REPORT FOR UTILIZATION OF

DST- PURSE GRANT

Sanction Letter No.: SR/S9/Z-23/2010/43, dated 16-03-2011

(Period: April 1, 2014 to February 23,2015)

Sardar Patel University
Vallabh Vidyanagar- 388 120
Gujarat, INDIA

Report for Utilization of DST-PURSE Grant

F. Y. 2014-15 (1st April 2014 to till date)

1. Name of University:

Sardar Patel University

Vallabh Vidyanagar-388120

Gujarat

2. Address for Communication:

a) Prof. Dr. Harish Padh

Coordinator, PURSE Programme of DST

Vice-Chancellor

Sardar Patel University

Vallabh Vidyanagar-388120, Gujarat

Telephone: 02692-226803, Telefax: 02692-230009

E-mail: vcspu@yahoo.co.in, vcspu@spuvvn.edu

b) Prof. Dr. N. V. Sastry

Nodal Officer, PURSE Programme of DST

Sardar Patel University

Vallabh Vidyanagar-388120

Telephone: 02692-226864, Telefax: 02692-226864

E-mail: nvsastry17@gmail.com

3. Date and Ref. No. of DST Sanction Letter: SR/S9/Z-23/2010/43 dated 16th March 2011

4. Total Amount Released under the Programme

Sanctioned: Rs. 600.00 Lakhs

Released: Rs. 575.00 Lakhs

5. Expenditure during the period 1st April 2014 to 31st March 2015: Rs. 2,73,65,322.00

Total expenditure consolidated upto 23th February 2015: Rs. 5,97,06,047.00

6. Details of the Grant

Sr. No.	(A) Flexible Component	Amount (Rs. In Lakhs) Received with Date
1.	Equipment	410.00
2.	Consumable	35.00
3.	Research Infrastructure Facility	35.00
4.	Networking & Computational Facility	20.00
	Total (A)	500.00
Sr. No.	**(B) Fixed Component**	
1.	Manpower	52.50
2.	Contingencies	4.50
3.	Travel	4.50
4.	Seminar/ Workshop	4.50
5.	Maintenance	12.00
	Total (B)	**75.00**
	Total (A+B)	**575.00**

7. Details of Utilization of PURSE Grant under the Flexible Component:

7a. Sanctioned Major Equipment Ordered/ Purchased/ Installed:

(A) Instruments Purchased and Installed				
Sr. No.	**Name (With Model & Make)**	**Order Date**	**Installation Date**	**Cost in INR (Total Cost of the Equipment after paying all the charges)**
	Purchased/ Installed			
1.	Liquid Nitrogen Container 3.9 ltr, Liquid Nitrogen Container 10.5 ltr	01-02-14	----	38,571.00
2.	Cold Storage Deep Freezer	30-12-13	19-03-14	4,40,000.00
3.	PC + Printer for SZ-100Z UPS, High Performance Particle Size Analyzer along with Zeta Potential, Service Charges	18-12-13	17-04-14	73,125.00+15,91,858.00+33,708.00 = 16,98,691.00
4.	Isothermal Titration Calorimeter & Demurrage Charges	21-02-14	09-05-14	44,16,517.00 + 6,698.00 = 44,23,215.00
5.	Fluorescence Microplate Reader	03-12-13	26-03-14	14,82,577.00
6.	PL Aquagel-OH Mixed-H 8um 300 x 7.5 mm Easi Vial PEG/PEO 2 ml 3 KVA Online UPS with 1Hr Backup Computer & Print Dell Vostro 270 18.5" windows 7 Professional and HP LaserJet Printer 1020 for Size Exclusion			2,88,750.00

6.	"Remi" Refrigerated Centrifuge Model: CPR-24 PLUS Complete with R-244M R-247M& R-248M-Angle Heads & VS-03 (Volt. Stab. Servo. Controlled)	29-05-14		2,29,908.00
7.	Complete DCI-VC-V Semi Conductor Characterization System, Liquid/Powder Volume Resistivity Test Cell with Micrometer ETS Make	28-02-14	23-04-14	39,27,523.00
8.	Modular Table Size L – 2000, W -1000, H -750 mm for ICP-OES	03-12-14		87,050.00
9.	Tender Notice for Scientific Equipment	-	-	5,376.00
			Total Rs. (A)	**1,26,21,661.00**

(B) Instruments Purchased and under installation

Sr. No.	Name (With Model & Make)	Order Date	Cost in INR (Total cost of the equipment after paying all the charges
1.	Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES)	07-08-14	33,09,828.00
2.	Simultanious High Temperature DTA-DSC-TGA System	07-08-14	27,16,665.00
3.	Real Time PCR	06-08-14	11,70,000.00
4.	Refractive Index Detector (For Size Exclusion Chromatograph)	23-02-15	6,30,000.00
		Total Rs. (B)	**78,26,493.00**

(C) Instruments with Procurement in Progress

Sr. No.	Name (With Model & Make)	Proposal Date	Cost in INR (Total cost of the equipment after paying all the charges
1.	Shimadzu Prominence Preparative cum Analytical HPLC System with local Accessories	13-02-15	34,63,607.00
2.	DANI make Gas Chromatograph with Head Space Sampler	29-01-15	21,75,554.00
		Total Rs. (C)	**56,39,161.00**
		Total (A+ B + C)	**2,60,87,315.00**

7b. Particulars for Consumables Procured (Chemicals, Supplies etc.)

For research workers in CENTER FOR INTERDISCIPLINARY STUDIES IN SCIENCE AND TECHNOLOGY (CISST) expenditure Total Rs. 1,73,814. 00

Please see below for Complete Details:

Sr. No.	Name of the Chemical	Quantity	Make/Grade
1.	Alluminium Sulphate AR	2*500gm	Himedia
2.	Ammonium Nickel Sulphate Hexahydrate	1*500gm	Himedia
3.	Benzaldehyde	2*500ml	Himedia
4.	Calcium Chloride	2*500gm	Himedia
5.	Citric Acid	1*500gm	Himedia
6.	Diethyl Ether	1*500ml	Himedia
7.	D-Fructose	2*100gm	Himedia
8.	Sucrose	2*500gm	Himedia
9.	Potassium Hydroxide AR	2*500gm	Himedia
10.	Methyl Acetate	1*500ml	Himedia
11.	Phenol Crystal AR	1*500gm	Himedia
12.	Potassium Persulphate AR	1*500gm	Himedia
13.	Sodium Meta Bisulphite AR	2*500gm	Himedia
14.	Ferrous Sulphate	2*500gm	Himedia
15.	Mangnesium Sulphate Anhydrous AR	2*500gm	Himedia
16.	Dimethyl Glyoxine AR	1*100gm	Himedia
17.	Glycerol AR	2*1ltr	Himedia
18.	Phenolphthalein	2*25gm	Himedia
19.	Methyal Methacrylate	2*500ml	Himedia
20.	X-Pert DNA Estimation Teaching kit 5PR	1pkt	Himedia
21.	X-Pert RNA Estimation Teaching Kit 5PR	1pkt	Himedia
22.	Thin Layer Chromatography Teaching Kit-10	1pkt	Himedia
23.	Foiln reagent 125ml	1pkt	Himedia
24.	Glucose Oxidase 10000U	1pkt	Himedia
25.	4-Aminoantipyrene	1*25gm	Himedia
26.	Dextrose	1*100gm	Himedia
27.	Bovin Serum Albumin	1*5gm	Himedia
28.	Folin wuse alkaline copper solution	1*500ml	Himedia
29.	P-Hydroxybenzoic Acid	1*100gm	Himedia
30.	Potassium Phosphate dibasic anhydrous	1*100gm	Himedia
31.	MES-NA Buffer ph 5.7	1*25gm	Himedia
32.	(1-Octanol 99%) n-Octanol 99%	1*500ml	Loba
33.	3,5-Dinitrosalicylic Acid 97%	1*25gm	Loba
34.	Aceto Carmine	1*100ml	Loba
35.	Sodium Azide 99% Extra Pure	1*100gm	Loba
36.	Folin & Ciocateu's Phenol Reagent (Phenol)	1*100ml	Loba
37.	Dimethyl Sulphoxide 99% AR (DMSO)	3*500ml	Loba
38.	Sodium Citrate Solution 3.8% W/V	5*500ml	Loba

39.	Janus Green B Stain	1*10gm	Loba
40.	Karl Fischer's Reagent, Pydridine Free	1*250	Himedia
41.	Hand Spacimen of Minerals, Thin Section of Minerals, Hand Spacimen of Rocks, Thin Section of Rocks	----	-----

7c. Details of Research Infrastructure developed out of PURSE Support:

Central Experimental Facility: DST PURSE Programme

Sr. No.	Received Items	Make	Cost (INR)
1.	Precision Balance (01 Nos.)	J. J. Labware	63,604.00
		Total Rs.	**63,604.00**

7d. Details of Networking & Computational Facilities created out of PURSE Support:

Sr. No.	Details of the items procured for Computer Laboratory	Make	Date of Purchase	Total Cost (INR) (Total Cost of the item/ Equipment after paying all charges)
	-	-	-	**NIL**
			Total Rs.	**NIL**

8. Details of Utilization of PURSE Grant under 'Fix Component'

8a. Particular of Manpower Employed:

Sr. No.	Designation (Number of Persons)	Monthly Emoluments (INR) per person
1.	Research Associate (01)	22,000.00
2.	Research Assistant (07)	12,000.00
	Total Amount spent on Manpower (as on 23th February, 2015)	**8,21,076.00**

8b. Details of Expenditure incurred under 'Travel':

Sr. No.	Particular of Man Trips	Total Cost (INR)
1.	Prof. Dr. N. V. Sastry (Nodal Officer), S. P. University, Vallabh Vidyanagar	2,670.00
2.	Prof. Dr. P. Venktesu, Dept. of Chemistry University of Delhi, Delhi	14,122.00
3.	Prof. Dr. T. S. Banial, Dept. of Chemistry, Amritsar, Punjab	6,802.00
4.	Prof. Dr. Gunjan Varma, Chemistry Devision , Tromby, Mumbai	4,129.00
5.	Dr. Rajendrakumarsingh, Dept. of Chemistry, Banaras University, Varanasi	20,084.00
6.	Dr. Arvindkumar, CSMCRI, Bhavnagar	4,015.00
7.	Dr. Ramesh Gardas, IIT, Madras	1,000.00
8.	Prof. Dr. K. J. Patil, School of Chemical Sience, N. M. University, Jalgaon	2,931.00
9.	Prof. Dr. Fatehsinh Nandel, Dept. of Biophysics, Punjab University, Chandigarh	5,310.00
10.	Dr. Prarthan Mehta, Dept. of Electronics & Comm. Eng., Faculty of	4,784.00

	Technology, D. D. University, Nadiad	
11.	M/s. Spartan Travels, Puspakunj, 2nd Floor, Vaghasiwala Building, Dairy Road, Anand	5,530.00
12.	M/s. Spartan Travels, Puspakunj, 2nd Floor, Vaghasiwala Building, Dairy Road, Anand	3,979.00
13.	M/s. Spartan Travels, Puspakunj, 2nd Floor, Vaghasiwala Building, Dairy Road, Anand	3,040.00
14.	M/s. Spartan Travels, Puspakunj, 2nd Floor, Vaghasiwala Building, Dairy Road, Anand	10,805.00
15.	M/s. Spartan Travels, Puspakunj, 2nd Floor, Vaghasiwala Building, Dairy Road, Anand	3,335.00
16.	M/s. Spartan Travels, Puspakunj, 2nd Floor, Vaghasiwala Building, Dairy Road, Anand	3,285.00
17.	Dr. Sudhir Kumar, Post Doctrol Fellow, Dept. of Materials Science and Engineering , National TsingHua University, Taiwan	12,403.00
	Total Rs.	**1,08,224.00**

8c. Any Seminar/ Workshop/ Conference Organized by the University during the period of Report, especially those involving the newly created facility under PURSE Initiative:

Sr. No.	Description of Seminar/ Workshop organized under PURSE programme	Budget Allocated (INR)
1.	Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	4,435.00
	Total Rs.	**4,435.00**

Conferences, Seminar and Workshop Organized by Science Departments:

Sr. No.	Theme	Sponsors	Duration
1.	Interdisciplinary Studies in Science & Technology- Opportunities (ISST-2015)- Center for Interdisciplinary Studies in Science and Technology (CISST)	UGC	19th February, 2015
2.	National Seminar on Crystallography (NSC 43B) and National workshop on CADD (Department of Physics)	UGC	1st -3rd September, 2014
3.	Thermodynamics of Chemical, Biological Environmental and Nano-conventional Energy Systems (TCBNES-2014) (Department of Chemistry)	UGC	17th October to 18th October, 2014

8d. Details of Budget for Contingencies

Sr. No.	Description of Details (Item Wise)	Total Cost (INR)
	-	NIL
	Total Rs.	**NIL**

8e. Particulars of Funds utilized for 'Maintenance' Purpose:

Sr. No.	Details of Maintenance	Department	Cost (INR)
1.	M/s. Jalaram Refrigeration and Automobiles, Opp. City Bus Stand, A. V. Road, V. V. Nagar (Service Charges for A.C.)	DST-PURSE Programme	1,250.00
2.	M/s. Millipore (India) Pvt. Ltd. 50A, 2nd Phase, Ring Road. Peenya, Bangalore-560058 (Elix Integral Service AMC and Smart Synergy Service AMC)	DST-PURSE Programme	34,253.00
3.	M/s. Printer Line Services, Ground Floor, J. K. House, Nr. Morarji Ground, B/h. Kalpana Cinema, Anand	DST-PURSE Programme	4,500.00

	(HP Colour Laser Printer CP 1525 Imaq Unit Replace)		
4.	M/s. Om Enterprise, Popati Nagar, Nr. Akashganga Flat, Anand (Refill Toner)	DST-PURSE Programme	900.00
5.	M/s. Millipore (India) Pvt. Ltd. 50A, 2nd Phase, Ring Road. Peenya, Bangalore-560058 (Elix Integral Service AMC and Smart Synergy Service AMC)	DST-PURSE Programme	65,951.00
6.	M/s. Worldlink Marketing Co., S4 Vaiderbhi Complex, Near Janta Circle, GIDC, Vitthal Udyognagar (Dist. Anand)	DST-PURSE Programme	6,500.00
7.	M/s. Spincotech Pvt. Ltd., Vadodara (C18 G 150 x 4.6 x 5 Column 02 x 15,000.00 (Per No.)	DST-PURSE Programme	31,750.00
		Total Rs.	**1,48,700.00**

9. Utilization of the facilities created under PURSE Program Support:

a) The facility of LCMS (Shimadzu Nexera, 8030) is in extensive use by the researchers from other departments of SPU. Total of 551 samples have been analysed. Around 11 samples have been analyzed for the researchers of other Universities.

b) The facility of Rheometer (Modular Compact Rheometer, Anton Paar) is in extensive use by the researchers from other departments of SPU (Department of Chemistry, Department of Biosciences, Department of Pharmaceutical Sciences) About 980 samples are analysed. 205 samples have been analyzed for the researchers from the M. S. University of Baroda, the Charusat University, Changaa and Veer Narmad South Gujarat University, Surat

c) Spectrofluorophotometer facilty (RF 5301PC, Shimadzu) is extensively used and 1415 samples have been analyzed so far for the Science Departments of the University and approximately 20 samples for researchers from Veer Narmad South Gujarat University, Surat

d) Particle Size Analyzer with Zeta Potential (SZ 100, Horiba) instrument is used for the analytical purposes by the Science Departments and approximately 135 samples are analyzed. 95 samples are analyzed for the other research workers from Veer Narmad South Gujarat University, Surat

e) Fluoroscence Microplate Reader (Spectramax MZ & Multi Detection, Molecular Devices, LIC) is used for analyses for the samples from within SPU and around 235 samples have been analyzed.

f) Complete DCI-VC-V Semiconductor Characeterization System is used by the workers of Electronics Department of SPU.

g) Isothermal Titration Calorimeter (Nano ITC Standard Volume System, Water Ges.m.b.H): around 170 samples have been analyzed for research workers within SPU.

h) The sample analysis services with above instruments have also been provided to researchers from the Charusat University, Changa and M.S.Unuiversity, Baroda, Veer Narmad South Gujarat University, Surat.

i) The detailed progress report of the work in progress by the research personnel appointed under DST PURSE programme under the title **Summary of Ongoing Research Work by Personnel appointed under PURSE Programme can be seen in Annexure- I (Page Nos. - 18-55).**

10. Details of full length Research Publication (in Peer- Reviewed Journals) during the Period under report:

An Overview

[A] Articles/Papers published in Academic Journals

Sr. No.	Department	Published/Communicated
1.	Biosciences	65
2.	Chemistry	54
3.	Computer Science	33
4.	Electronics	03
5.	Materials Science	05
6.	Mathematics	18
7.	Physics	16
8.	Homescience	04
9.	Statistics	14
10.	Pharmaceutical Sciences	04
	Total	**223***

***This includes the research papers (2014-15) by Prof.Dr. Harish Padh, Hon'ble Vice-Chancellor, Co-oridantor, DST-PURSE Programme**

[i] Details of Citations and h-index of Faculty Members as per Scopus (February 2015)

Period	Number of		h-index
	Articles	Citations	
2011-2015	774	3356	32

Dr. Harish Padh **Vice Chancellor, Coordinator of DST- PURSE program** *Pharmaceutical Sciences, Cell and Molecular Biology and Biotechnology*			
Overall figures (1996 onwards)	**Number of**		**h-index**
	Articles	**Citations**	
	129	2173	23

Department wise (for present Faculty Members)

Name of Authors	Number of		h-index
	Articles	Citations	
Department of Biosciences			
Dr. A. V. R. L. Narasimhacharya	27	244	9
Dr. Datta Madamwar	166	2853	31
Dr. Kiran Kalia	27	380	11
Dr. K. C. Patel	49	359	10
Dr. J. S. S. Mohan	19	97	07
Dr. T.V. Ramana Rao	17	37	04
Dr. R. B. Subramanian	39	143	08
Dr. Haresh Keharia	24	339	09
Dr. A. S. Reddy	02	01	01
Dr. Ujjwal Trivedi	26	263	12
Dr. Amit Shah	36	348	08
Dr. Sujata Bhatt	03	10	02
Dr. Vasudev Thakkar	20	91	05
Total	**455**	**5165**	**117**
Department of Chemistry			
Dr. D. I. Brahmbhatt	45	172	07
Dr. N. V. Sastry	79	1547	25
Dr. D. K. Raval	42	204	08
Dr. M. N. Patel	107	1027	17
Dr. M. P. Patel	88	650	15
Dr. N. J. Parmar	22	114	06
Dr. K. H. Patel	16	95	07
Dr. S. S. Soni	28	422	10
Dr. K. R. Surati	11	128	09
Dr. N. P. Talpada	05	50	04
Dr. H. S. Patel	161	688	13
Total	**604**	**5097**	**121**
Department of Physics			
Dr. U. H. Patel	18	45	04
Dr. P. C.Vindokumar	45	244	11
Dr. V. M. Pathak	41	92	06
Dr. M. P. Deshpande	60	135	06
Dr. B. Y. Thakore	60	114	06
Dr. K. D. Patel	57	114	05
Dr. G. K. Solanki	36	60	04
Dr. S. H. Chaki	46	78	04
Dr. N. K. Bhatt	38	58	04
Total	**401**	**940**	**50**
Department of Materials Science			
Dr. R. H. Patel	13	36	03
Dr. N. M. Batra	11	91	06
Total	**24**	**127**	**09**

Department of Mathematics			
Dr. G. M. Deheri	59	233	08
Dr. D. J. Karia	07	28	03
Dr. A. H. Hasmani	03	01	01
Dr. H. S. Mehta	06	04	01
Dr. H. V. Dedania	18	45	04
Dr. P. A. Dhabi	06	08	02
Dr. S. J. Bhatt	38	135	07
Total	**137**	**454**	**26**
Department of Statistics			
Dr. P. A. Patel	05	15	02
Dr. A. Shanubhogue	10	18	02
Dr. M. B. Bhatt	02	03	01
Dr. D. P. Raykundaliya	03	01	01
Total	**20**	**37**	**06**
Department of Homescience			
Dr. V. H. Patel	08	14	03
Dr. Neeta Dave	03	01	01
Dr. Rema Subhash	04	20	03
Total	**15**	**35**	**07**
Department of Electronics			
Dr. D. Lakshminaryana	27	244	10
Dr. B. H.Patel	08	36	03
Dr. Vibha Vaishnav	08	22	03
Total	**43**	**302**	**16**
Department of Computer Science			
Dr. Dipti Shah	03	11	02
Dr. Priti Sajja	04	22	04
Total	**14**	**28**	**03**
Centre for Interdisciplinary Studies in Science and Technology (CISST)			
Dr. Rupal A. Vasant	14	28	03
Total	**07**	**33**	**06**
Overall SPU Sci. Depts. Total	**1720**	**12218**	**361**

[B]Books/Chapters in Book

Sr. No.	Department	Book Chapters/ Books
1.	Biosciences	02
2.	Chemistry	01
3.	Computer Science	03
4.	Mathematics	03

For the details of publications please see Annexure- II (Page Nos. 56 to 77)

11. Sponsored research projects in operation during the period under report (please provide names of PI/Co-PIs, title of the project, funding agency and total quantum of external support)

An Overview

Sr. No.	Department	Sponsored Research Projects (Ongoing / New) (Nos.)	Total Grant (Rs.)	Sponsoring Agency
1.	Biosciences	14	5,17,67,500.00	DBT New Delhi, DST New Delhi, UGC New Delhi, GSBTM Gandhinagar, MOFPI – DST(SERB) New Delhi, BASF, India Ltd
2.	Chemistry	08	1,53,63,755.00	UGC New Delhi, UGC – DAE Consortium for Scientific Research, Mumbai Center, R-5 Shed, BARC, Mumbai, SERB, DST, New Delhi (DST Young Scientist Award)
3.	Computer Science	01	60,000.00	SPU Seed Grants
4.	Home Science	01	11,37,200.00	UGC, DBT, New Delhi
5.	Materials Science	02	18,27,800.00	UGC, New Delhi, IPR-BRFST
6.	Physics	05	45,74,542.00	UGC, New Delhi
7.	Statistics	01	11,96,000.00	UGC, New Delhi
8.	Pharmaceutical Science	02	1,20,000.00	SPU Seed Grants
	Total		**7,02,76,255.00**	

Please see Annexure-III for the details, Project wise (Page Nos. 78 to 82)

12. Utilization of Equipments by other institutes:

The facility of LCMS, Rheometer is in use by the researchers from other Universities like MS University, Vadodara (around 20 Samples for LCMS and around 36 Samples for Rheometer), CHARUSAT- Changa University, Changa (around 6 samples for rheological analysis)

13. Self assessment of the impact of the PURSE support:

13 a. Success of the students at national level tests (various PG/Ph.D. entrance tests and tests for JRF etc) during the April 2014 to March 2015.

