situ gel containing trifluridine	India	2018	201821010721
6	New 2,4-diaminopyrimidine derivatives, A process and uses thereof	India	2018	201821010739
7	New indole derivatives, A process and uses thereof	India	2018	201821010737
8	New 7-chloro-2-furanyl quinazolin-4(3H)-one derivatives and preparation thereof	India	2018	201821010736
9	New 7-chloro-2-methyl quinazolin-4(3H)-one derivatives and preparation thereof	India	2018	201821010735
10	New 2-furanyl quinazolin-4(3H)-one derivatives and preparation thereof	India	2018	201821010730
11	Finasteride loaded nanoemulsion for treatment of androgentic alopecia	India	2018	201821010727
12	Polysaccharide and cellulose derivatives based hydrogels for agricultural needs thereof	India	2018	201821010724