Sr. No.	Department	PG	Ph. D.	NET	GATE	SLET	Others
1.	Chemistry	-	8	2	-	-	1
2.	Electronics	-	-	-	-	-	-
3.	Home Science	-	-	-	-	1	-
4.	Materials Science	-	-	-	3	-	-
5.	Physics						
6.	Mathematics	-	-	6	-	2	-

7.	Biosciences	-	22	15			-
8.	Statistics	-	-	-	-	-	-
9.	Computer Science	-	-	-	-	-	-
10.	Pharmaceutical Science	-	-	-	-	-	-

13 b. Any other new innovation/research projects that emerged on the basis of PURSE support:

For the meaningful implementation of the DST-PURSE Programme, the University has established the Center for Interdisciplinary Studies in Science and Technology (CISST) which, on one hand, houses Centeral Experimental Facilities consisiting the equipment under DST-PURSE Programme so as to facilitated research with an optimum use of the facilities; on the other hand, it is mandatory to carry out the relavent academic activities to promote interdisciplinary activities. The following is a brief of the academic activities carried out under CISST.

(1) Interdisciplinary Research in Progress

The Research in progress during 2014-15 at CISST by the research Personal Appointed under DST-PURSE/CISST Programme is briefly described below

Sr. No.	Name and Position	Theme
1.	Dr. Rupal A. Vasant Assistant Professor	Fluorosis and its amelioration by natural products
2.	Dr. Rakesh V. Patel Assistant Professor	Nanocomposite materials
3.	Dr. Deep A. Shah Research Associate/ Assistant Professor	Chitosan Films: Preparation, Characterization and evalution for drug based formulations
5.	Ms. Mili B. Vyas Research Assistant	
6.	Dr. Mihir D. Oza	Ionic Liquids: Synthesis and Rheological measurements
7.	Ms. Anjali B. Thakkar Research Assistant	Chitosan Nanoparticles for Site Specific Drug Delivery of Herbal Actives in Management of COPD (chronic obstructive pulmonary disease) and Asthma.
8.	Ms. Swati K. Kurtkoti Research Assistant	Comparative study of properties of topically applied organogels and hydrogels for drug delivery Chitosan Nanoparticles for Site Specific Drug Delivery of Herbal Actives in Management of COPD (chronic obstructive pulmonary disease) and Asthma.
9.	Mr. Dharmesh P. Parmar Research Assistant	Clouding phenomenon and time dependent changes in viscocities of aqueous solutions of pluoronic co-polymers
10.	Mr. Hetul J. Suthar Research Assistant	Smart and self-responsive system based on programmable logical controller and android for efficient agricultural practices.
11.	Ms. Pooja A. Trivedi Research Assistant	Studies on effect of ionic liquids on the solubilization and release of drug from hydrogels based on micellar solutions of amphiphilic block copolymers in aqueous media

(2) Confrences Organized

(a) Interdisciplinary Studies in Science and Technology- Opportunities (ISST 2015) was held on 19th February, 2015

This conference consisted of expository lectures by University professors and Scientists aimed at providing Interdisciplinary Perspectives in Research to the undergraduate students.
(No. of expository talks: 5; No. of participants: 160)

(b) LCMS Workshop was organized during 21st -22nd January, 2015

This was a workshop on Liquid Chromatography/Mass Spectrometry (LC/MS) organized with the aim of spreading the knowledge about the latest advanced developments in chromatographic techniques for the benefit of industries and young researchers from academic institutions on 21st-22nd January, 2015. The main focus of the workshop was on the basic and applied aspects on classification of chromatography, principles and different analysis modes of liquid chromatography-triple quadrupole mass spectrometry including the applications in qualitative and quantitative analysis. The course consisted of lectures by expert faculty drawn from academia and industries. This was followed by hands on experience on the instrument for qualitative and quantitative analysis.
(No. of invited speakers: 02; No. of participants: 40)

(3) As a follow-up of an MOU signed at National Education Summit 2014 at Gandhinagar among University of Turku, Finland, ToolTec Industries India and SPU, Mr. Atul Khanna, ToolTec Industries India visited CISST on 14th August, 2014 for the discussions with the Faculty Members regarding the said MoU for the proposed **Centre of Biotechnology for Affordable Health Care**, to be established at CISST

(4) Regular in House Research Discussions and Interactions

The CISST arranges regular in house research presentation cum interaction cum discussion by research personnels at the center presenting the work in progress.

(5) New Programmes Initiated

The University has initiated at CISST, with **its own resources**, following M. Sc. Programs:

a) Biomedical Science and Technology
b) Defence Science and Technology
c) Earth System Sciences

The CISST also designed and submitted proposals for financial assistance to this program to the Govt. of Gujarat under Innovative Program.

The University has also alloted, since 2014, the following program to CISST.

d) M.Sc in Bioinformatics

The unique features of the M.Sc Programs at CISST include collaborative teaching by professors from different basic science departments of University as well as by research scientists from Institutes like PRL, Ahmedabad, ISRO, Ahmedabad and M.S. University, Vadodara.This further includes components like Research Projects, Seminar Presentations, Innovative Mathematics and Statistics Laboratory Courses as well as self study components.The curriculum of M.Sc. at CISST consisits of a semester long project for the students accordingly at present students are working at Physical Research Laboratory, Ahmedabad, High Energy Materials Research Laboratory (HEMRL), Pune and Envision Scientific Pvt. Ltd., Surat

(6) Collabrative Research

As a result of DST-PURSE Programme, CISST has facilitated collaborative research involving collaborators from different disciplines as follows:

a) Physics & Chemistry: Synthesis and X-Ray crystallographic Investigations of Heterocyclic compounds
b) Mathematics & Bioscience: Fractality and Allometry in some biological system and processes
c) Pharmaceutical Science & Medicine: Clinical Investigation of Hydrogel loaded with Methotrexate for treatment of Psoriasis
d) Pharmaceutical Science & Chemistry: Comparative study of Topically applied Hydrogels and Organogels in drug delivery
e) Chemistry & Biosciences : Chitosan Hydrogel Preparation, Characterization and evalution for drug based formulations
f) Bioscience & Computer Science: Bioinformatics
g) Mathematics & Finance: Fractal analysis in financial market

(7) Visitors to CISST during 2014-15

1. Prof. Dr. A. Venkatramana
   P. G. Studies in and Research in Chemistry,
   Jnana Ganga University,
   Gulbarga-585 106, Karnataka

2. Dr. Satish Chandra Gupta
   Armament Research & Development Establishment,
   Armament PO,
   Pashan, Pune-411 021

3. Dr. Himanshu Shekhar
   Scientist F, Joint Director,
   High Energy Materials Research Laboratory (HEMRL),
   Sutarwadi,
   Pune- 411 021

4. Dr. Sudhir Kumar
   Department of Materials Science and Engineering,
   National Tsing Hua University,
   Hsinchu – 30013, Taiwan (R. O. C)

5. Dr. Ajit Datar
   Advisor C.S.C
   Shimadzu Analytical (India) Pvt. Ltd, Mumbai

6. Dr. Mahadevbhai Patel
   President, R & D Support Services Inc.
   Pennsylvania, USA

7. Dr. Hemant Vaidya
   Assistant Professor at UC Davis Graduate School of Management,
   Davis, USA

(8) Central Experimental Facility

(a) Central Experimental facilities strengthened

The following new Scientific Equipments were added during 2014-15

i. Inductively Coupled Plasma Optical Emission Spectrometer (ICP-OES)
ii. Simultanious High Temperature DTA-DSC-TGA System
iii. Real Time PCR
iv. Refractive Index Detector (For Size Exclusion Chromatograph)

(9) Sample Analysis Service Provided

(I) Within the University: During the year of 2014-15 the following number of samples from Basic Science Departments like Chemistry, Bioscience from the University have been analysed using respective equipments.

a) LC-MS about 551 samples
b) Rheometer about 980 samples
c) Spectrofluorophotometer about 1415 samples
d) Partical size analyzer about 135 samples
e) Microplate reader about 234 samples
f) Isothermal titration calorimeter about 170 samples

(II) Outside the University: During the year of 2014-15 samples analysis service has been provided by the CISST to the researchers from the following institutes.

a) Charusat: Charotar University of Science and Technology
b) M. S University of Baroda
c) Veer Narmad South Gujarat University, Surat

(10) Achievements of personals at CISST

Dr. Subhash Bhatt has been awarded Emeretitus Fellowship by UGC, New Delhi

(11) Participation in Conference by CISST/ DST-PURSE personals during 2014-15

Name	Conference	Date
Dr. Rupal A. Vasant	National Symposium on Dryland Birds: Strategy for Conservation and Management	9th- 10th Jan., 2015
	A state level new generation seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
Dr. Rakesh V. Patel	A state level new generation seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
	A national conference on Thermodyanamics of Chemical, Biological, Environmental and Non-conventional Energy Systems	17th-18th Oct., 2014
Dr. Deep A. Shah &	A state level new generation seminar on	19th Feb., 2015

Ms. Mili B. Vyas	Interdisciplinary Studies in Science & Technology- Opportunities	
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
	A national conference on Innovations & Recent Trends in Drug Discovery Techniques, Radio-Labeling & Applied Science Research	23rd-24th Jan., 2015
Dr. Mihir D. Oza	A state level New Generation Seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
	A national conference on Thermodyanakics of Chemical, Biological, Environmental and Non-conventional Energy Systems	17th-18th Oct., 2014
Ms. Swati K. Kurtkoti & Ms. Anjali B. Thakkar	A state level New Generation Seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
	A national seminar on Forced Degradation Study: A Need of Analytical Method Development	7th Feb., 2015
Mr. Hetul J. Suthar	A state level New Generation Seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
	A national conference on Frontiers In Instrumentation	11th Oct., 2014
Ms. Pooja A. Trivedi	A state level New Generation Seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015
Mr. Dharmesh P. Parmar	A state level New Generation Seminar on Interdisciplinary Studies in Science & Technology- Opportunities	19th Feb., 2015
	Workshop on Liquid Chromatography- Mass Spectrometry (LC-MS/MS)	21st-22nd Jan., 2015

13 c. Did newly created facility lead to betterment of quality of research publications?

Yes certainly it led and would lead.

13 d. Any patent filed by the University as a result of PURSE grant.

No

14. Is any problem faced in utilization of the grant/facilities?

No

15. A report highlighting the research activities of the University using facilities crated under PURSE Initiative during the period under review may also be provided:

Please see Annexure – IV for details (Page Nos. 83 to 94)

(Prof. Dr. N. V. Sastry)
Nodal Officer, PURSE-DST Program

(Prof. Dr. Harish Padh)
Vice Chancellor
Coorodinator
PURSE-DST Program

Annexure – I

DST-PURSE PROGRAMME

Center for Interdisciplinary Studies

in

Science and Technology (CISST)

SARDAR PATEL UNIVERSITY

VALLABH VIDYANAGAR-388 120

Summary of Ongoing Research Work by

Personnel appointed under PURSE Programme

Name: **Dr. Deep A. Shah and Ms. Mili B. Vyas**
Position: **Research Associate (Presently Asst. Prof. CISST) / Research Assistant**
Department: **DST-PURSE Programme**
Research Mentor: **Prof. Dr. N. V. Sastry**

Title: **Chitosan Films: Preparation, Characterization and Evaluation for Drug based Formulations**

Objectives:

- To synthesize and set up conditions of low molar mass chitosan samples by acid hydrolysis of commercial higher molar mass homologue.
- To characterize the samples by FTIR spectroscopy.
- To determine the molar mass and rms radius of the chitosan by viscosity and static light scattering methods.
- To establish the solution conditions for chitosan gel formation from Rheological measurements.
- To obtain rheological characteristics such as zero shear viscosity, loss modulus, storage modulus and complex viscosity for adjudging the rheo-mechanical behavior in terms of relaxation models.
- To prepare the films of above samples for immobilization of various hydrophobic drugs and monitor their release.
- Characterization of the films for their dynamic mechanical and thermal behavior.
- To study and model the drug release efficiency and establish its release mechanism.

Work done:

Three different low molar mass samples of chitosan were obtained by acid hydrolysis of molar mass chitosan commercial samples. As obtained, samples were drawn into films by following procedure: The samples were first dissolved in 0.25 mol.dm^{-3} acetic acid aqueous solutions under stirring for 2 hrs. The solutions were sonicated for about 30 min for removal of entrapped air and to obtain homogeneous dispersed solution. Then the solutions were warmed upto 60°C for getting required flow and transferred to petri dish and were kept in oven maintained at 65°C for 24 hours. Good transparent and standing films were obtained. Dexamethasone (a steroidal drug) was also incorporated into chitosan films using steps as describe above but in drug aqueous solutions.

The films were analyzed and characterized by dynamic mechanical analysis (DMA, Triton DMA Instrument) to obtain stiffness and damping factor in terms of modulus and tan delta. The thermo analytical properties of chitosan films were evaluated by Thermogravimetric analysis and Differential Scanning Calorimetry (TA instrument, SDT Q 600).
To study drug release, the dexamethasone loaded chitosan films were placed in the vessels containing of phosphate buffer solution (20 ml, pH 7.4) as the dissolution medium. The vessels were incubated at 37°C with continuous stirring at 100 rpm. To determine the amount of the dexamethasone released at definite time interval, a 2 ml aliquot was taken from the released media and carefully replenished with 2 ml of fresh phosphate buffer solution. The amount of DEX released was quantified using UV-visible spectroscopy (Molecular devices M2e) by monitoring the maximum absorbance at 242 nm. Percentage of drug dissolved at different time intervals was calculated using the calibration curves constructed from the reference standards.

Data obtained from *in vitro* drug release analysis were fitted to various existing kinetic models in literature to determine the kinetics and mechanism of drug release from chitosan films. The kinetic model dependent approaches included zero order, first order, Higuchi, Hixson-Crowell, Korsmeyer-Peppas and Ritger peppas models. The release constants were obtained from the slope of the appropriate plots, and regression coefficient (R^2) was determined by linear regression analysis.

The results are presented in Fig. 1 – 5.

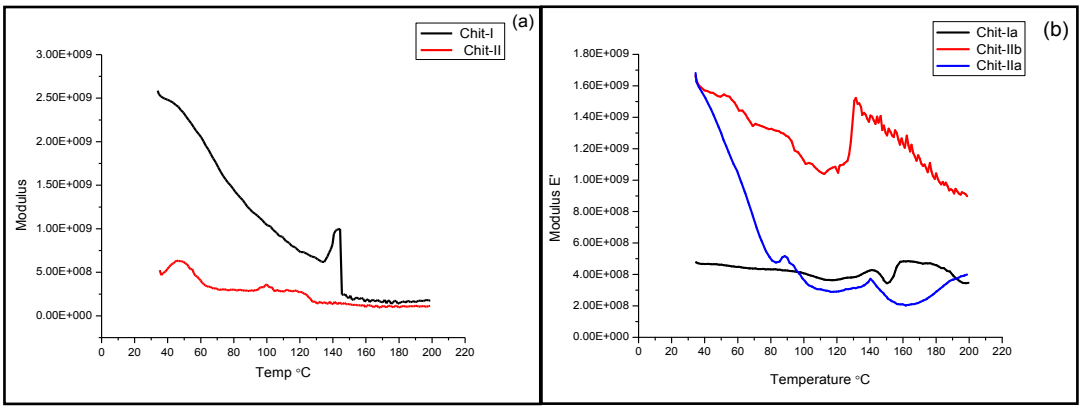


Fig. 1: Temperature dependence of storage modulus (*E'*) of

(a) Chit-I, Chit-II (b) Chit-I_a, Chit-II_a, Chit-II_b

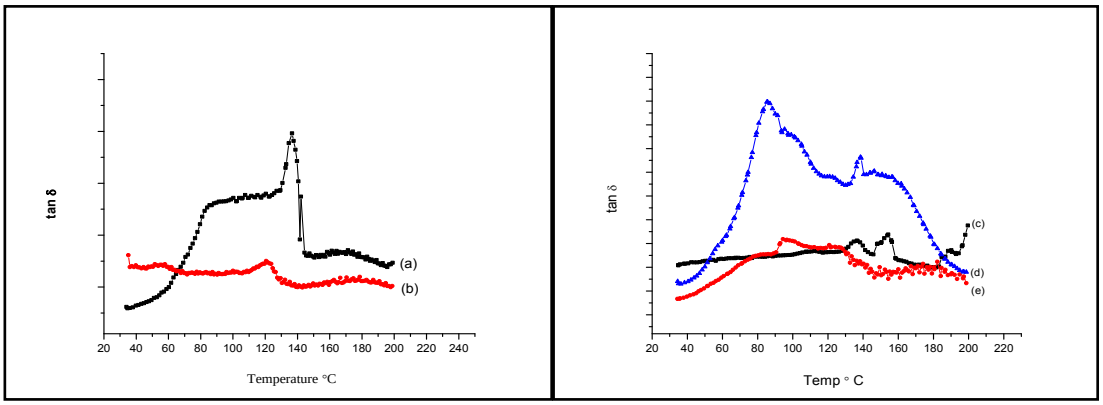


Fig. 2: Tanδ curves of (a) Chit-I (b) Chit-II (c) Chit-I_a (d) Chit-II_a (e) Chit-II_b

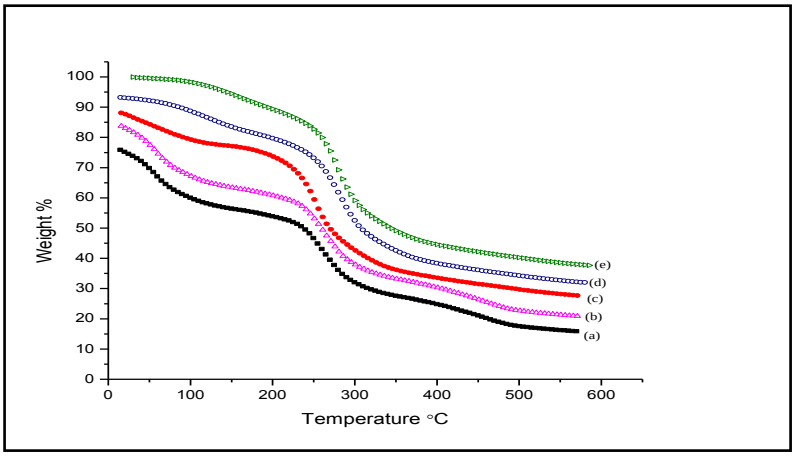


Fig. 3a: Thermogravimetric graphs of (a) Chit-I (b) Chit-I_a (c) Chit-II (d) Chit-II_a (e) Chit-II_b

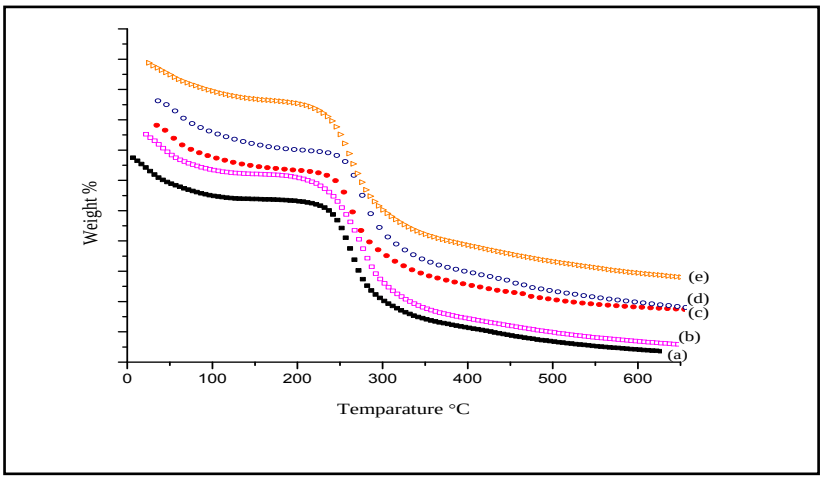


Fig. 3b: Thermogravimetric graphs of DEX loaded chitosan films

(a) 6Chit-I (b) 6Chit-I_a (c) 6Chit-II (d) 6Chit-II_a (e) 6Chit-II_b

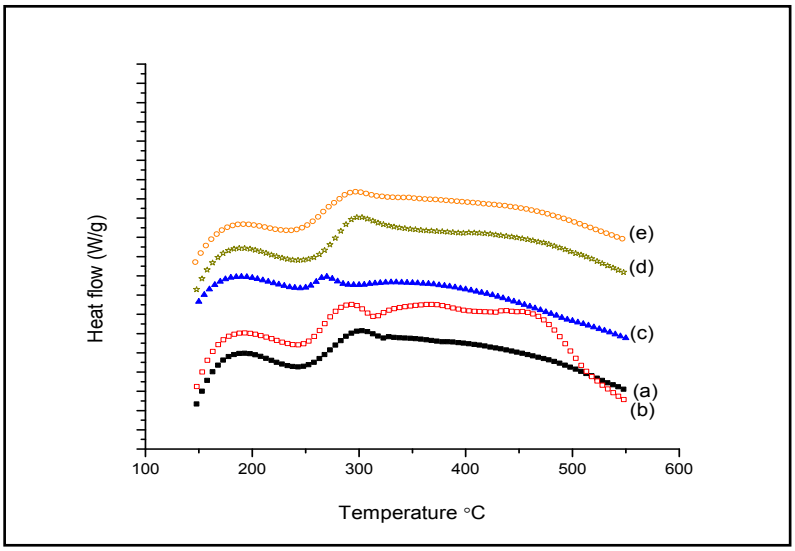


Fig. 4a: DSC curves of blank films (a) Chit-I (b) Chit-I_a (c) Chit-II (d) Chit-II_a (e) Chit-II

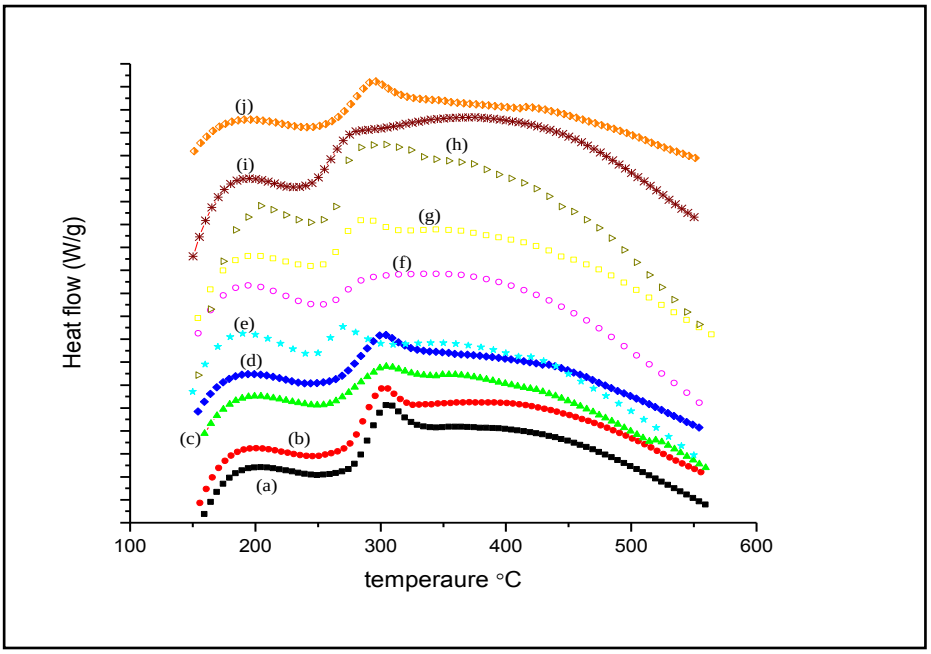


Fig. 4b: DSC curves DEX loaded films (a) 6Chit-I (b) 10Chit-I (c) 6Chit-I_a (d) 10Chit-I_a (e) 6Chit-II (f) 10Chit-II (g) 6Chit-II_a (h) 10Chit-II_a (i) 6Chit-II_b (j) 10Chit-II_b

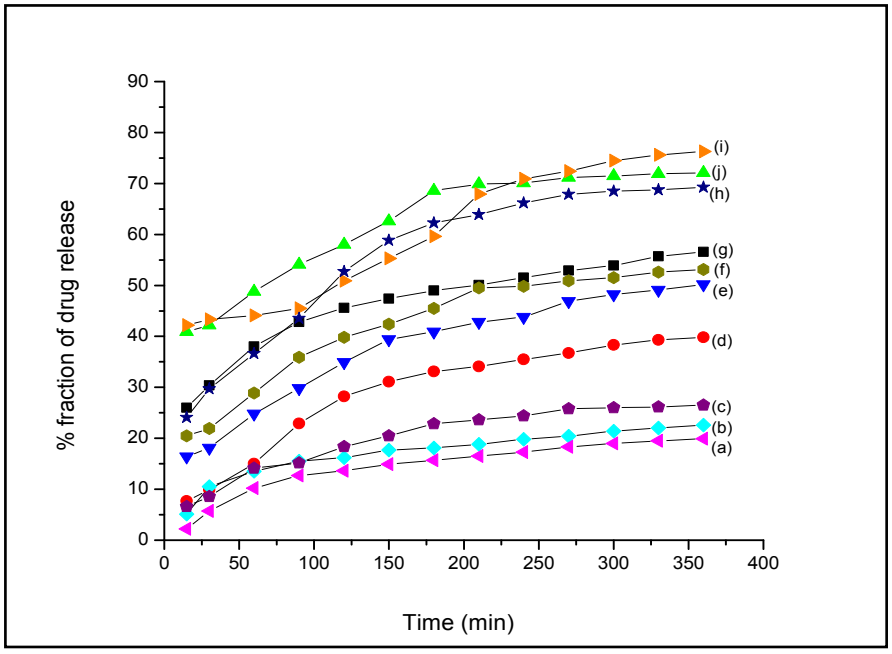


Fig. 5: Percentage fraction of drug released as a function of time of different concentrations of DEX loaded (a) 10Chit-II (b) 6Chit-II (c) 10Chit-I (d) 6Chit-I (e) 10Chit-II_b (f) 6Chit-II_b (g) 10Chit-I_a (h) 6Chit-I_a (i) 10Chit-II_a (j) 6Chit-II_a films

Table.1 Correlation co-efficient (r) and reaction constant K of the Kinetic Models applied to the release of dexamethasone from different films

Chitosan films	Zero order		First order		Higuchi		Korsmeyer Peppas		Hixone crowell		Ritger Peppas	
	r^2	K	r^2	K	r^2	K	r^2	K	r^2	K	r^2	K
Chit II_b (10 mg)	0.890	0.086	0.820	0.000	0.961	2.126	0.985	-4.20	0.915	-0.002	0.890	-0.001
Chit II_b (6 mg)	0.840	0.084	0.689	0.002	0.941	2.119	0.949	0.302	0.866	-0.001	0.840	-0.001
Chit I_a (6 mg)	0.861	0.094	0.778	0.002	0.926	2.302	0.952	-1.843	0.878	-0.002	0.861	-0.001
Chit I_a (10 mg)	0.814	0.090	0.780	0.000	0.915	2.274	0.953	-6.16	0.837	-0.002	0.814	-0.001
Chit I (10 mg)	0.803	0.042	0.658	0.002	0.898	1.060	0.907	-0.148	0.818	0.00	0.803	-0.001
Chit I (6 mg)	0.770	0.040	0.554	0.002	0.892	1.034	0.871	0.500	0.785	0.00	0.770	-0.001

Table 2. Interpretation of diffusion release mechanism from drug loaded different chitosan films

Drug System	Release exponent(n)	Drug release mechanism
Chit II_b (10 mg)	3.803	super case II transport
Chit II_b (6 mg)	0.527	non-Fickian transport
Chit I_a (6 mg)	2.550	super case II transport
Chit I_a (10 mg)	4.636	super case II transport
Chit I (10 mg)	1.939	super case II transport
Chit I (6 mg)	1.454	super case II transport

Key findings of the work done:

- The chitosan films with and without drug dexamethasone were successfully prepared.
- The Dynamic mechanical analysis confirmed that the stiffness of the chitosan film was high as it was having high storage modulus (Fig.1)
- Thermogravimetric analysis of the chitosan films showed the molar mass dependent degradation behaviour. The high molar mass chitosan film showed maximum degradation temperature. Approximately 25 to 40% weight loss at 600 °C is seen for all chitosan films. . It can be observed that weight loss is more as the molar mass decreases (Fig. 3a, 3b)
- Differential scanning calorimetric curves showed the exothermic peak of blank chitosan films in the temperature range between about 200 to 300 °C corresponding to the decomposition of the polymer while this peak appeared in the temperature range between about 240 to 350 °C in dexamethasone loaded chitosan films.

- The T_g (glass transition temperature) of the samples ranged from 120° C-190°C (Fig. 2 and Fig. 4a, 4b). It can be observed that as the molar mass of the chitosan decreases the T_g of the blank chitosan films decreases from the DSC curves. Also with the increase in the concentration of DEX in chitosan films, the T_g increases. The variation in T_g may be due to the differences in film composition and presence or absence of drugs in the film. The shift in the T_g of dexamethasone loaded chitosan films indicated weak interactions between amino group of chitosan and hydroxyl group of dexamethasone.
- The release profile from chitosan film showed a rapid dexamethasone release within first hour. This release is attributed to the passive diffusion of dexamethasone from the chitosan film into release medium. Chitosan films have produced sustained release of DEX in all formulations (Fig. 5)
- The drug release kinetic studies showed that dexamethasone release from the chitosan films followed Korsmeyer-Peppas model (Table 1) and it was found that some of the formulations followed non Fickian diffusion drug release while some followed super case II transport (Table 2)

Manuscripts under preparation:

N. V. Sastry, Deep A. Shah, Mili B. Vyas , 2015. Chitosan Films: Preparation, Characterization and Evaluation for Drug based Formulations, **Int. J. Biomacromolecules** (To be submitted soon)

Participations at conferences:
Uka Tarsadia University, Bardoli Mahuwa Road, SURAT, GUJARAT

"Innovations & Recent Trends in Drug Discovery Techniques, Radio-Labeling & Applied Science Research", 23rd – 24th Jan. 2015.

Details of other work:

Workshop on **LIQUID CHROMATOGRAPHY- MASS SPECTROMETRY (LC-MS/MS)** on 21st-22nd January 2015 organized by Centre for Interdisciplinary Studies in Science and Technology (CISST) Under the auspices of DST-PURSE Programme, Sardar Patel University, Vallabh Vidyanagar:

Mili Vyas, Organizing Secretary and Dr. Deep Shah, Member of Organizing Committee

A state level New Generation Seminar on **Interdisciplinary Studies in Science & Technology-Opportunities (ISST-2015)**, 19th February, 2015 organize by Centre for Interdisciplinary Studies in Science & Technology (CISST), DST-PURSE Programme Sardar Patel University, Vallabh Vidyanagar

Dr. Deep Shah, Organizing Secretary, Mili Vyas, Member of Organizing Committee

Analytical services:

- LC-MS: No. of samples - 200, Spectroflurophotometer: No. of samples - 20, Particle size analyzer: No. of samples - 47, Rheometer: No. of samples – 144, as from various departments.
- Conducted M. Sc Sem-I & Sem–II Chemistry practical at Centre for Interdisciplinary Studies in Science and Technology (CISST), Sardar Patel University, Vallabh Vidyanagar.

Name: **Anjali Thakkar and Swati Kurtkoti**

Position: **Research Assistants**

Department: **DST-PURSE Programme**

Research Guide: **Prof. Dr. N.V.Sastry**

Title: Chitosan Nanoparticles for Site Specific Drug Delivery of Herbal Actives in Management of COPD (chronic obstructive pulmonary disease) and Asthma.

Objectives:

- **Characterization of herbal extracts of *Boswellia serrata***
- **Preparation of Chitosan Nanoparticles**

  Chitosan nanoparticles is to be prepared by the ionic Gelation technique using Tripolyphosphate (TPP)
- **Evaluation of Chitosan Nanoparticles**
  I. Particle size determination
  II. Zeta potential analysis
  III. Characterization of Drug using HPLC
- **Evaluation of Drug loaded Chitosan Nanoparticles**
  I. Particle size determination
  II. Zeta potential analysis
  III. % entrapment efficiency determination
- **Optimization of Nanoparticle synthesis using the statistical approach**
- **Loading of drug in Chitosan Nanoparticles**

Work done:

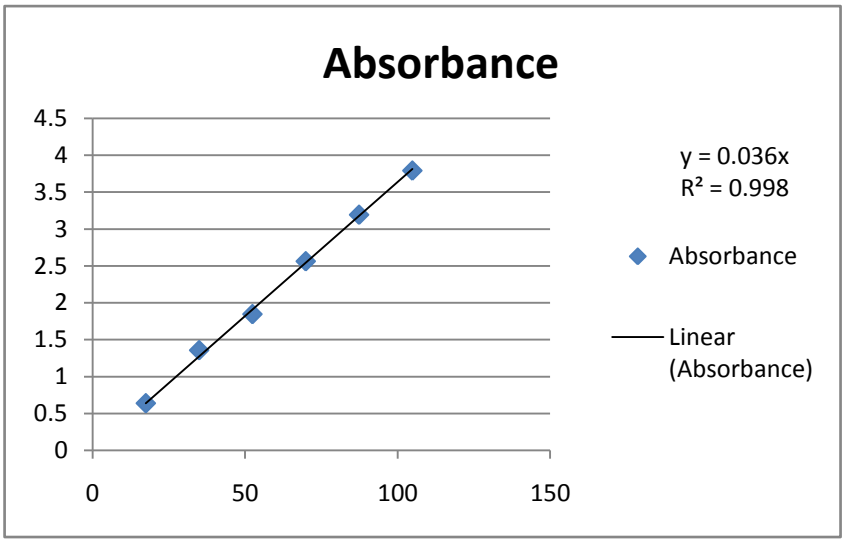
- **Characterization of herbal extracts of *Boswellia serrata***.
  Qualitative Analysis of *Boswellia serrata* extract (BSE) using Liquid chromatography mass spectroscopy (LC-MS) Accurately weighed 50 mg standard BSE powder was dissolved in 25 mL of methanol to get a BSE stock solution.

Chromatographic conditions: The mobile phase consisted of acetonitrile–water (90:10, % v/v) adjusted to pH 4 with glacial acetic acid.

Samples were analyzed using the following parameters: flow rate, 2.0 mL/min; injection volume, 20 µL; run time 18 min; temperature, 27 ± 2ºC; detection wavelength, 260 nm.

The Quantification was done using UV-spectrophotometer. (Using Microplate M_2e Model of Molecular Device)

Accurately weighed 50 mg standard BSE powder was dissolved in 25 mL of methanol to get a BSE stock solution and then prepare working stock solutions of (1,2,3,4,5ml take from the stock solutions and form the dilutions and take the OD at 239nm) and form the Calibration curve.



- **Preparation of Blank chitosan nanoparticles**

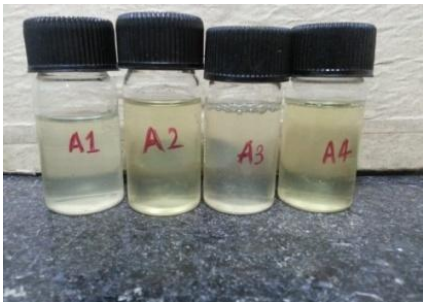
Chitosan solutions (25 mL) of different concentrations (1% w/v, 2% w/v) were prepared by dissolving chitosan in 1% acetic acid under stirring at room temperature. After dissolving completely, Tween-80 (2% v/v) was added as a surfactant. Subsequently, dichloromethane (2.5mL) was added, under stirring at 1250 rpm under magnetic stirring. Stirring was continued for 5 minute.

The formed emulsion was then sonicated for 15min using an ultrasonic bath sonicator. Later cross-linking of the particles was induced by the drop wise addition of tripolyphosphate (TPP) solutions (10mL) of different concentration (0.1% w/v, 0.2% w/v) into o/w emulsion under magnetic stirring at 500 rpm.

To ensure complete evaporation of dichloromethane, it was kept overnight at 40˚C under stirring at 90 rpm on a magnetic stirrer.

The drug loaded chitosan nanoparticles were prepared in the same manner as above. Drug was dissolved in dichlorormethane and added to form the emulsion in order to get the drug loaded chitosan nanoparticles.

A



B

A: contain blank chitosan nanoparticles, **B:** contain drug loaded chitosan nanoparticles

- **Particle size analysis of formulated chitosan nanoparticles**

  The particle size of the chitosan nanoparticles was measured by dynamic light scattering method using High Performance Particle size Analyser with zeta potential measuring system (Horiba Nano Partica SZ-100)

- **Zeta potential measurement of formulated chitosan nanoparticles**

  The Zeta Potential was measured using High Performance Particle size Analyser with zeta potential measuring system (Horiba Nano Partica SZ-100)

- **Determination of drug entrapment efficiency**

  Nanoparticles were isolated by centrifugation at 10,000 rpm for 45 minutes at 20◦C using cooling centrifuge and the supernatant was used for the measurement of free Boswellic acid (KBA:11-keto-β-boswellic acid and AKBA:3-O-acetyl-11-keto-β-boswellic acid) by Liquid chromatography Mass spectrometry technique (LC-MS 8030, shimadazu, Japan) which is mentioned in to the table 1.

  The drug loading of selected formulation were calculated by the following equation

$$\%\ \text{Drug loading} = \frac{D_a - D_s}{N_a} * 100,$$

  where Da is the total amount of drug added in system, Ds is the amount of drug in supernatant after the centrifugation, and Na is the total amount of nanoparticles obtained.

- **Statistical Analysis of Response by MiniTab**

  Minitab 17 software was used for the analysis of effect of each variable on the response. The statistical significance of the difference in particle size, percentage of drug encapsulation, percentage of drug loading and zeta potential was tested by one-way analysis of variance. The significant response polynomial equations generated by Minitab were used to validate the statistical design. Quantitative and qualitative contributions of each variable on each of the

responses were analyzed. Response surface plots were generated to visualize the simultaneous effect of each variable on each response parameter.

- **Selection of Optimized Formulation on the Basis of Desirability Function**
  The percentage of drug encapsulation efficiency and percentage of drug loading values were maximized in the optimization procedure, as optimized nanoparticles batch should have high percentage of drug encapsulation efficiency and percentage of drug loading. The desirability functions of four responses were calculated using the following equation:

$$\mathrm{ID}_1 \text{ or } \mathrm{ID}_2 = \frac{Y_i - Y_{\min}}{Y_{\text{target}} - Y_{\min}},$$

Where ID_1 is the individual desirability of percentage of drug encapsulation efficiency and ID_2 is the individual desirability of percentage of drug loading.
The values of Y_{target} and Y_{min} are the maximum and minimum response for entrapment efficiency and drug loading where as Y_i is the individual response for entrapment efficiency and drug loading.
The particle size and zeta potential value was minimized in the optimization procedure, as optimized nanoparticles batch should have low particle size and low zeta potential. The desirability functions of this response were calculated using the following equation:

$$ID_3 \text{ or } ID_4 = \frac{Y_{max} - Y_i}{Y_{max} - Y_{target}}$$

Where ID_3 is the individual desirability of particle size and ID_2 is the individual desirability of zeta potential.
The values of Y_{target} and Y_{max} are the minimum and maximum response for entrapment efficiency and drug loading where as Y_i is the individual response for particle size and zeta potential.

Key findings of the work done:

The Qualitative Analysis of boswellic acid extract was done using Liquid Chromatography Mass Spectroscopy. Figure 1a and b represents the chromatogram of boswellic acid extract and its corresponding mass spectra. The chromatogram of the standard Boswellic acid extract solution shows two major peaks at 4.30 min and 7.11 min retention times. The mass analysis of the respected peaks shows the mass of 417 and 513 corresponding to the molecular weight of 11-keto β Boswellic acid (11-KBA) and Acetyl-11-Keto β Boswellic acid (A-11-KBA) respectively this confirms the presence of (11-KBA) and (A-11-KBA)

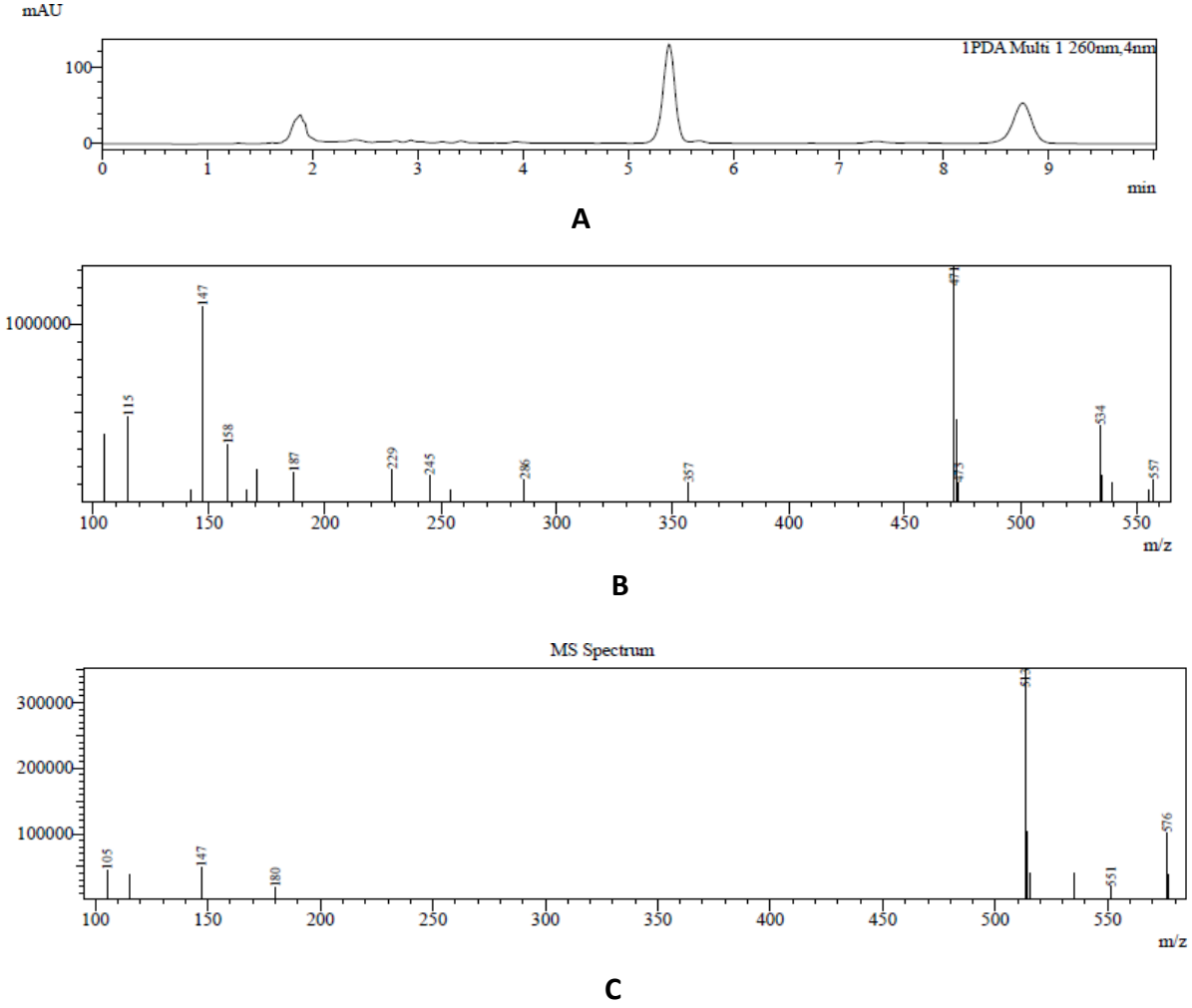


Fig 2. A) Chromatogram of Boswellic acid extract **B)** Mass spectra corresponding to the retention time 5.38min of 11-KBA **C)** Mass spectra corresponding to the retention time 8.7min of A-11-KBA

Table 1: Formulation composition nanoparticles

BLANK					
Formulation	**Composition**				**Appearance**
	Chitosan (%)	**TPP (%)**	**Tween80 (%)**	**Drug (mg)**	
No Chitosan	-	0.2	2	-	Clear solution
B3	1	0.2	2	-	Colloidal (white hazy)
B2	2	0.1	2	-	Colloidal (white hazy)
B1	1	0.1	2	-	Colloidal (white hazy)
B4	2	0.2	2	-	Colloidal (white hazy)
Drug Loaded					
A4	2	0.2	2	50	Yellowish turbid
A2	2	0.1	2	50	Yellowish turbid
A1	1	0.1	2	50	Yellowish turbid
A3	1	0.2	2	50	Yellowish turbid

- Particle size of the blank chitosan nanoparticles was found to be in the range of 12 to 70 nm while particle size of the drug loaded chitosan nanoparticles was found to be in the range of 50 to 160nm
- Zeta potential of all the formulations was found to be a positive value
- From the statistical analysis it can be concluded that A4 is the best formulation

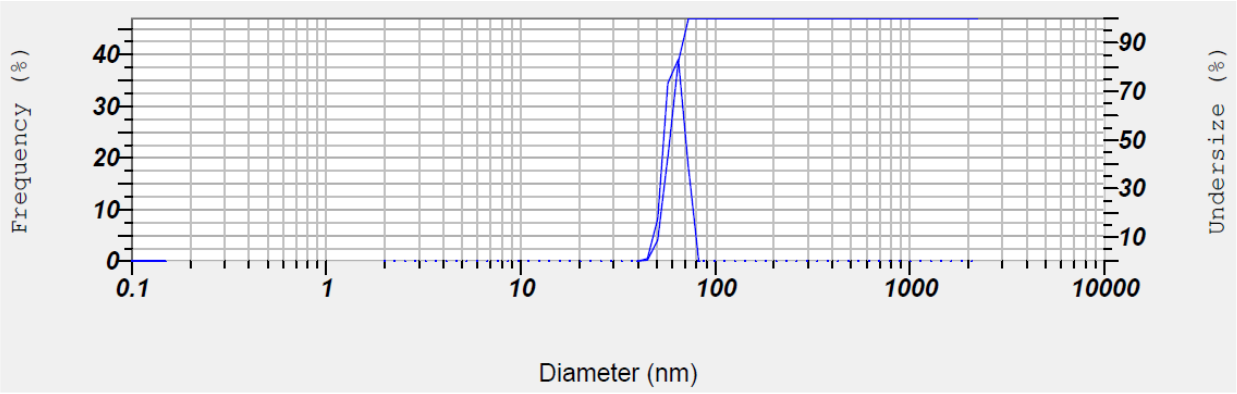


Fig 3: The particle size distribution of formulation A4

Measurement Results

Date	:	Saturday, December 20, 2014 4:36:12 PM
Measurement Type	:	Zeta Potential
Sample Name	:	A4
Temperature of the Holder	:	24.9 °C
Dispersion Medium Viscosity	:	0.897 mPa·s
Conductivity	:	3.893 mS/cm
Electrode Voltage	:	2.7 V

Calculation Results

Peak No.	Zeta Potential	Electrophoretic Mobility
1	8.1 mV	0.000062 cm2/Vs
2	--- mV	--- cm2/Vs
3	--- mV	--- cm2/Vs

Zeta Potential (Mean)	:	8.1 mV
Electrophoretic Mobility Mean	:	0.000062 cm^2/Vs

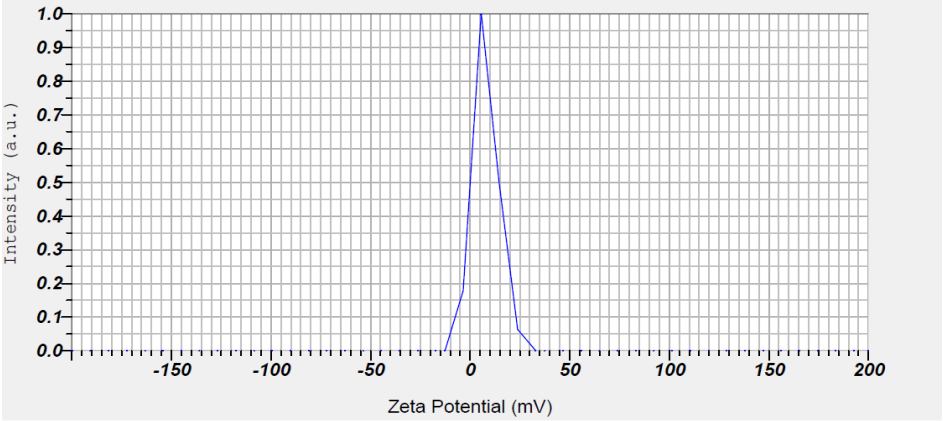
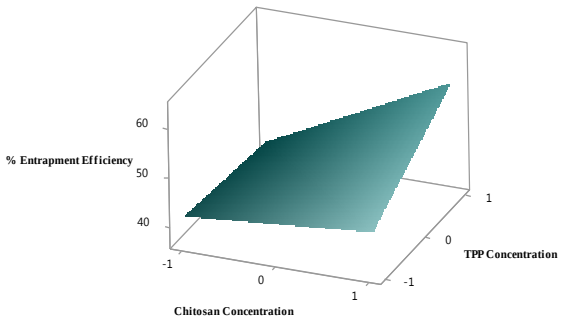


Fig 4: Zeta potential of formulation A4

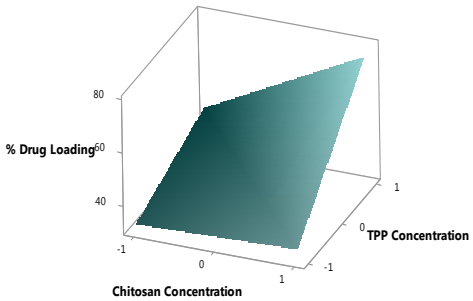
Table 2. Drug entrapment efficiency of chitosan solutions

Formulations	Drug entrapment efficiency of KBA	Drug entrapment efficiency of AKBA	Combined Drug entrapment efficiency of KBA & AKBA
A1	-	-	-
A2	46.25%	43.33%	45.33%
A3	41.26%	37.14%	39.91%
A4	52.85%	63.95%	56.90%

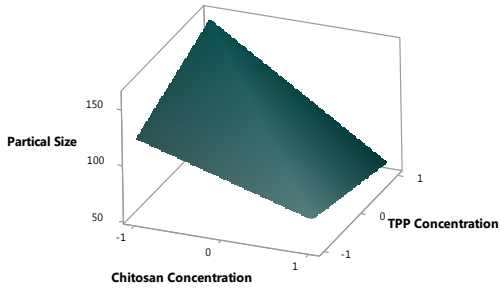
Surface response curve



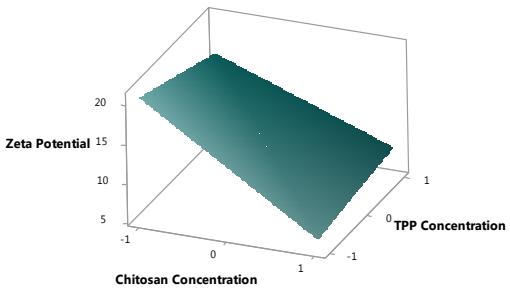
A



B



C



D

Fig 5: surface response curve of **A)** % Entrapment efficiency **B)** % Drug Loading **C)** Particle size and **D)** zeta potential vs chitosan concentration and TPP concentration.

Details of Publications:

Manuscripts under preparation:

1. **Thakkar Anjali B., Sastry N.V., Kurtkoti S.K.,** Phytochemical analysis, Antibacterial and Free radical scavenging activity of fruit and peel extracts of *Trapa bispinosa Roxb, Applied biochemistry and biotechnology* .(To be submitted soon)
2. **Kurtkoti S.K., Sastry N.V.,** Comparative study of properties of topically applied organogels and hydrogels for drug delivery, *American Association of Pharmaceutical Scientists* (To be submitted soon)

Participations at conferences:

Participated in one day National Seminar on 'Forced degradation study: A need of analytical method development' SPONSORED by Gujarat Technological University, (GUJCOST) at 07/02/2015 in INDUKAKA IPCOWALA COLLEGE OF PHARMACY, New Vidyanagar, Anand

Other Details:

1) Workshop on **LIQUID CHROMATOGRAPHY- MASS SPECTROMETRY (LC-MS/MS)** on 21st-22nd January 2015 organized by Centre for Interdisciplinary Studies in Science and Technology (CISST) Under the auspices of DST-PURSE Programme, Sardar Patel University, Vallabh Vidyanagar: Swati K. Kurtkoti and Anjali B. Thakkar , Member of Organizing Committee

2) A state level New Generation Seminar on **Interdisciplinary Studies in Science & Technology-Opportunities (ISST-2015)**, 19th February, 2015 organize by Centre for Interdisciplinary Studies in

Science & Technology (CISST), DST - PURSE Programme Sardar Patel University, Vallabh Vidyanagar: Swati K. Kurtkoti and Anjali B. Thakkar , Member of Organizing Committee

Other Work:

- Analysed 70 samples (from user department/institute) for Rheological studies
- Analysed 179 samples (from user department/institute) for particle size measurements and 48 samples for Zeta potential measurements
- Analysed 234 samples (from user department/institute) of UV-absorbance by Microplate Reader
- Took Biology practicals of M.Sc Biomedical Science/Earth Science/Defence Science (Semester I) and M.Sc Biomedical Science (Semester III)

Name: **Swati Kurtkoti**
Position: **Research Assistant**
Department: **DST-PURSE Programme**
Research Guide: **Prof. Dr. N. V. Sastry**

Title: **Comparative study of properties of topically applied organogels and hydrogels for drug delivery**

Objectives: Formulation of different gels

- Formulation of Organogel (Span 60-Sunflower oil organogel) and Hydrogel

Evaluation of Physico-Chemical properties of the formulated gels

- Evaluation of gels for pH, Spreadability, Gel-Sol temperature, Rheological properties and in-vitro diffusion studies.

Comparison of properties of organogel and hydrogel

Work done:

1) Quantification of Dexamethasone

Dexamethasone was quantified using LCMS. For chromatographic analysis, an enable C18 column (150 mmx4.6 mm i.d, 5µ particle size,) was used. Separation was carried out by binary elution. The mobile phase consisting of Methanol: Water in the ratio of 80:20 v/v was used. The injection volume was 10µl and the flow rate was 0.4ml/min. UV detection was carried out at 238 nm. Chromatographic separations were carried out at room temperature (25-30°C). The calibration curve was prepared with the linearity in the range of 0 to 5ng/ml.

2) Formulation

Preparation of hydrogel

The carbopol hydrogel (H1) was prepared by allowing the weighed quantity of carbopol (Table 1) to be soaked in distilled water until complete swelling and dispersion of the polymer was achieved. The dispersion was then stirred for homogenization. The homogenised dispersion was neutralised with NaOH to obtain a neutral pH (pH 6-7) and a viscous gel was obtained. Dexamethasone (0.4% w/w) was accurately weighed and dissolved in sufficient ethanol to form a clear solution. This was then added to the previously formed gel under stirring to obtain the drug loaded hydrogel.

Preparation of Organogel

The organogels were prepared by solid-fibre mechanism. Accurate quantity of sunflower oil (Table 1) was taken in a culture tube and heated to 60˚C on a water bath under stirring. Further, specified quantity of tween 80 and span 60 was added and allowed to form a homogeneous clear solution. To this solution, accurately weighed quantity of dexamethasone (0.4% w/w) was added under stirring to get a homogeneous dispersion of drug in the melt. Stirring was continued for two min for homoginization. The mixture was allowed to cool to give drug loaded organogel

Table 1 Composition of gels

Gels	Ingredients (%w/w)						
	Span60	Tween80	Sunflower oil	Carbopol	NaoH	Water	Drug
Organogel	20	2	78	-	-	-	0.4
Hydrogel	-	-	-	2	trace	q.s	0.4

a) Determination of pH of the gels

The surface pH of the gels was determined by bringing the probe of the digital pH meter in contact with the sample.

b) Determination of spreadability

The spreadability of each gel was measured using a fabricated spreadability apparatus which consisted of two glass slides. The known weight of gel (0.5g) was placed on the lower glass slide and the upper glass slide was placed on it. Above this a known weight (125gms) was placed for 1 min and the diameter of spread area of the gel after 1 min was measured.

Spreadability was measured using the formula:

$$S = M \times L/T$$

Where, M = weight taken, L = mean diameter of the spread area, and T = time.

c) Rheological studies

The zero shear viscosity of the gels was determined by the modular compact rheometer using the plate-plate probe at room temperature. The linear viscoelastic region of the gel was determined by measuring the storage modulus and loss modulus as functions of the strain. The gel was further subjected to frequency sweep test at frequency of 0.01 to 100rads-1 at room temperature. Using the frequency sweep test the storage modulus, the loss modulus and the complex viscosity was analyzed. The temperature sweep analysis of the gel was done from 10˚C to 80˚C using the cone plate probe.

4) In-Vitro Drug Release Study:

In-Vitro drug release studies were carried out using Franz Diffusion Cell Apparatus. The receptor compartment was filled with 7.5 ml of Phosphate buffer saline pH 7.4 as the dissolution media. The donor compartment and the receptor compartment were separated using dialysis membrane (molecular weight cut off 100kDa.) The dialysis membranes were hydrated in phosphate- buffer saline pH 7.4. Accurately weighed quantity of organogel and hydrogel were placed in the donor compartment. The diffusion cell was maintained at 37 ± 0.5 0C and was stirred at 100 rpm. At specified intervals of time 1 ml of the sample was withdrawn and analyzed for drug content using LCMS. The data obtained was analyzed by applying various drug release kinetic models, so as to find out best fit model.

Key findings of the work done:

Organoleptic characteristics of gels:

The organoleptic characteristics of the gel need to be studied as it directly influences the acceptability of the formulation by the end users. The cosmetic qualities such as colour, odour, texture and consistency are very important and need to be studied in detail. The prepared hydrogel were transparent, homogeneous in appearance and solid-like gel. The organogel were found to be opaque with slight yellowish white colour. They had an agreeable odour and smooth and solid gel like appearance. However, the drug loaded organogel was found to be pure white in colour. This may be due to the uniform distribution of the drug in the organogel matrix. The opacity of organogel further protects the drug from direct exposure to light and thus may reduce the degradation of drug by light.

pH of the gels

The pH of the organogels and hydrogels were found to be in the range of 6.0 to 7.0 which is compatible with the skin pH indicating their use for topical and transdermal delivery. The pH of gels are shown in table 2

Spreadability

The spreadability of a given formulation determines the ease of application of the formulation especially for topical use. The higher the spreadability of the formulation the better is its applicability. The spreadability of both the gels is as shown in Table 2. The spreadability of both the gels was found to be comparatively similar

Rheological characteristics

Rheological analysis provides detailed information for optimizing and evaluating topical semisolids, including information about the structure, consistency and phase transition process. The viscosities of the gels are shown in **Table 2.** A gel, in terms of rheology, can be described as a semisolid preparation for which the storage modulus and loss modulus are frequency independent and phase angle ($\tan\delta$) is low at all frequencies. When the double logarithmic graph of G', G" and η^* was plotted as a function of angular frequency ω at room temperature, it was observed that for organogel and hydrogel **(Fig 1)**, the storage modulus G' was higher than the loss modulus G" at all given point. This indicates that the elastic properties were more prominent than the viscous properties and these gels exhibited typical rheological behavior of gel networks. Furthermore, the complex viscosity η^* showed a linear decrease with the increase in the frequency thus exhibiting a shear thinning effect. Such systems are useful in topical formulations as higher viscosities are desirable during storage (low shear rate) and lower viscosities on application of shear helps in application of the formulation on skin.

Fig 2 shows the rheological properties of the gels during heating and cooling cycles, in which it can be seen that the organogel shows thermo reversibility whereas no thermo reversibility was seen in case of hydrogel. The entire graph can be divided into 4 regions. The first region, (10-15^{0}C) were a slight decrease in the storage and loss modulus was seen. The second region (15-45^{0}C) represents the glassy transition state (1st order transition). The third region (45-60^{0}C) shows the pseudo transition stage were the gel exhibited visco-elastic properties and the last region (60-80^{0}C) shows the 2nd order transition where the gel shows fluid behavior. Compared to organogel, the hydrogel did not show any such phases in heating and cooling cycle.

Fig 3 shows the loss tangent curves for both the gels. In case of organogel, the phase angle was less than 1. At temperature 38.08^{0}Cthe tan delta value was equal to 1 which corresponds to the gel point. Gel point is the point at which crystallization phenomenon is seen and the crystal aggregates into clusters.

Table 2 Physicochemical properties of Gels

Gels	pH	Spreadability gcm/sec	Viscosity(mPa, at room temperature)
Organogels	6.32	5.46	68035
Hydrogels	6.89	5.2	12198000

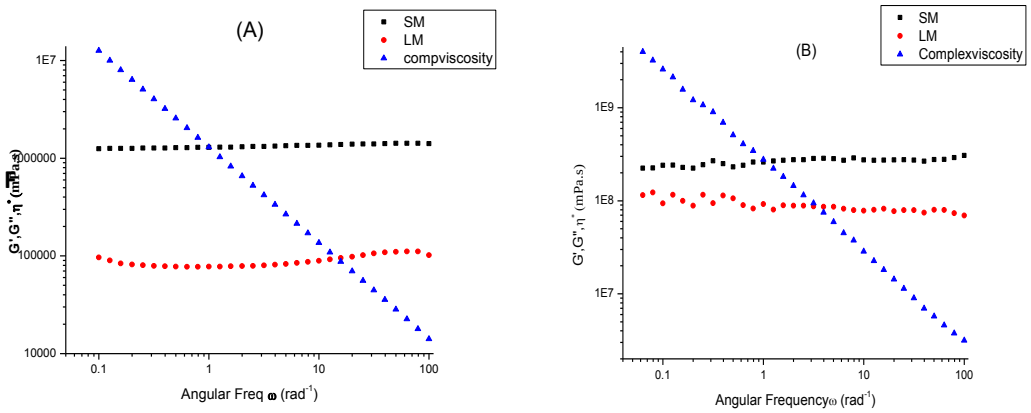


Fig 1 Frequency sweep curve of A) Hydrogel and B) Organogel

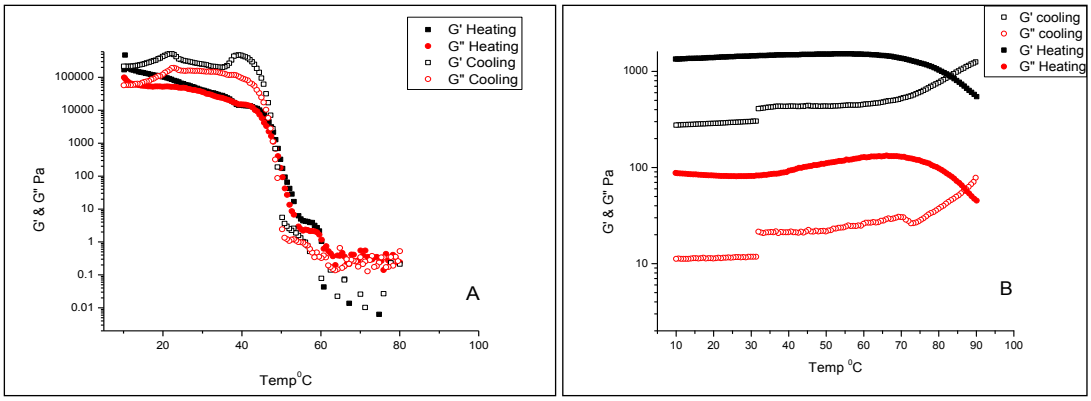


Fig 2 Temperature sweep curve: Storage modulus (G' red) and Loss modulus (G" black) as a function of temperature in heating (solid) and cooling (open) stages of A) organogel and B) hydrogel

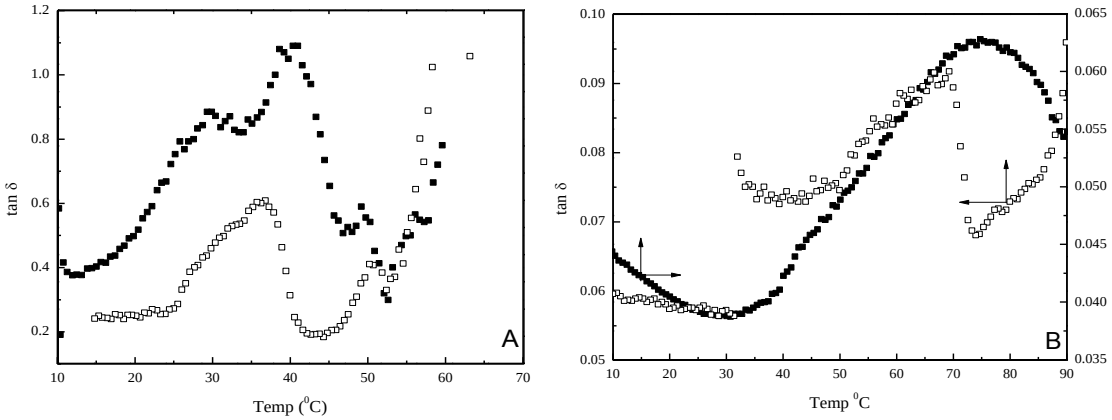


Fig 3 Loss tangent curves of A) Organogel and B) Hydrogel

In-vitro Drug Release

The in-vitro drug release study is one of the simplest and most effective methods for characterizing the efficacy of topical and transdermal formulation. From the in-vitro release tests, it is possible to determine how viscosity and formulation parameters affect the drug release profiles of the same drug from different formulations. The release profile of Dex from different gel matrices is shown in fig 4. The release profile of Dex from different gel matrices showed that the hydrogel exhibited the highest drug release rate compared to the organogels i.e hydrogels released almost double the amount of drug (18.51%) in contrast to organogels (9.85%) in 24 hours. The release studies data were fitted in different kinetic models (**Table 3**) and as per the goodness of fit method (highly linear response, $r^2 \geq 0.997$), it was found that both gels followed the Hixson Crowell model. The lower release rate of the drug from the organogels may be attributed to the fact that the drug was not soluble in the sunflower oil and was dispersed in the organogels and that the organogels are having higher lipophilicity as compared to that of hydrogels.

According to the Stokes-Einstein equation:

$$D = kT/6\pi a\eta$$

Where, D is the diffusion coefficient of the solute, k is the Boltzmann constant, T absolute temperature, a is the molecular collision radius of solute and η is the viscosity of the medium.
As per the equation the diffusion of drug from the matrices is inversely proportional to that of the viscosity of the matrices and hence higher the viscosity results in lower drug release. However this was not seen in case of the organogel and the hydrogel. This shows that not only the viscosity but also the nature of the gel matrices and the active ingredient also influences the drug release profile

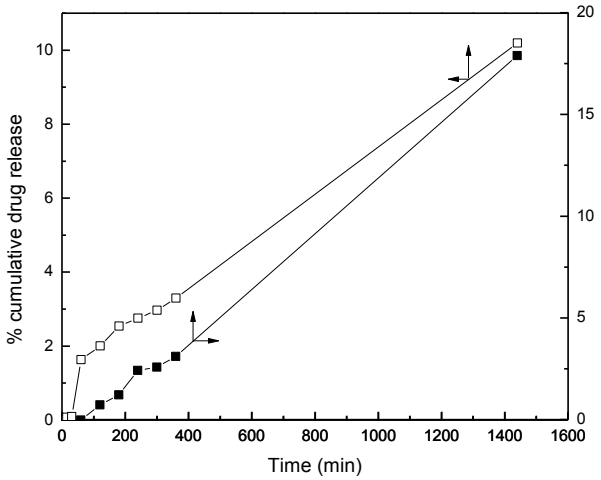


Fig 4: Drug release profile of organgel (Solid) and hydrogel (Open)

Table 3 kinetic model fitting

Gels	Zero Order		First Order		Higuchi		**Hix. Crowell**		Korsmeyer Peppas		Ritger Peppas
	r^2	K	r^2	K	r^2	K	**r^2**	**K**	r^2	n	r^2
Organogels	0.968	4.114	0.922	0.00016	0.857	0.1002	**0.997**	**0.0158**	0.644	2.023	0.970
Hydrogels	0.866	1.369	0.9827	0.0009	0.930	0.3586	**0.998**	**0.017**	0.790	2.132	0.877

Conclusion

As per the rheological measurements, it was found that both the gels exhibited typical characteristic gel structure. Temperature analysis showed that the organogels exhibited thermoreversibility whereas the hydrogel lacked to show thermoreversibility. According to the above studies, it was found that both the organogels and hydrogels showed promising results for controlled delivery of dexamethasone transdermally. The release rate of the drug from hydrogel (18.51% in 24 hrs) was almost double from that of organogel (9.85%).

All though the in vitro studies indicates that both the gels are potential drug carriers for transdermal application, further studies need to be done to establish its use in therapeutics.

Details of Publications:

Manuscripts under preparation:

Kurtkoti S.K., Sastry N.V., Comparative study of properties of topically applied organogels and hydrogels for drug delivery, *American Association of Pharmaceutical Scientists* **(To be submitted)**

Participations at conferences:

Participated in one day National Seminar on 'Forced degradation study: A need of analytical method development' SPONSORED by Gujarat Technological University, (GUJCOST) at 07/02/2015 in INDUKAKA IPCOWALA COLLEGE OF PHARMACY, New Vidyanagar, Anand

Other details :

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Other Work:

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- Took Biology practicals of M.Sc. Biomedical Science/Earth Science/Defence Science (Semester I) and M.Sc. Biomedical Science (Semester III)

Name: **Hetul J. Suthar**
Position: **Research Assistant**
Department: **DST-PURSE Programme**
Research Guide: **Prof. Dr. N.V.Sastry**

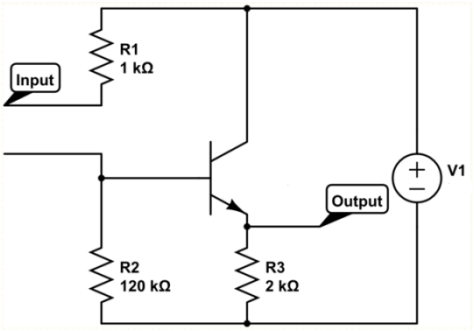
Title: **Smart & Self-Responsive System Based on Programmable Logical Controller & Android for Efficient Agricultural practices**

Objectives:

- To develop automated smart, self-responsive irrigation and fertilizer control system for the Agricultural Practices using "Programmable Logical Controller" (PLC) for android based operating system, which is very useful for the farmer to irrigation and manuring in to the farm.
- Designing of by Also, the proposed device or Controller System is so designable to run on power based solar panels.

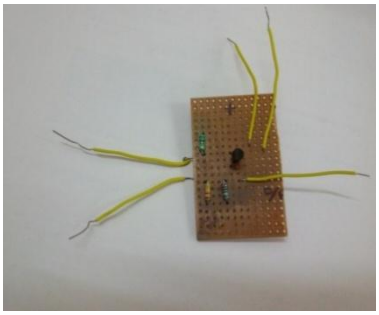
On Going Work :

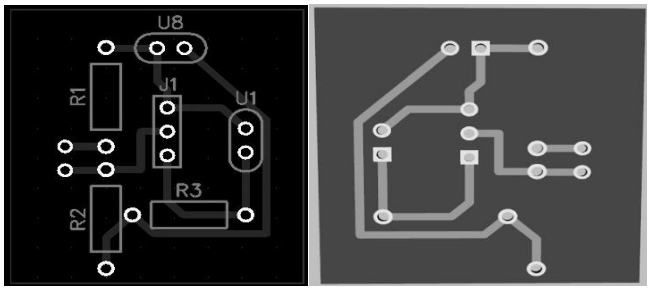
The PLC Unit includes input, output and processing unit. The signal from the environmental sensor is given to the sensing unit. The output from the sensing unit is given to the input module of the PLC. The type of PLC which can use Schneider HMISCUxB5 The output will be given to the processing unit. Processing unit will process the output according to our programming code. The programming language for PLC is ladder logical diagram.



In above circuit is the input part have use of some Resistor 1KΩ, 120KΩ and 2KΩ. Also using NPN Transistor BC547 in this circuit part the BC547 is working as a switch. Soil moisture circuit works on 24V DC Power Supply. Soil moisture sensor is connecting to the input part of above circuit. Output part connecting to directly PLC input. If soil is wet sensor passing the 24VDC easily if soil is dry voltage supply not passing. When the soil is dry it is not possible for electricity to pass between the probes, essentially making the probe an insulator with infinite resistance.

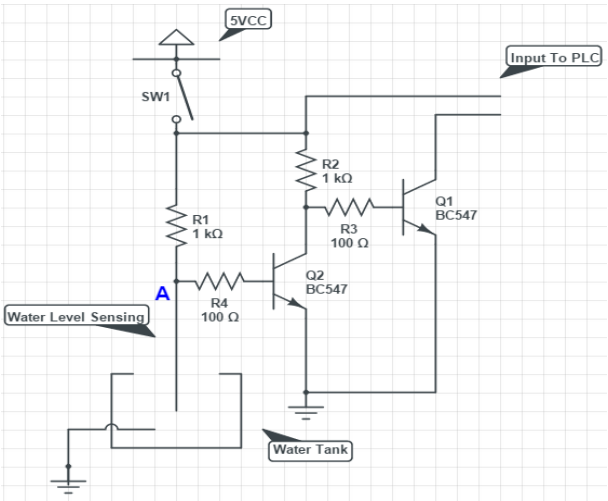
As water is added to the problem more electrons can pass between the probes effectively reducing the amount of resistance between the problems to the point when it is fully saturated where the probe has virtually zero resistance. By using this range of values you can determine the amount of water than exists in your soil. At that level this circuit is done on general purpose board





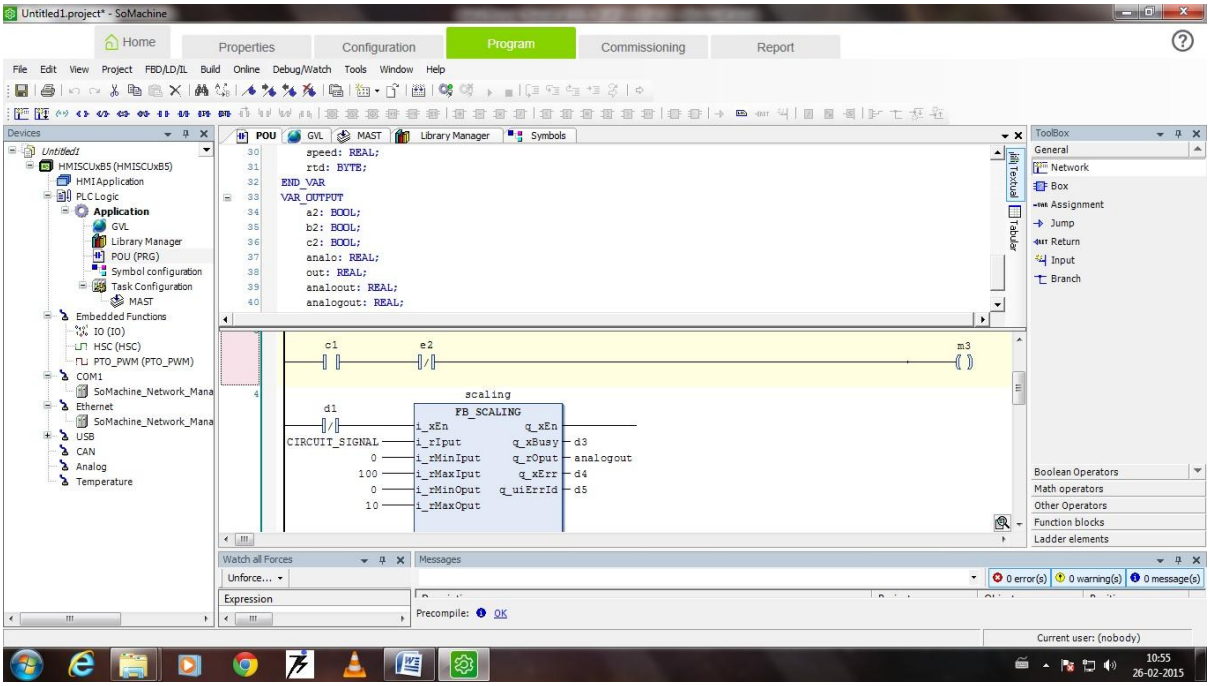
Second Level is etching PCB by using the $Fecl_3$

Water Level Sensing Circuit



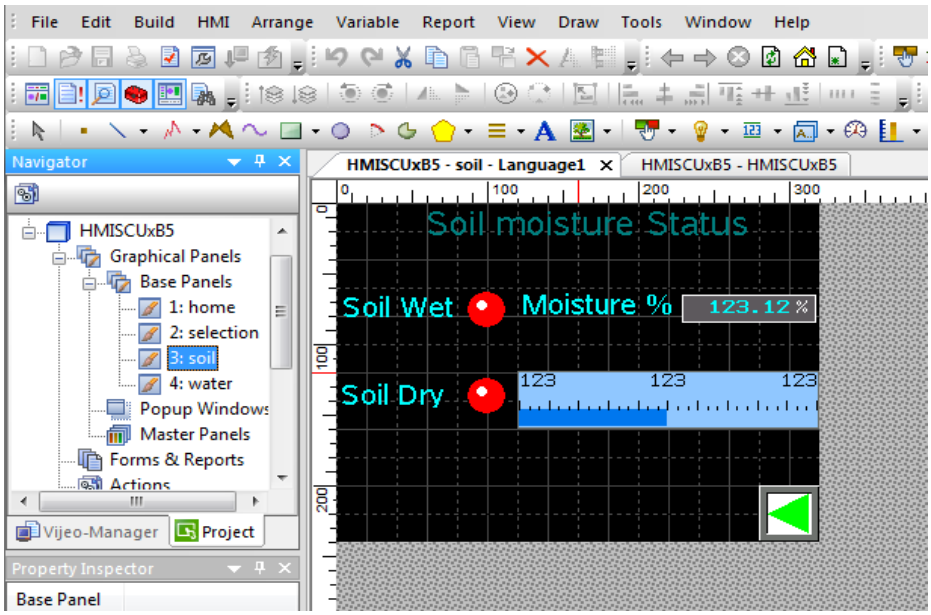
Initially the potential at point A in the circuit is Vcc, so the transistor Q1 remains in ON state and its collector voltage at Vce sat (0.02V). The collector voltage of Q1 is fed to the base terminal of transistor Q2 via100Ω resistor. 0.02V is not sufficient to turn ON the transistor Q2, hence it remains in OFF state. A connection from ground is dipped in the water reservoir. When water level rises, the ground comes in contact with the base terminal of transistor Q1. Thus it changes to OFF state and the collector voltage rises to Vcc. The high voltage at the collector of Q1 turns ON the transistor Q2 since this high voltage is connected to the base of transistor Q2, then a current flow in to PLC Input Port.

We have using SoMachine Software for PLC Programming as well as HMI Design Programming for irrigation system. It can operating and visualize though android phone.

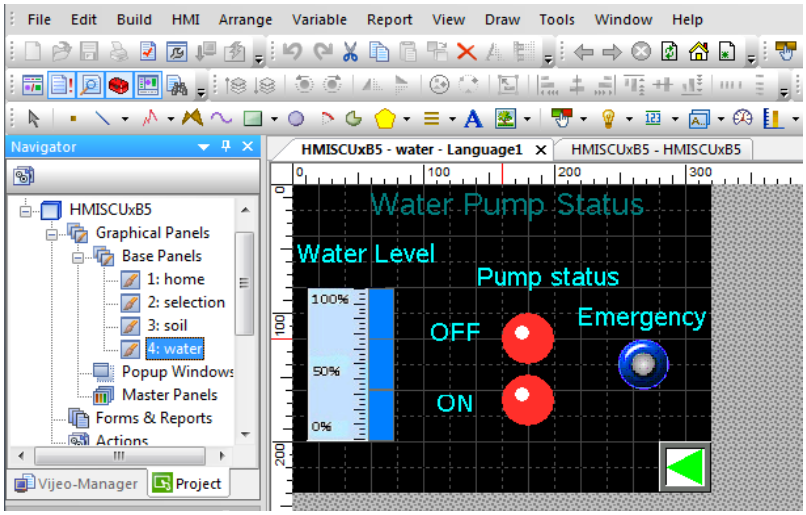


This screen is the PLC Programming which we have done. After done PLC Programming we have to design different screen for HMI display we have design four different type of HMI Screen

First screen is introducing our work. Second screen is representing what you have measure and visualize. Third screen is representing about the soil moisture status and level



And the fourth screen is for the Water level and Water Pump status. We can on or off water pump as per our requirement. There is one option for the emergency stop.



These all screen are visualizing on our Android mobile application and we can control all the parameter by android phone.
The PLC is connecting with the Network connection Though LAN. PLC have own IP address and Port number.
Same IP address and Port number we have configure our android mobile for connecting the PLC.

Attending Conference:

Institute of Science & Technology for Advance Studies & Research, Vallabh Vidyanagar
FRONTIERS IN INSTRUMENTATION (FI-2014) 11th October, 2014,

Analytical Services:

- Semiconductor Characterization: No of Sample-05, from others department
- Conducted M. Sc Sem-I Physics practicals & Sem–III Defence Science practicals at Centre for Interdisciplinary Studies in Science and Technology (CISST), Sardar Patel University, Vallabh Vidyanagar.

Other Details:

Worked in committees for organizing two Workshops

Name: **Pooja A. Trivedi**
Position: **Research Assistant**
Department: **DST- PURSE Programme**
Research Guide**: Prof. Dr. N.V.Sastry**

Title: Effect of ionic liquids as additives on the solubilization and release of dexamethasone from aqueous miceller solutions

Objectives:

- **Studies on effect of ionic liquids on the solubilization and release of drug from hydrogels based on micellar solutions of amphiphilic block copolymers in aqueous media**

Work done:

The diblock and triblock copolymers used are gift samples from the Dow Chemical Company. They were used as received. The structures and various molecular characteristics of the copolymers are listed in **Table. 1.**

Table. 1. Structure, type and molecular characterization of copolymer samples

Copolymers	Type	M	n	R	R'	% EO	Molar Mass (g mol^{-1})
B – 1 R — (EO)m— (BO)n— R'	Di block	18	9	OCH3	OH	55	1600
B – 2 R — (EO)m— (BO)n— (EO)m— R'	Triblock	13	10	OH	OH	60	1900

Synthesis of Amphiphilic Ionic Liquids:

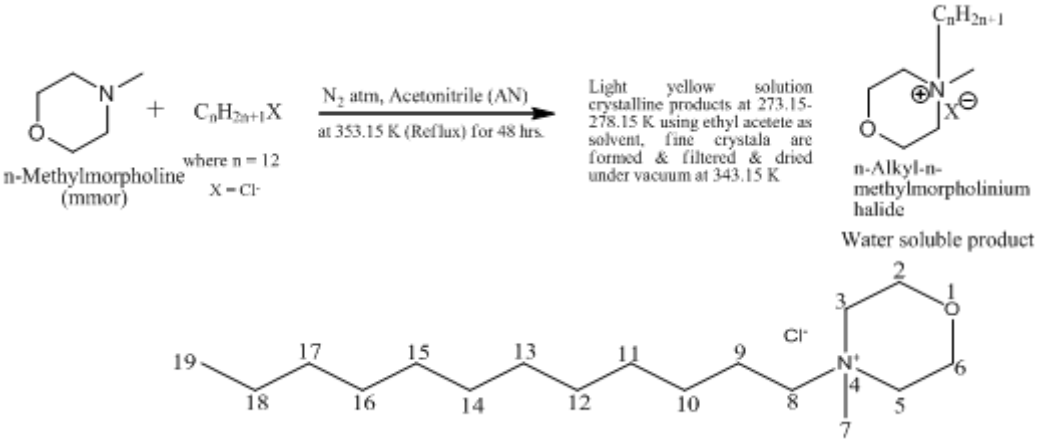
These ionic liquid samples were prepared by following general procedure. 4-methylmorpholine, or 1-methylpiperidine, or 1-methylpyrrolidine or 4-methyl pyridine and appropriate chloroalkane (in excess amount) were dissolved in acetonitrile and the resultant contents in an emulsion form were reacted under stirring at 353.15 K for 48 h under nitrogen atmosphere. The solution was cooled and transferred to a vigorously stirred ethyl acetate at (273.15 – 278.15) K. A two phase mixture was obtained and it was kept at this temperature for two hours followed by removal of the supernatant in upper layer (by a syringe). This procedure was repeated three times until no more chloroalkane was detected in the supernatant by gas chromatography. The final products were dried under vacuum at 343.15 K for twenty four hours.

The structures of the products were confirmed by ^{1}H and ^{13}C NMR spectra in D_2O or $CDCl_3$. The melting points of the ILs were obtained from Differential Scanning Calorimetry (DSC) traces.

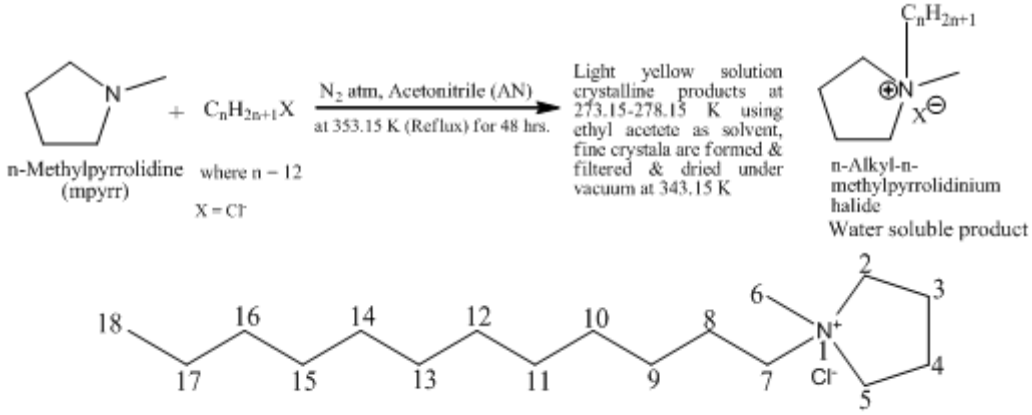
4-dodecyl-4-methylmorpholinium chloride: [C_{12}mmor][Cl]: White solid powder: yield, 80 %: m. pt. 317.15 K

1-dodecyl-1-methylpyrrolidinium chloride: [C_{12}mpyrr][Cl]: White solid powder: yield, 97 %: m. pt. 331.15 K.

Reaction Scheme:



4-Dodecyl-4-methylmorpholinium chloride, [C_{12}mmor][Cl]



1-Dodecyl-1-methylpyrrolidinium chloride, [C_{12}mpyrr][Cl]

Characterization of Ionic Liquids:

The ^{1}H NMR chemical shifts for each of the ILs are: [C_{12}mmor][Cl]: ^{1}H NMR (400 MHz, δ): 0.878 (3H, t, J=6.4 Hz, N-$(CH_2)_{11}$*CH_3*, 1.254 (20,H, m, N-$(CH_2)_2$-*$(CH_2)_{10}$*-CH_3, 1.852 (2H, t, J=6.8 N-CH_2-*CH_2*-$(CH_2)_9$-CH_3, 3.370 (3H, s, N-CH_3), 3.627 (2H, m, J=8.0 Hz, H3), 3.778 (2H, t, J=8.0 Hz, H5), 4.133 (2H, t, H=8.0 Hz, H5), 4.250 (2H, t, ,J=8.0 Hz, H6).

[C_{12}mpyrr][Cl]: ^{1}H NMR (400 MHz, δ): 0.784 (3H, t, 8 MHz, N-$(CH_2)_{11}$-CH_3), 1.166 (14H, m, N-$(CH_2)_4$-$(CH_2)_7$-CH_3), 1.269 (4H, m, N-$(CH_2)_2$-$(CH_2)_2$-$(CH_2)_7$-CH_3), 1.677 (2H,m N-(CH_2)-(CH_2)-$(CH_2)_9$-CH_3), 2.212 (4H, m, N-(CH_2)-$(CH_2)_2$-CH_2), 3.214 (3H, s, N-CH_3), 3.524 (2H, m, N-CH_2-$(CH_2)_{10}$-CH_3), 3.736 (4H, m, N-CH_2-CH_2-$(CH_2)_2$).

Hydrogel preparation:

Agar – agar hydrogel (3.0 % (w/v) in water) was used in this study as the drug carrier after incorporating an appropriate amount of the drug (Dexamethasone) solubilized into copolymer+ IL micelles. The detailed procedure for the preparation of the hydrogel samples is described below. Hydrogels of agar-agar were prepared either in dexamethasone loaded copolymer + IL mixture solutions in the following manner. A weighted amount of agar-agar was added to the above solutions individually, and the contents were warmed for 10 minutes at 90 ^{o}C. The hot and optically clear solutions were poured into a petridish in hot condition. A good care was taken during the warming by gentle stirring to avoid any air bubbles formation. The hot solution was allowed to cool to room temperature till a sheet of hydrogel is formed. The hydrogel sheets were then cut into small pieces of equal size of 10×10 mm dimension.

Results and discussion:

Drug release profile of DEX from micelles of copolymer-ionic liquid mixture:

Fig. 1 shows the cumulative release profile of DEX versus time from micelles of copolymer-ionic liquid mixture. Different molefractions of copolymer (B-1 & B-2) and ionic liquid ([C_{12}mmor][Cl], [C_{12}mpyrr][Cl]) were prepared such that the concentration of block copolymers always remains above cmc and the concentration of IL below. Thus, we could find the effect of the unimers of IL on the micelles of the copolymers. It was found that the fraction of the drug released increased linearly in the initial time and later reaches a plateau i.e. they were of the typical inverted L type. In order to understand the mechanism of release of the drug, we treated the profiles in terms of various mathematical models assuming different rates. Looking at the **Fig. 1.a** we can see that with the increase in the IL fraction the amount of drug release decrease (B1 + [C_{12}mmor][Cl] mixture, X_{IL} = 0 (~100 %) , 0.4 (~98%), 0.6 (~90%), 0.9(~60%)) which shows a synergistic interaction between the copolymer micelles and unimers of IL, thus it stabilizes the copolymer micelles leading to a slow release of the drug.

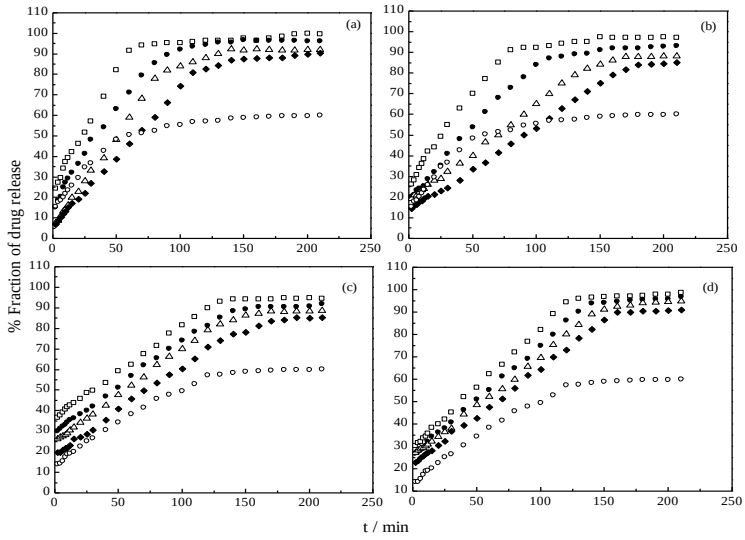


Fig. 1 Percentage fraction of drug released as a function of time in copolymer- ionic liquid mixtures at 303.15 K: where, X_{IL} (a) (B-1) + [C_{12}mmor [Cl], (b) (B-1) + [C_{12}mpyrr][Cl], (c) (B-2) + [C_{12}mmor][Cl], (d) (B-2) + [C_{12}mpyrr][Cl]: X_{IL} = (○) 0, (□) 0.4, (●) 0.6, (△) 0.8, (◆) 0.9

Kinetics of drug release

Table. 2 represents the summary of the data obtained from application of various kinetics models to the drug rlease data. The values of the correlation coefficients for experimental and calculated values are found to be : zero order (0.849 to 0.909), first order (0.865 to 0.999), Higuchi (0.923 to 0.999), Hixson-Crowell release model (0.956 to 0.994) and Korsmeyer and Peppas model (0.982 to 0.999).

The perusal of the data shows Korsmeyer and Peppas model has better r^2 values and the value of time exponent, n for the copolymer–IL mixture fractions was found to be less than 0.15. This indicates that the release mechanism would correspond to non– Fickian transport.
The goodness of the fit was excellent with r^2 values range between 0.982-0.999.

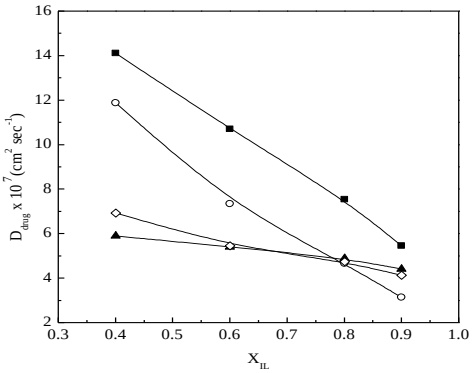


Fig.2 Variation of drug diffusion coefficient, D_{drug} as a function of molefraction of IL, X_{IL} in aqueous solutions at 303.15 K: (■) B-1 + [C_{12}mmor][Cl], (○) B-1 + [C_{12}mpyrr][Cl], (◢) B-2 + [C_{12}mmor][Cl], (◇) B-2 + [C_{12}mpyrr][Cl]

The variation of drug diffusion coefficient, D_{drug} as a function of ionic liquid mole fraction shown in **Fig. 2.** It can be seen that in general there is a decrease in the D_{drug} value with the increase in the IL mole fraction. The decrease in the D_{drug} value of B-1(diblock) copolymer mixture is greater than that of the B-2 (triblock) copolymer.

Key findings of the work done:

(1) The fraction of the drug released increased linearly in the initial time and later reaches a plateau.
(2) Korsmeyer and Peppas model has better r^2 values and the value of time exponent, n for the copolymer–IL mixture fractions was found to be less than 0.15. This indicates that the release mechanism would correspond to non– Fickian transport.
(3) Addition of ionic liquids facilitates the drug release at faster rates . Therefore copolymer + ionic liquid mixtures are good modulators for controlled release of drug systems

Table. 2. Summary of different kinetics model depicting the release pattern of DEX from co-polymer and ionic liquid and their mixed micelles

System	concs (mM)	Mole Fraction	Zero Order Release model		First Order Release model		Hixson-Crowell release model		Higuchi Release model		Koresmeyer peppas model			Ritger and Pepass model	
			r^2	K_o	r^2	K_1	r^2	K_{HC}	r^2	K_H	r^2	n	K_m	r^2	K
[C_{12}mmor]	32.7	-	0.897	-0.33	0.972	-0.007	0.972	-0.013	0.975	5.69	0.986	0.4	8.79	0.991	-0.016
[Cl]	81.7	-	0.883	-0.32	0.944	-0.004	0.944	-0.010	0.970	5.53	0.982	0.56	5.16	0.998	-0.013
	163.4	-	0.871	-0.32	0.923	-0.003	0.923	-0.009	0.965	5.55	0.897	0.56	4.35	0.999	-0.011
[C_{12}mpyrr]	33.5	-	0.909	-0.42	0.999	-0.009	0.999	-0.018	0.984	7.11	0.989	0.3	0.34	0.997	-0.015
[Cl]	83.6	-	0.904	-0.40	0.992	-0.005	0.992	-0.013	0.982	5.73	0.982	0.4	0.37	0.999	-0.011
	167.3	-	0.904	-0.34	0.980	-0.003	0.980	-0.009	0.982	6.81	0.982	0.55	0.55	0.999	-0.008
B-1	0.03	-	0.856	-0.32	0.965	-0.008	0.965	-0.014	0.959	5.47	0.972	0.3	21.48	0.994	-0.019
	0.063	-	0.883	-0.35	0.946	-0.005	0.946	-0.011	0.970	5.82	0.978	0.3	12.47	0.998	-0.012
	0.625	-	0.842	-0.28	0.893	-0.003	0.893	-0.007	0.957	4.76	0.974	0.3	13.4	0.993	-0.009
B-1 +	-	0.4	0.998	-1.41	0.939	-0.200	0.984	-0.040	0.988	-10.60	0.998	0.09	18.4	0.981	-0.022
[C_{12}mmor]	-	0.6	0.995	-0.92	0.962	-0.140	0.998	-0.020	0.994	-9.40	0.991	0.1	12.4	0.995	-0.017
[Cl]	-	0.8	0.999	-0.89	0.919	-0.120	0.994	-0.200	0.978	-9.20	0.995	0.14	5.4	0.994	-0.012
	-	0.9	0.999	-0.67	0.926	-0.080	0.992	-0.020	0.987	-8.30	0.995	0.12	5.5	0.996	-0.009
B-1 +	-	0.4	0.996	-0.83	0.894	-0.260	0.994	-0.030	0.993	-8.80	0.998	0.07	20.9	0.999	-0.019
C_{12}mpyrr][	-	0.6	0.997	-0.66	0.870	-0.200	0.997	-0.020	0.985	-7.59	0.996	0.08	14.5	0.999	-0.012
Cl]	-	0.8	0.999	-0.46	0.918	-0.080	0.994	-0.010	0.981	-6.29	0.999	0.06	14.8	0.997	-0.007
	-	0.9	0.999	-0.40	0.923	-0.050	0.991	-0.010	0.977	-5.88	0.998	0.07	11.2	0.989	-0.005
B-2	0.26	-	0.849	-0.32	0.964	-0.008	0.964	-0.014	0.959	5.41	0.969	0.1	22.44	0.996	-0.018
	0.53	-	0.877	-0.34	0.943	-0.005	0.943	-0.011	0.970	5.76	0.975	0.4	13.09	0.998	-0.014
	5.26	-	0.841	-0.28	0.893	-0.003	0.893	-0.007	0.957	4.76	0.974	0.3	13.43	0.993	-0.009
B-2 +	-	0.4	0.999	-0.44	0.946	-0.100	0.989	-0.010	0.982	-5.54	0.998	0.04	30.5	0.991	-0.009
[C_{12}mmor]	-	0.6	0.999	-0.43	0.895	-0.100	0.995	-0.010	0.983	-5.68	0.997	0.05	24.2	0.981	-0.009
[Cl]	-	0.8	0.998	-0.43	0.886	-0.120	0.997	-0.010	0.986	-5.98	0.996	0.05	20.3	0.993	-0.008
	-	0.9	0.998	-0.41	0.865	-0.120	0.997	-0.010	0.983	-5.73	0.997	0.06	14.9	0.989	-0.007
B-2 +	-	0.4	0.999	-0.54	0.881	-0.110	0.995	-0.010	0.983	-6.86	0.997	0.05	23.8	0.998	-0.011
C_{12}mpyrr][	-	0.6	0.999	-0.49	0.906	-0.080	0.997	-0.010	0.982	-6.39	0.998	0.06	20.9	0.998	-0.009
Cl]	-	0.8	0.999	-0.44	0.851	-0.080	0.996	-0.010	0.977	-5.94	0.996	0.05	21	0.997	-0.007
	-	0.9	0.999	-0.43	0.901	-0.080	0.994	-0.010	0.980	-5.90	0.998	0.06	17.8	0.996	-0.007

Details of Presentations at conferences:

(1) Presented a poster entitled "**Thermophysical Properties of Ionic Liquids, [$C_n$mim][X], where n = 6 or 8, X = Cl^- , Br^-, I^-, BF_4^-**" at 9th National conference on Thermodynamics of Chemical, Biological, Environmental and Non-conventional Energy Systems (TCBNES–2014) organized at Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar during 17-18 October, 2014.

(2) Presented a poster entitled "**Thermodynamic Properties of Aggregation of Amphiphilic Ionic Liquids in Water: Comparison between the Indirect and Direct Methods of Determination**" at 9th National conference on Thermodynamics of Chemical, Biological, Environmental and Non-conventional Energy Systems (TCBNES – 2014) during 17-18 October, 2014 at Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar

(3) Presented a poster entitled "**Surface Activity and Interactions in Amphiphilic Copolymer (ACP) and Amphiphilic Ionic Liquid (AIL) Mixtures in Aqueous Solutions**" at 9th National conference on Thermodynamics of Chemical, Biological, Environmental and Non-conventional Energy Systems (TCBNES – 2014) during 17-18 October, 2014 at Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar.

(4) Attended the Workshop on Liquid Chromatography – Mass Spectrometry (LC-MS/MS) during 21 – 22 January, 2015 at Centre for Interdisciplinary Studies in Science and Technology (CISST), Sardar Patel University, Vallabh Vidyanagar.

Manuscript under preparation:

1. N. V. Sastry, P. A. Trivedi, Dipak Singh. Effect of ionic liquids as additives on the solubilization of dexamthasone in aqueous micellar solutions of amphihilic copolymers and its release profiles from agar agar gels.

Name: **Dharmesh Parmar**

Position: **Research Assistant**
Department: **DST- PURSE Programme**
Research Guide**: Prof. Dr. N.V. Sastry**

Title: Clouding phenomenon and time dependent changes in viscosities of aqueous solutions of pluronic copolymers

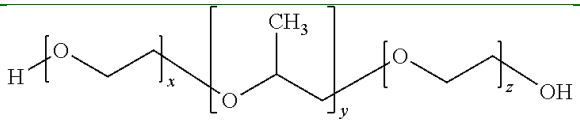
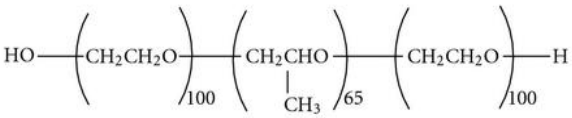
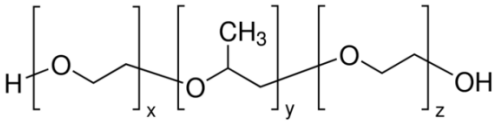
Objectives:

To establish the correlation between the clouding phenomenon and time dependent viscosity changes

Work done:

The triblock EPE copolymers with following structures and molecular characteristics were obtained as a gift samples from BASF, USA and Germany:

Table 1. Molecular characteristics of copolymers

Copolymer	Formula	Molar mass gm mol^{-1}	Structure
L64	$E_{13}P_{30}E_{13}$	2900	 where x = 13, y = 30 and z = 13
F127	$E_{100}P_{65}E_{100}$	12600	
P123	$E_{20}P_{70}E_{20}$	5800	 where x = 20, y = 70 and z = 20

Solution preparation:

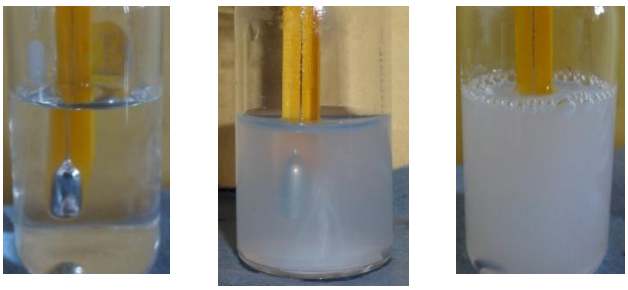
The stock solutions of amphiphilic copolymers were prepared by dissolving the known amount in millipore water under swirling on a magnetic stirrer for 60–90 minutes. After allowing the stock solutions to stand for a day, dilutions were made to get the desired concentrations. The solutions were always stored in stoppered glass vials.

Cloud point measurements

The aqueous solutions of copolymers when warmed turn turbid and become cloudy at high temperatures. The temperatures at which turbidity and clouding sets in are denoted as turbid point (Tp) and cloud point (Cp), respectively. The typical images showing the changes in physical appearance of 1 % solutions of each of the copolymers, P-123, L-64 and F-127 are shown in **Fig. 1.**

at R.T. at T_P at C_P

P123



at R.T. at T_P at C_P

L-64

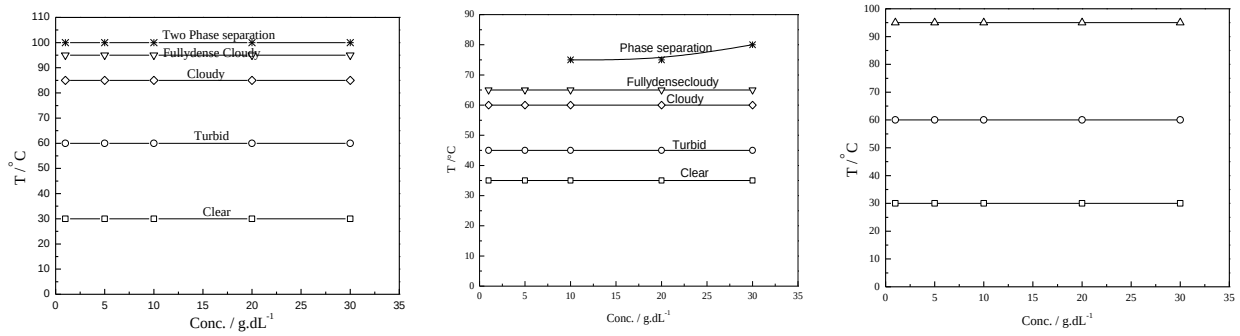
at R.T. at T_P at C_P

F-127

Fig. 1 Changes in physical appearance of aqueous solutions upon warming

Dilute Aquoeus Solution Phase diagrams:

The dilute aquoeus phase diagrams for three copolymers are constructed by plotting the temperatures characterisitc of typical changes as a function of concentration and the same are shown in **Fig. 2.**



P-123 L-64 F-127

Fig. 2: Dilute aqueous solution phase diagrams

Viscosity Measurements:

Interestingly, the copolymer aqueous solutions become more viscous when kept at isothermal conditions at their respective cloud points. The reasons for increase of the viscosity are to be understood. So we carried out measurements of viscosity under low shear by keeping the temperature fixed at different time intervals using Anton Par MCR 102 Rheometer. Two types of measuring systems were used depending upon the viscosity of the solutions. For low to moderate solutions, cone and plate measuring system having a cone angle of 1° and diameter of 50mm was employed. For highly viscous solutions, a plate-plate system, with a diameter of 25 mm was used. The temperature during the measurement was maintained by an inbuilt Peltier system with an accuracy of ± 0.01 °C. The results showing the change in viscosity of L-64 aqueous solutions in absence and presence of two additives namely 2-butoxyethanol (BOX) and sodium salicylate (SS) are shown in **Fig. 3**.

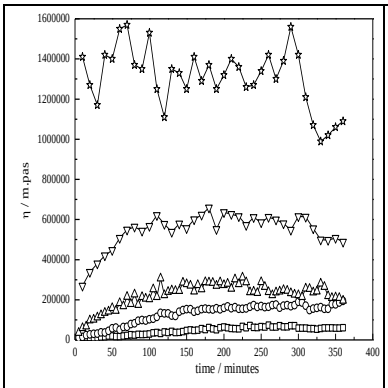
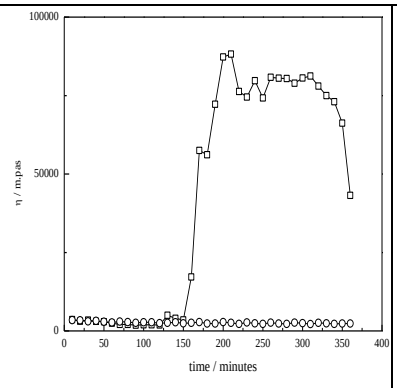
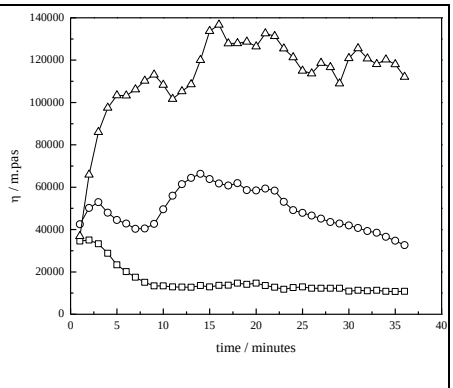


Fig. 3: (a) Viscosity measurement of aqueous solution of pluronic copolymer L-64 at cloud point temperature (65 °C): (□) 1 %, (○) 5 %, (△) 10 %, (▽) 20 % and (✻) 30 %



(b) Viscosity measurement of mixture of aqueous solution of pluronic copolymer L-64 + BOX (20%) mixture at cloud point temperature (35 °C): (○) 1 % and (□) 5 %



(c) Viscosity measurement of mixture of aqueous solution of pluronic copolymer L-64 (5%) + SS at cloud point temperature (85 °C): (□) 0.5 %, (○) 1 % and (△) 5 % SS

Key findings of the work done:

- Pluronic copolymer solutions can be turned into highly viscous and gel type by warming
- The cloud points can be decreased to temperatures close to R.T by adding additives
- There is a close correlation between viscosity increase and clouding temperature which in turn depend on percentage of oxyethylene groups
- The viscous solutions are analyzed for sweep studies to understand the type of structures that are formed

Research work presentations at conferences:

1. Presented a poster entitled "**Rheological behavior of amphiphilic ionic liquids and temperature effect of gels**'' at 9th National conference on thermodynamics of Chemical, Biological, Environmental and Non-conventional Energy Systems (TCBNES-2014) organized at Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar during 17-18 October,2014.

2. Attended the Workshop on Liquid Chromatography – Mass Spectrometry (LC-MS/MS) during 21 – 22 January, 2015 at Centre for Interdisciplinary Studies in Science and Technology (CISST), Sardar Patel University, Vallabh Vidyanagar

Other details:

1. Instruments Handling: Measurements on Rheometer (no of samples: 300)

2. Assisted in purchase of chemicals, glass wares and maintaining chemical store

Annexure – II

1. Details of full length Research Publication (in Peer- Reviewed Journals) during the Period 1st April, 2014 to till date

[A] Details of research papers published/communicated in peer- reviewed journals

Dr. Harish Padh

Vice Chancellor, Coordinator of DST- PURSE program

(2011-till date)

- SH Almal, H Padh, Frequency distribution of autoimmunity associated FCGR3B gene copy number in Indian population, International Journal of Immunogenetics, 42 (1), 26-30, (2015). **[I.F.: 1.338]**

- N Chauhan, H Padh, Variants of NAT2 polymorphisms: intra and inter-ethnic differences, African Journal of Biotechnology, 13 (51), 4639-4646, (2014). **[I.F.: 0.57]**

- D Dhawan, H Padh, Stem cell biomarkers in early diagnosis, prognosis, and therapy of cancer, Cancer Biomarkers: Minimal and Noninvasive Early Diagnosis and Prognosis, 143, (2014)**.**

- D Bhatt, N Chauhan, A Sharma, D Dhawan, RV Bhatt, S Phatak, H Padh, Investigating the role of plasma glucose concentration as a phenotypic marker for CYP2C9 genetic variants, in the diabetic population of Gujarat, Indian Journal of Pharmaceutical Sciences 76 (1), 72,(2014). **[I.F.: 0.296]**

- H Padh, Pharmacogenetics: polymorphism and genotype-phenotype correlation of drug response in Indian population, Molecular cytogenetics 7 (Suppl 1), I52, (2014). **[I.F.:2.66]**

- S Almal, H Padh, Gene copy number variation in Indian population and its implication in health, Molecular Cytogenetics, 7 (1), 1-1, (2014). **[I.F.:2.66]**

- A Gupta, H Padh, Genetic variation in intercellular adhesion Molecule-1 (ICAM-1): candidate gene in susceptibility to malaria in the Indian population, Molecular Cytogenetics, 7 (1), 1-1, (2014). **[I.F.: 2.66]**

- S Patel, H Padh, C Bhavsar, Manova over anova—a better objective in bioequivalence study, International Journal of Pharmaceutical Science and Research 4 (5), 1874-1881, (2013). **[I.F.:2.44]**

- D Dhawan, H Padh, Pharmacogenomics and Personalized medicine for cancer, Omics for Personalized Medicine, 215-235, (2013)**.**

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201. Deepali A. Kotadia, Urmila H. Patel, Sahaj Gandhi , Saurabh S. Soni, Pd doped SiO2 nanoparticles: An efficient recyclable catalyst for Suzuki, Heck and Sonogashira reactions , RSC Advances- An International Journal to Further the Chemical Sciences, 4, 32826-32833, (2014). **[I.F.: 3.708]**

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203. Patel U.H., Patel B.D., Quantum chemical studies on crystal structure of 1, 1' sulfonyldiimidazole, International Journal of Applied Science and Engineering Research, 1, 595-603, (2014).

204. Patel B. D., Patel U. H, Shah D. A., Synthesis and crystal structure determination of 2-Amino-1 (4-Bromo-phenyl)-5-oxo-4, 5-dihydro-1-H-pyrrole-3-carboxylic acid ethyl ester, International Journal of Applied Science and Engineering Research, 1, 755-762, (2014).

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206. Sarath R, Vinodkumar P C., Bose–Einstein condensation in generalized Pöschl–Teller potential, PRAMANA— Journal of Physics, 1–13, (2014). **[I.F.: 0.720]**

207. Devlani N., Kher V., Rai A. K., Masses and electromagnetic transitions of the Bc mesons. The European Physical Journal A, 50: 154, 1-7, (2014). **[I.F.: 2.421]**

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210. Vinodkumar M., Limbachiya C., Desai H., Vinodkumar P. C., Electron-impact total cross sections for phosphorous triflouride. Physical Review A, 89, 1-9, (2014). **[I.F.: 2.991]**

211. Bhatt P., Patel S., Vinodkumar P. C., Medium effects on cc^{-} states through colour screening. Proceedings of the DAE Symposium on Nuclear Physics, 59, 662-663, (2014).

212. Vinodkumar P. C., Heavy flavour hadron spectroscopy: An overview. PRAMANA— Journal of Physics, 773–782, (2014). **[I.F.: 0.720]**

213. Patel S., Bhatnagar S., Vinodkumar P. C., Masses and Decay properties of excited charmonia states. Proceedings of the DAE Symposium on Nuclear Physics, 59, 666-667, (2014).

214. Shah M., Patel B., Vinodkumar P. C. Mass spectra and decay properties of Ds meson in a relativistic Dirac formalism. PHYSICAL REVIEW D 90, 1-11, (2014). **[I.F.: 4.864]**

215. Vinodkumar PC., Shah M., Patel B. Hadronic and Leptonic decay widths of D and Ds Mesons using Dirac formalism, Proceedings of the DAE Symposium on Nuclear Physics, 59, 638-639, (2014).

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[B] Books/ Book Chapters published:

Department of Biosciences

1. Rastogi R. P., Madamwar D. and Incharoensakdi A., Multiple defense systems in cyanobacteria in response to solar UV radiation. In: Cyanobacteria: Ecological importance, biotechnological uses and risk management. Nova Publishers, USA. Chapter 6, pp: 125-158. (2015).

2. Rastogi R. P., Sonani R. R. and Madamwar D., The potential of mycosporine-like amino acids as UV-Sunscreens. In: Sunscreen: properties, role in skin cancer prevention and health effects. Nova Publisher, USA. In Press. (2015).

Department of Chemistry

3. Kiran R. Surati, Photochromisum and its application, (ISBN: 978-93-81386-09-5) Sardar Patel University Press IST Addition (ISBN: 978-93-81386-09-5).

Department of Computer Science

4. Sajja, P.S., Knowledge representation using fuzzy xml rules in web based expert system for medical diagnosis, in Senthil Kumar AV (Ed.), Fuzzy Expert Systems for Disease Diagnosis, Chapter 6, IGI Global Book Publishing, Hershey, PA, USA (2014).

5. Sajja, P.S, Computer Studies (Standard 10) (as co-author), Gujarat State Board of School Textbooks, India (2014).

6. Smart J V, Computer Studies (Standard 12) (as co-author), Gujarat State Board of School Textbooks, India (2014).

Department of Mathematics

7. A H Hasmani, T.S. Jani and V.R. Shah, Tutorial Workbook: Calculus, ISBN: 978-81-927554-8-9, (2014).

8. A H Hasmani, T.S. Jani and V.R. Shah, Tutorial Workbook: Advanced Engineering Mathematics, ISBN: 978-81-927554-9-6, (2014).

9. A H Hasmani, T.S. Jani, V.R. Shah and V.G. Khambholja, Tutorial Workbook: Linear Algebra & Vector Calculus, ISBN: 978-81-927554-4-1, (2015).

Annexure – III

Details of sponsored research projects during the period 1st April 2014 to till date

[A] Please provide names of PI/Co-PIs, title of the project, funding agency and total quantum of external support)

Sr. No.	Principle Investigator/ Co-Investigator	Project title	Status (Ongoing/ new/ completed)	Total Grant (Rs).	Sponsering Agency
Department of Biosciences					
1	Prof. Datta Madamwar (Coordinator/PI) Prof. R. B. Subramanian (PI) Dr. Hareshkumar Keharia (PI)	Molecular and '-omics' technologies to gauge microbial communities and bioremediation of xenobiotic contaminated sites	Ongoing	3,07,73,000/-	DBT, New Delhi
2	Prof. Datta Madamwar (PI)	Folding and stability of naturally truncated photosynthetic pigment, C-phycoerythrin from cyanobacteria *Phormidium tenue*	Ongoing	3,60,000/-	DST, New Delhi
3	Prof. Datta Madamwar (PI)	Molecular assessment of bacterial community structures of long term oil contaminated soil and screening of lipase producers for lipase production and their application in ester synthesis in organic solvents	Ongoing	13,55,800/-	UGC New Delhi
4.	Prof. Datta Madamwar (PI)	Ecological Perspective of Rann of Kachchh: Studies on Physio-chemical and Microbial Community Structure of Soil	Ongoing	78,99,600/-	DBT New Delhi
5.	Dr. T. V. Ramana Rao (PI)	Evaluation of Biosafe Products as an Alternate Strategy to Improve the Postharvest Quality and Shelf life of Some Perishable Horticultural Produce	Recommended during interface meeting held on 14-01-2015	Rs. 14,60,000/- for 3 years	UGC New Delhi
6.	Dr. T. V. Ramana Rao (PI) Dr. Anil N andane (CO-PI)	Development and optimization of edible coating formulations to improve the postharvest	Ongoing	Rs. 17,12,800/- for 3 years	SERB, DST, New Delhi – Major project

		quality and shelf-life of underutilized short lived fresh fruits by using RSM			
7.	Dr. Amita R. Shah (PI) Prof. Datta Madamwar (CO-PI)	An integrated approach for the development of microwave system for pretreatment of lignocellulosic biomass for cellulolytic enzyme and bioethanol production.	Ongoing	Rs. 23,70,000/-	DBT, New Delhi
8.	Dr. Amita R. Shah (PI) Prof. Datta Madamwar (CO-PI)	Production of *β*-xylosidase and accessory hemicelluloytic enzymes for effective bioconversion of plant lignocelluloses	Competed	Rs. 19,60,800/-	GSBTM, Gandhinagar, Gujarat
9.	Prof. J.S.S.Mohan	Evaluation of Physiological Effects of Opera 183 g/l SE and Xelora on *Arachis hypogaea* L.	Ongoing	2,75,000.00	BASF, India limited
10.	Prof. J.S.S.Mohan	Evaluation of Physiological Effects of Opera183 g/l SE in banana (*Musa paradisiaca*)	New	2,75,000.00	BASF, India limited
11.	Dr. K. C. Patel	Curdlan and Lipase production using *Cellulomonas flavigena* UNP3 and their application	Completed	7, 57,800/-.	UGC, New Delhi
12.	Dr. K. C. Patel/Dr. U. B. Trivedi	Production and characterization of a yellow antioxidant pigment from *Colletotrichum* sp. KCP1	Completed	20, 13,200/-.	DBT, New Delhi
13.	Dr. R B Subramanian (PI)	An investigation on the effect of Cabrio Top 60% WG on physiology and growth of Tomato (*Solanum lycopersicum*)	Ongoing	Rs. 3,19,000/-	BASF
14.	Dr. R B Subramanian (PI)	An investigation on the effect of headline 20% WG and cabrio top 60% WG on physiology and growth of *Gossypium hirsutum* (Cotton)	Ongoing	Rs. 02,35,500/-	BASF
Department of Chemistry					
15.	Prof. N. V. Sastry	Nanoaggregates in Mixed Micellar Systems of Amphiphilic Copolymer and Conventional Ionic or Nonionic Surfactants – A Search for Synergistic Behaviour and Their Utility As Drug Solubilizing and Release Systems Based On Hydrogels	Completed	7.0 Lakhs	UGC, New Delhi
16.	Prof. N. V. Sastry and Dr. V. K. Aswal	Studies on Aggregation Behavior of Pyridinium based Amphiphilic Ionic Liquids in Water and in Presence of Aggregate Growth Promoters	Completed	4.0 lakhs	UGC – DAE Consortium for Scientific Research, Mumbai

17.	Dr. M. N. Patel	UGC BSR "one time grant"	Ongoing	Seven lakhs	UGC, New Delhi
18.	Dr. S. S. Soni	Scaling of Dye Sensitized Solar Cell Fabrication	Ongoing	Rs. 87,75,000/-	DST, New Delhi
19.	Dr. Kiran R. Surati/ Prof. Iyar P. K., IIT Guwahati	Highly Efficient Phosphorescent Iridium (III) and Zinc (II) Mixed Ligand Complexes for OLEDs: Fabrication and it's Application	Ongoing	Rs. 25,92,255/-	DST (TSG), New Delhi
20.	Dr. Kiran R. Surati	Novel coordination compounds derived from pyrazolone Schiff base and transition metal ions : Design, Synthesis, Characterization and biological activities Investigations	Ongoing	Rs. 8,54,000/-	UGC, New Delhi
21.	Dr. Kiran R. Surati	Highly efficient Phosphorescent Mixed Ligand Complexes for OLEDs: Fabrication and it's Application	Ongoing	Rs. 2,20,000/-	GUJCOST, Gandhinagar
22.	Dr, Jignesh H. Trivedi (CO-PI)	Photo-Induced Synthesis, Characterization and Potential Applications of Sodium salt of Partially Carboxymethylated Sodium Alginate	Completed	Rs.11,22,500/-	UGC, New Delhi
Department of Homescience					
23.	Dr. Rema Subhash	Immobilization of Probiotic Micro-organism on food matrices and their efficiency in the preparation of fermented Dairy products.	Completed	Rs.11,37,200/-	DBT, New Delhi
24.	Ms. Viraj Rogheliya	Haematinic effect and antioxidant activity of cactus pear fruit (*Opuntia Ficus-Indica*)	2014-2016	Rs. 3,25,000/-	UGC, New Delhi
Department of Materials Sciences					
25.	Prof. L. M. Manocha	Development of Ag based polymer matrix composites	Completed	Rs.8.58 Lakhs	UGC, New Delhi
26.	Dr. (Miss) R. H. Patel	Studies on flame retardant polymer coatings based on polyester-urethane epoxy resin systems	Completed	Rs. 9,69,800/-	UGC, New Delhi
Department of Pharmaceutical Science					
27.	Dr. Bhavna A. Patel	Modern analytical Techniques used for the standardization of the Herbal drugs	Ongoing	60,000	Seed grant, SPU.
28.	Ms. Shraddha J. Parmar	Development and validation of analytical method for estimation of phytoconstituent from the medical plant used for the management of diabetes and its complications	Ongoing	60,000	Seed grant, SPU.

Department of Computer Science					
29.	Mr. B. B. Patel (PI)	A comprehensive study of web services in the field of Bioinformatics	New	60,000/-	Seed grant, SPU.
Department of Statistics					
30.	Dr. Bhatt Milind B.	Inferential problems on Non-regular (Truncation parameter) family of distributions	Ongoing	Rs. 11,96,000/-	UGC, New Delhi
Department of Physics					
31.	Prof. M. P. Deshpande (PI)	Synthesis and characterization of V2- VI3 compound in single crystal/nanomaterial/thin film forms	Ongoing	Rs. 11,16,800/-	UGC, New Delhi
32.	Dr. N. K. Bhatt (PI) / Prof. A. R. Jani (CI)	Vibrational response and phase transition in certain non simple metals and alloys covering wide range of destinies	Ongoing	Rs. 9,76,800/-	UGC New Delhi
33.	Prof. P. C. Vinodkumar (PI)	Study of strong and weak decay processes of mesons involving heavy flavor quarks	Completed	Rs. 9,00,400/-	UGC, New Delhi
34.	Prof. G. K. Solanki (PI)	Studies on well characterized doped crystals of GeSe and SnSe for their applications in optoelectronic devices.	Completed	Rs. 4,95,000/-	UGC, New Delhi
35.	Prof. S. H. Chaki (PI)	Preparation and characterization of Cu2S(x=1 to 2) in nanocrystalline thin films, nanoparticles and single crystal forms for optoelectronic devices	Ongoing	Rs. 10,85,542/-	UGC, New Delhi

[B] Details of major funding to the Department (e.g. SAP/CAS/FIST/Innovative programs /any other)

Department of Biosciences

1. Department of Biosciences has been conferred upon 'UGC-Centre of Advance Study (CAS) for the period of five years (April 01, 2015 to March 31, 2020) with financial support of Rs. 247.5 lakhs.

Department of Chemistry

2. CAS - 1.5 Crore
3. FIST - 38 lacs
4. UGC XIIth Plan – 41 lacs

Department of Homescience

5. DRS-I programme for 5 years from April-2010, Funding Non-recurring =44.00 lakh Recurring = 31.00 lakh, Total = 75.00 lakh (For five years)

6. P.G.Diploma in Nutrigenomics (one year) under Innovative Programme and Research interdisciplinary and emerging arrears from 01/04/2010 to 31/03/2015. Funding Non-recurring =38 lakh, Recurring = 20 lakh, Total = 58 lakh, (+ 1 post of lecturer) (For five years)

Department of Materials Sciences

7. Innovative Programme, State Govt. Innovative Programme M.Sc. (Nano Sci.)& (Nano.tech.) & Special Paper in Ceramic Tech. in M.Sc. (Materials Science), Directorate of Higher Education Govt. Of Gujarat under Innovative Programme of State Government, Rs.63 lakhs , 2009 onwards

Department of Mathematics

8. UGC-SAP-DRS-III

3. Self assessment of the impact of the PURSE support:

Success of the students at National Level tests (various PG/Ph.D. entrance tests, like JRF etc) Please make separate list for

Sr. No.	Department	PG	Ph. D.	NET	GATE/GSET	SLET	Others
1.	Chemistry	-	8	2	-	-	1
2.	Electronics	-	-	-	-	-	-
3.	Home Science	-	-	-	-	1	-
4.	Materials Science	-	-	-	3	-	-
5.	Physics						
6.	Mathematics	-	-	6	2	-	-
7.	Biosciences	-	22	15			-
8.	Statistics	-	-	-	-	-	-
9.	Computer Science	-	-	-	-	-	-
10.	Pharmaceutical Science	-	-	-	-	-	-

Annexure – IV

Research Activities of the department during the period 1st April, 2014 to till date:

[A] Thrust Areas of Research in the Science Departments

Department	Thrust Areas of Research
Department of Biosciences	Environmental Genomics, Cyanobacterial Biotechnology, Non-Aqueous Enzymology , Bioconversion of Lignocellulosic Biomass, Bioresource technology
Department of Chemistry	Polymer Science (Polymer synthesis, modification and characterization, composites, solution properties, biodegradable polymers etc) , Organic Chemistry (Synthesis of bio-active heterocycles, photochromic dyes, medicinal chemistry etc) Inorganic Chemistry (Coordination chemistry and polymers), Physical Chemistry (Thermodynamics of Nonelectrolyte solutions, Ionic liquids) ,Theoritical Chemistry (Normal coordinate treatment & MO calculations of organic and inorganic molecules), Material Chemistry (Mesoporous Thin Films, Dye Sensitized Solar Cells)
Department of Computer Science	Simulation and Speech Recognition, Distributed Computing, Image Processing, Soft computing, Software Engineering, Search Engine Optimization, Speech Recognition.
Department of Electronics	Electronic / Semiconducting Materials and DevicesSensors & Transducers – Interfacing,Electroluminescent(EL) Display Devices,BioSensors & Bio Electronics,Polymer Electronics
Department of Home Science	SAP –DRS • Field studies in community health and care • Development of functional foods Innovative • Obesity • Antioxidants Textiles and Clothing • Natural Dyes • Textile Finishes • Traditional Textiles and Crafts
Department of Materials Science	• Synthetic Polymers: Synthesis, Characterization and application • Synthesis of nanomaterials • Development and characterization of nanostructured incorporated composites • Coating of substrates using PECVD
Department of Mathematics	Analysis, Geometry and Applications

Department of Physics	Crystal growth (different methods) and Characterization, Thin film preparation and device fabrication, Nano-particle studies, Photovoltaic and other Electronic Applications, X-ray crystallography of bio-molecules etc, High Pressure studies on crystals, Low Dimensional conductors, Theory of Condensed-Matter systems, Atomic and Molecular Collisions and electron impact ionization (Theory), Oceanographic and remote sensing data analysis and modeling (Collaboration with SAC-Isro Ahmedabad), Hadron Physics (Theory)
Department of Statistics	Statistical Inference, Design of Experiments, Survey Sampling Inference, Statistical Quality Control, Market research and Financial research, Statistics in Pharmaceutical Science, in Home Science, in Bio Sciences, in Engineering, and in Social Sciences.
Department of Pharmaceutical Sciences	• Modern Analytical Method development • Validation • Degradation study • Pharmaceutical Formulation • NDDS

[B] Seminar/Workshop/Lecture Series organized by the department

Sr.No.	Title of the event and theme	Day (s) and Date (s)	Sponsers
Department of Chemistry			
1.	Thermodynamics of Chemical, Biological, Environmental and Non-conventional Energy Systems (TCBNS-2014)	17 – 18 October, 2014	UGC
Department of Electronics			
1.	"National Seminar on Crystallography (NSC 43B) and National workshop on CADD	1st-3rd September, 2014	-

[D] Academic Achievements:

Details of Foreign visits by faculty

Department of Biosciences

1. Prof. Datta Madamwar visited Dubai to deliverer an invited talk on “Microbial response to industrial pollution: Community analysis and functional capabilities” in International Conference on ‘Biotechnology and Bioengineering’ at Birla Institute of Technology & Science, Pilani Campus, Dubai during October 29-30, 2014.
2. Dr. Vasudev Thakkar will be visiting U.S.A. and Canada to present a research paper at international conference on “Experimental Biology” at Boston, USA, from 28th March to April 1, 2015. He has also been invited to visit University of Guelph, Ontario, Canada.

3. Dr. Vasudev Thakkar is invited to judge the poster competition for undergraduate students at ASBMB (American Society for Biochemistry and Molecular Biology) annual meeting during Experimental Biology international conference (28th March to April 1, 2015).

Department of Chemistry

1. Prof. Dr. N. V. Sastry: As James Chair of Pure and Applied Science, at St. Francis Xavier University, Antigonish, Canada from 1st January 2015 to 31st March 2015

2. Dr. Saurabh S. Soni, visited Universite du Maine, FRANCE for the period of one month as a "Visiting Professor". (22/09/2014 to 22/10/2014)

Details of Fellowships/ Awards to Faculty

Name of the Teacher	Name of the Fellowship/Honors/Recognition/Awards/Achievement with details.
Department of Biosciences	
Dr. Vasudev Thakkar	Received travel grant from DST, Govt. of India to attend and present a research paper at international conference on "Experimental Biology" at Boston, USA, from 28th March to April 1, 2015.
Department of Materials Sciences	
L.M. Manocha	Elected as vice-President of Indian carbon Society
L.M. Manocha	Elected as Executive member on Indian Ceramic Society
L.M. Manocha	Continues as Chairman of MRSSI (Gujarat Chapter)Member on Advisory Board of CPE Program of GURU Nanak University , Amritsar University and Osmania University Hydrabad
L.M. Manocha	Nominated Chairman of the ceramic Education and Traning Programme.
L.M. Manocha	Nomminated as Expert Member of UGC DST.
Department of Mathematics	
Professor Subhash J. Bhatt	has earned UGC Emaritus Fellowship

Details of Fellowships/ Awards to Research Students

Sr. No	Name of the student	Name of the Guide	Title of Thesis	Fellowship/Award	Year
Department of Biosciences					
1.	Mr. Parth Thakor	Dr. Vasudev Thakkar	-	Endeavour Research Fellowship 2015	18th May to 10th November 2015.
2.	Mr. Ravi Patel	Dr. Vasudev Thakkar	-	Travel Award At international conference on Experimental Biology, Boston, USA	28th March to 1st April 2015
3.	Mr. Anil Prajapati	Dr. R B Subramanian	-	Project fellow BASF, India	-
4.	Ms. Vishaka Pawar	Dr. R B Subramanian	-	Project fellow BASF, India	-
Department of Homescience					
5.	Dalwadi Khushbu	-	-	Inspire Fellowship to persue Ph.D	2015
Department of Pharmaceutical Science					
6.	Rachna Gohel	Dr. Bhavna A. Patel	Isolation and Characterization of Shatavarin IV from *Asparagus racemosus Willd. And* Development & Validation of Double Divisor Ratio Spectra Derivative Spectroscopic Method for Simultaneous Estimation of Olmesartan Medoxomil , Amlodipine Besylate and Hydrochlorthiazide in Tablet Dosage Form	Gold medal	2014
7.	Viral Patel	Ms. Shraddha J. Parmar	Formulation and characterization of micellar nanoparticles loaded with resveratrol for the management of aging	2014 (Gold Medal)	

Details of Ph.D. Degrees Awarded

Sr. No.	Name of the Student	Guide	Title of Thesis	Year of award
Department of Biosciences				
1.	Miss Vilas Patel	Prof. Datta Madamwar	Taxonomic profiling of bacterial community structure from marine ecosystem of Alang-Sosiya ship breaking yard, Gujarat and exploitation of the bacterial wealth for PAH bioremediation	2014

2.	Madhuri Narra	Dr. Amita R. Shah	Microbial production, purification and characterization of cellulases: Application in biofuels production	2014
3.	Mr. Ankit Sudhir	Dr. R B Subramanian	Cloning and expression of L-asparaginase gene from Actinomycetes.	2015
4.	Vimalkumar S. Prajapati	Dr. K. C. Patel	Production, purification, characterization and application of a yellow antioxidant pigment and glucoamylase from *Colletotrichum* sp. KCP1	2014
5.	Mrs. Rita Mahapatra	Prof. J.S.S. Mohan	Induction of systemic acquired resistance (SAR) in *Zea mays* L. (maize) by using different elicitors	2014
Department of Chemistry				
6.	Mr. Rakesh R. Giri	Dr. D. I. Brahmbhatt	"Studies on synthesis and antimicrobial efficiency of some coumarin derivatives containing modified pyridine, bipyridine and pyrazole moieties"	October, 2014
7.	Pradip Macwan	Dr. N. V. Sastry	Surface active , aggregation and rheological investigations on nanoaggregates of amphiphilic ionic liquids (AIL) and AIL + sodium dodecylbenzene sulfonate mixtures in aqueous media	July 2014
8.	Mr. Anshul Kumar Patidar	Dr. M. N. Patel	Synthesis, characterization and biological interphase of some copper(II) and palladium(II) complexes as an artificial metallonucleases	2014
9.	Mehul B. Kanani	Dr. M. P. Patel	Synthesis and biological evaluation of new quinoline based diverse heterocycles	Dec 2014
10.	Balvantsingh M. Labana	Narsidas J. Parmar	Synthesis and biological studies of some new chromeno— and thiochromeno— fused heterocycles	2015
11.	Rohit L. Vekariya	Dr. S. S. Soni	Design, synthesis and potential multidisciplinary applications of task specific ionic liquid	September 2014
Department of Homescience				
12.	Anjali Vijay Bhatt	Dr.Vinayak H. Patel	Evaluation of Actual Antioxidant intake of traditional Indian diet with the help of in-vitro gastrointestinal Model	2014
13.	Ranjeetkaur Shikh	Dr. M.S.Acharya	An ergonomic Assessment of selected Activities carried out in Food Units	2014
Department of Materials Sciences				
14.	Kishan A. Ram	Prof.L.M.Manocha	Utilisation of Fly Ash in Composite Materials	2014
15.	Parth Joshi	Prof.(Mrs.)S. Manocha	Separation Study of Heavy Metals using Hydroxy apatite.	2014
16.	Ankur Darji	Prof.(Mrs.)S. Manocha	Synthetics of Characterization High temp. Siloxanes.	2014
Department of Mathematics				
17.	Sanjay Ghevariya	H.V. Dedania	BSM formula for ML and FP payoff	2014

			functions	
18.	V.G. Khambholja	A.H. Hasmani	Higher Dimensional Theories of Gravitation	2014

Details of Ph.D. students working

Sr. No.	Name of the Student	Guide	Area of Research
Department of Biosciences			
1.	Kunal Jain	Dr. Amita Shah (Guide) Prof. Datta Madamwar (Co-Guide)	Environmental Microbiology
2.	Sananda Chattaraj	Prof. Datta Madamwar	Environmental Microbiology
3.	Zeenat Khan	Prof. Datta Madamwar	Environmental Microbiology
4.	Binal Shah	Prof. Datta Madamwar	Environmental Microbiology
5.	Sagar Vaidya	Prof. Datta Madamwar	Environmental Microbiology
6.	Vrutika Patel	Prof. Datta Madamwar	Non-Aqueous Enzymology
7.	Ravi Sonani	Prof. Datta Madamwar	Cyanobacterial BIotechnology
8.	Avinash Narayan	Dr. Amita Shah (Guide) Prof. Datta Madamwar (Co-Guide)	Environmental Microbiology
9.	Jenny Johnson	Prof. Datta Madamwar	Environmental Microbiology
10.	Shivani Amin	Prof. Datta Madamwar	Environmental Biotechnology
11.	Neelam Devpura	Prof. Datta Madamwar	Environmental Microbiology
12.	Soumya V. Menon	Dr. T. V. Ramana Rao	Histo-physiological analysis of melons with their different rates of ripening
13.	Sonu Sharma	Dr. T. V. Ramana Rao	Antioxidant enrichment and antimicrobial protection of fresh cut fruits using innovative approaches.
14.	Pinal B. Vyas	Dr. T. V. Ramana Rao	Improvement of nutritional characteristics and extension of shelf life of perishable tropical fruits and vegetables by using postharvest elicitors and edible coatings
15.	Nilanjana S. Baraiya	Dr. T. V. Ramana Rao	Improvement of health promoting properties and enhancement of shelf life of short lived tropical fruits and vegetables by using some innovative postharvest technologies
16.	Kaushik Jodhani	Dr. T. V. Ramana Rao	Evaluation of biosafe products as an alternate strategy to improve the postharvest quality and shelf life of Some perishable horticultural produce
17.	Disha Patel	Dr. Vasudev Thakkar	Biochemistry
18.	Ravi Patel	Dr. Vasudev Thakkar and Dr. R. B. Subramanian	Biotechnology
19.	Parth Thakor	Dr. Vasudev Thakkar and Dr. R. B. Subramanian	Biotechnology
20.	Tekalign Kejala	Dr. Vasudev Thakkar	Biotechnology
21.	Dilip Raval	Dr. Vasudev Thakkar and Dr. R. B. Subramanian	Biochemistry
22.	Sneha Trivedi	Dr. Amita R. Shah	Microbial production of Inulinase
23.	Kunal Jain	Dr. Amita R. Shah and Prof. Datta Madamwar	Environmental Microbiology

24.	Harshvadan Patel	Dr. Amita R. Shah	Microbial production of Hemicellulolytic enzymes
25.	Avinash Narayan	Dr. Amita R. Shah and Prof. Datta Madamwar	Microbial diversity
26.	Sarasvati Sukhanandi	Sujata Bhatt	Zoology: Aquaculture Nutrition
27.	Sanjay S Karn	Prof. A.V.R.L.Narasimhacharya	Zoology
28.	Krutika S Bhole	Prof. A.V.R.L.Narasimhacharya	Zoology
29.	Krupal K Patel	Prof. A.V.R.L.Narasimhacharya	Zoology
30.	Khushboo Rawal	Dr. Haresh Keharia	Purification and characterization of cyclic depsipeptides produced by Isaria sp.
31.	Sandhya Nanjani	Dr. Haresh Keharia	Characterization of Dye degrading bacterial consortium
32.	Dhruti Amin	Prof. J.S.S. Mohan	Biotechnology
33.	Zalak Patel	Prof. J.S.S. Mohan	Biotechnology
34.	Ali Ahmed Ben Ahmed (Synopsis submitted)	Prof. J.S.S. Mohan	Biotechnology
35.	Dhananjay Patel (Synopsis submitted)	Prof. J.S.S. Mohan	Biotechnology
36.	Naynika Patel (Synopsis submitted)	Prof. J.S.S. Mohan	Botany
37.	Ajit Patel	Dr. K. C. Patel	Fungal lignolytic enzymes
38.	Ravi K. Shah	Dr. K. C. Patel	Cloning of hydrolases from rumen organisms
39.	Juhi Pandya	Dr. K. C. Patel	Agricultural microbiology
40.	Mrs. Sunitha Christopher	Dr. R B Subramanian	Biochemical and molecular studies on *Fusarium* wilt in pigeon pea (*Cajanus cajan* (L)Mill sp.)
41.	Mr. Ketan Panchal	Dr. R B Subramanian	Screening and identification of potential plant species as source of novel metallothionein gene for phytoremediation
42.	Mr. Anand B. Patel	Dr. R B Subramanian	High throughput exome sequencing for SNP genotyping in four buffalo breeds of Gujarat
43.	Ms. Vishaka Pawar	Dr. R B Subramanian	Metabolic engineering of *Escherichia coli* for bio fuel production from keratin
44.	Mr. Anil Prajapati	Dr. R B Subramanian	Rearrangement of substrate binding pocket of cellulase and xylanase enzymes for altered substrate preference
45.	Ms. Monika Noranha	Dr. R B Subramanian	Ethnobotanical database based screening and identification of antiplasmodial substances from plants
Department of Chemistry			
46.	Ms. Yogita L. Chovatiya	Dr. D. I. Brahmbhatt	Synthetic studies on oxygen and nitrogen containing compounds and their bioactivity study
47.	Ms. Neha N. Gohil	Dr. D. I. Brahmbhatt	Synthesis, characterization and biological evaluation of coumarin derivatives

48.	Ms. Dharati S. Patel	Dr. D. I. Brahmbhatt	Synthesis and biological screening of some new coumarin derivatives
49.	Mr. Kaushik N. Kundaliya	Dr. D. I. Brahmbhatt	Synthesis and biological screening of heterocyclic substituted and fused coumarins
50.	Mr. Nilesh J. Patel	Dr. D. I. Brahmbhatt	Synthetic study on some new heterocyclic substituted and heterocyclic fused coumarin derivatives and to study their biological activity
51.	Ms. Parin V. Shaikh	Dr. D. I. Brahmbhatt	Synthesis and biological evaluation of some pyrono/pyridine substituted and pyrono/pyridine fused coumarins
52.	Mr. Krunal N. Patel	Dr. D. I. Brahmbhatt	Synthesis and biological evaluation of some pyridyl pyran substituted / pyridyl pyrano fused coumarins and terpyridine substituted / fused coumarins
53.	Hardik M Jagatiya	Dr. N. V. Sastry	Amphiphilic ionic liquids – micellar aggregates to gels (Thesis Submitted)
54.	Indravijay Ravalji	Dr. N. V. Sastry	Thermodynamic, thermophyscial, spectroscopic and computational investigations on ionic liquid mixtures with polar and nonpolar components of technological interest (Thesis Submitted)
55.	Dipak Kailash Singh	Dr. N. V. Sastry	Solubility of pharmaceutically active compound in Ionic liquids and their application as drug carrier and drug release system. Synthesis and Characterization of novel pharmaceutically active ionic liquid.
56.	M. J Barot	Dr. N. V. Sastry	Synthesis of Functional Novel Dispersing Agents and Their Evaluation in Resin minimal Pigment Concentrates
57.	Mr. Pankaj. A. Vekariya	Dr. M. N. Patel	Bio-inorganic chemistry
58.	Mr. Parag. S. Karia	Dr. M. N. Patel	Bio-inorganic chemistry
59.	Mr. Sanjay. B. Gajera	Dr. M. N. Patel	Bio-inorganic chemistry
60.	Mr. Jugal. V. Mehta	Dr. M. N. Patel	Bio-inorganic chemistry
61.	Ms. Khyati. P. Thakor	Dr. M. N. Patel	Bio-inorganic chemistry
62.	Ms. Miral. V. Lunagariya	Dr. M. N. Patel	Bio-inorganic chemistry
63.	Ms. Darshana N. Kanthecha	Dr. M. N. Patel	Bio-inorganic chemistry
64.	Mr. Bharat H. Pursuwani	Dr. M. N. Patel	Bio-inorganic chemistry
65.	Ankit J. Patel	Dr. M. P. Patel	Organic Chemistry (Heterocycles)
66.	Pratibha Prasad	Dr. M. P. Patel	Organic Chemistry(Heterocycles)
67.	Tushar R. Sutariya	Narsidas J. Parmar	Synthesis and biological stydies of some polycyclic heterocycles
68.	Bhagyashri D. Parmar	Narsidas J. Parmar	Synthesis and characterization of some bioactive polyheterocycles

69.	Gaurangkumar C. Brahmbhatt	Narsidas J. Parmar	Synthesis of some new polycyclic heterocycles of biological interest via Domino strategy
70.	Mr. Jayraj V. Vaghasiya	Dr. S. S. Soni	Design and Synthesis of Organic dyes for Dye Solar Cell Application
71.	Mr. Bharat G. Solanki	Dr. S. S. Soni	Synthesis of Organic Molecules for solid state electrolytes
72.	Mr. Keval K. Sonigara	Dr. S. S. Soni	Development of polymer gel electrolytes for lithium ion batteries and Dye solar cell
73.	Mr. Shilesh Satasia	Dr. D. K. Raval	Organic Synthesis
74.	Mr. Piyush Kalaria	Dr. D. K. Raval	Organic Synthesis
75.	Mr. Harsh Dadhania	Dr. D. K. Raval	Organic Synthesis
76.	Mr. Sharad Karad	Dr. D. K. Raval	Organic Synthesis
77.	Miss Bina Vaghasia	Dr. D. K. Raval	Organic Synthesis
78.	Mr. Vishal Purohit	Dr. K.H.Patel/ Dr.D.K. Raval	Organic Synthesis
79.	Mr. Nirav Saparia	Dr. K.H.Patel/ Dr.D.K. Raval	Organic Synthesis
80.	Arvind V. Chourasia	Dr. Jignesh H. Trivedi	Photo-Induced Synthesis, Characterization and Potential Applications of Sodium salt of Partially Carboxymethylated Sodium Alginate
Department of Homescience			
81.	Bhumi Parikh	Dr.Vinayak Patel	Antioxidant data-base
82.	Hinal Patel	Dr.Vinayak Patel	Anti-inflammatory Activity of plants
83.	Vincenta Khristi	Dr.Vinayak Patel	Medicinal plant on metabolic syndrome
84.	Anu Mishra	Dr.Vinayak Patel	Development and evaluation of Dietary Supplement
85.	Shazia Sharma	Dr.Vinayak Patel	Soya bean as a functional food
86.	Bhavana Chauhan	Dr.Vinayak Patel	Plasma antioxidant capacity
87.	Vijya Agarwal	Dr.Vinayak Patel	Socio-economic factor and dietary pattern on Obesity
88.	Tanvi Makwana	Dr.Vinayak Patel	Antioxidant potential of legumes
89.	Viraj Roghelia	Dr.Vinayak Patel	Organic Foods
90.	Minal Chauhan	Dr.Rema Subhash	Osteoporosis
91.	Tejashri Trivedi	Dr.Rema Subhash	Malnutrition
92.	Pratiksha Patel	Dr.Rema Subhash	Immobilization of Probiotic Micro-organisms
93.	Yogesh Vadwala	Dr.Namrita Kola	Natural Dyes
94.	Dolly Mohey	Dr.Namrita Kola	Traditional Textiles
95.	Mosmi Rupareliya	Dr.Namrita Kola Co-Guide: Dr.Ashutosh Mairal	Silicone Finishes
96.	Harbinder Kaur Shikh	Dr.Namrita Kola	Traditional Textile Craft
97.	Alpana Shah	Dr.Namrita Kola	Recycling of Textile Waste
Department of Materials Sciences			
98.	K.S.Patel	Dr(Miss)R.H.Patel	Studies on flame retardant polymers based on polyurethane-ester systems
99.	A.V.Hirani	Dr(Miss)R.H.Patel	Studies on flame retardant polymer blends based on polyesterurethane-epoxy resin systems

100.	B.R.Patel	Dr(Miss)R.H.Patel	Studies on self-extinguishing polymers:Preparation, Properties and Applications
101.	Milan Vyas	Prof.L. M. Manocha	Studies on Development and Characterization of Nano Structure incorporated Carbon and SiC. Bsaed Composites
102.	Valay Solanki	Prof.(Mrs.)S. Manocha	Development of Nano Clay Composites.
103.	Arpana Basak	Prof.(Mrs.)S. Manocha	Carbon Nanotubes reinforced Ceramics
104.	Hasmukh Gajera	Prof.L. M. Manocha	Synthetics Of Graphene & Polymers Matrix Conducting Composite
105.	Parul Sheth	Prof.L. M. Manocha	Studies of Microstructure of Different Carbom Composite Materials
106.	Pratipalsinh Rayjyada	Prof.L. M. Manocha	Studies on Structure & Performance of carbon & Ceramic coatings
Department of Pharmaceutical Science			
107.	Ms. Shraddha J. Parmar	Prof. Harish Padh	Herbal Standardization
Department of Mathematics			
108.	Mittal Shah	S.J. Bhatt D.J. Karia	Operator Algebras
109.	M.D. Patel	A.H. Hasmani	General Relativity
110.	Raxa Makwana	A.H. Hasmani	General Relativity
111.	Shruti Mehta	G.B. Deheri	Tribology
112.	U.P. Acharya	H.S. Mehta	Graph Theory
113.	B.M. Patel	A.B. Patel	Functional Analysis
114.	Mahavir Shekhavat	A. B. Patel	Operator Theory
115.	Dipak A. Patel	A. B. Patel	Operator Theory
116.	Hiten Kanani	H. V. Dedania	Spectral Properties in Banach Algebras
117.	Milan K. Kansagara	H. V. Dedania	Functional Analytic Aspect and Spectral Properties of Algebras of Vector-Valued Functions
118.	Vipul R. Shah	H. V. Dedania	Contribution to Mathematical Finance related with Derivatives
119.	Kailash Patil	D. J. Karia	Topological Algebras
120.	Yogita M. Parmar	D. J. Karia	Banach and Topological Algebras
121.	Nitin Patel	G. B. Deheri	Tribology
122.	Bhavyata N. Patel	A.H. Hasmani	General Relativity
123.	Dipti R. Patel	H.S. Mehta R. D. Mehta	Banach Algebra and Function algebra
124.	Aakar N. Rogheliya	H. S. Mehta R. D. Mehta	Banach algebra and Real Banach algebra
125.	Jaymin Patel	A B Patel	Operator Theory
126.	Jimit R. Patel	G. B. Deheri	Tribology
127.	Manish Pandey	P. A. Dabhi	Banach Algebras and Harmonic Analysis
128.	Rakshit S Upadhyay	P. A. Dabhi	Banach Algebras and Harmonic Analysis
129.	Savan K Patel	P. A. Dabhi	Banach Algebras and Harmonic Analysis
130.	Ravi R Panchal	A. H. Hasmani	General Relativity

131.	Sejal Patel	G. B. Deheri	Tribology
132.	Saurabh Patel	A. H. Hasmani	General Relativity
133.	Ashok C. Patel	A. H. Hasmani	General Relativity
134.	Krishna N. Patel	G. B. Deheri	Functional Analysis
135.	Disha Pandya	A. H. Hasmani	General Relativity
136.	Niraj Babariya	S J Bhatt	Functional Analysis
Department of statistics			
137.	Ms. Shraddha C. Bhatt	P. A. Patel	Theory of Sample Surveys
138.	Mr. Fagun Shah	P. A. Patel	Theory of Sample Surveys
139.	Bharat Tarapara	Jyoti Divecha	Design and Analysis of Experiments
140.	Jignesh Gondaliya	Jyoti Divecha	Design and Analysis of Experiments

Research Facilities created during the period including from other sources also.

Sr. No.	Name of the Equipment
Department of Biosciences	
1.	Gradient Thermal Cycler
2.	Gel Documentation System
3.	Gel Electrophoresis System (Horizontal & Vertical)
4.	Faction Collector
5.	2D-Electrophoresis System
6.	Electroporator
7.	Electronic Precision Balance
8.	Walk-in Cold Room
9.	BOD Incubators
10.	Ice Flake Making Machine
11.	Autoclave
12.	Laminar Air Flow
13.	Rotary Vacuum Concentrator
14.	DNA Sequencer
15.	Gas Generators
16.	HPLC
17.	Nano Spectrophotometer
18.	Pulsed Field Gel Electrophoresis (PFGE)
19.	RTPCR
20.	High Speed Refrigerated Centrifuge
21.	Denaturing Gradient Gel Electrophoresis (DGGE)
22.	Bead Beater
23.	Refrigerated Environmental Shakers
24.	Refrigerated Environmental Shakers
25.	Protein Concentrator
26.	Lyophilizer

Department of Chemistry	
1	DSA 5000M Density and Sound Velocity Meter
2	CHNO-S Analyzer
3	Q 600 TGA-DSC Thermal Analyzer
4	Fluorescence Spectrophotometer
5	Computer Cluster Laboratory
6	Rotavapour system
Department of Homescience	
1	Autoanalyzer
2	Spectroflourimeter
3	RT-PCR
4	Gradient PCR
5	-80°C Deep freezer
6	Sonicator
Department of Pharmaceutical Science	
1	HPLC- Agilent 1260 series with PDA Detector
2	HPTLC- Camag with Plate Applicator, Scanner and Visual documentation
3	FT-IR –Shimadzu
4	UV- Spectrophotometer- Shimadzu
5	Lyophilizer- Lab cone, USA.
6	Flow through Cell- Ectrolab
7	FBD- Hardik, Ahmedabad.
Department of Mathematics	
1.	The department houses NBHM-DAE Regional Library in Mathematics for Western Region being created in the department. This library contains approximately 8000 books and about 54 Journals are subscribed. Back volumes of many reputed journals are also available for the users.
2.	Facilities created through. The department has an excellent computational facility including mathematical software and hardware developed through various grants like UGC-MHRD infrastructure grant, XII Plan period grants and development grants from the state government. This facility is regularly updated.