

NATIONAL
CHEMICAL
LABORATORY
PUNE 411 008



ACHIEVEMENTS

1983 - 85

INTRODUCTION

This booklet, published along with the Biennial Report 1983-85 presents a summary of achievements and important events of the two years.

Important events

*The Indian Chemical Manufacturers' Association (ICMA) recognized the NCL's contributions while conferring the Sir P. C. Ray Award for 'Development of Indigenous Technology' for 1983 on CIPLA, Bombay, and the 'Forward Development Technology' award on HICO Products Ltd., Bombay.

The citation mentions the imaginative way NCL has demonstrated its expertise in dealing with complicated chemical engineering-oriented technology for the manufacture of silicones by HICO Products Limited. Recognition has been made of NCL's contribution in the development and successful transfer of technology in a very demanding and challenging area and the 'fruitful co-operation between a national laboratory and an industrial unit has been deeply appreciated'.

* **Dr. L. K. Doraiswamy**, Director of NCL, was presented the prestigious 'Distinguished Service Citation' by the University of Wisconsin-Madison, USA, in recognition of his eminent professional services as chemical engineer and researcher who 'through his technical expertise and commitment to excellence, has made contributions to chemical engineering science and the chemical industry of India.

Dr. Doraiswamy was invited by the University of Bombay to be the Dr. G. P. Kane Visiting Professor in Chemical Engineering for the year 1984-85.

*The Indian Academy of Sciences, Bangalore, selected as Young Associates **Dr. T. N. Guru Row** for his contributions to X-ray crystallography, **Dr. M. G. Kulkarni** for his contributions to polymer science and engineering, **Dr. S. D. Prasad** for his contributions to chemical engineering and **Dr. J. S. Yadav** for his contributions to organic chemistry.

* **Dr. A. F. Mascarenhas** was elected Fellow of the Maharashtra Academy of Sciences, Pune, for his contributions to plant tissue culture.

* **Dr. R. A. Mashelkar** was elected Fellow of the Indian Academy of Sciences in recognition of his outstanding contributions to chemical engineering

sciences and Fellow of the Indian National Science Academy for his outstanding contributions to polymer engineering science.

Dr. Mashelkar was awarded the inaugural Prof. M. Santappa Silver jubilee Award in recognition of his outstanding research in polymer science.

Dr. Mashelkar was awarded the prestigious 'Shanti Swarup Bhatnagar Prize for the year 1982 for engineering sciences in recognition of his outstanding research in polymer science and engineering.

Dr. Mashelkar was awarded the Mrs. Chinnamaul Memorial Prize for the best technical paper presented at the Annual Session of the Institute of Chemical Engineers (1983).

Dr. Mashelkar was invited by the University of Bombay to deliver the Prof. K. H. Kabbur Memorial Lecture for the year 1983.

Dr. Mashelkar was felicitated as one of the ten outstanding citizens of Pune by the Deccan and Saras Jaycees, Pune, 1983, and was awarded the 'Role of Honour - 1984' by Giants International, Pune.

* **Mr. B. M. Pathan** was awarded the third prize at the Sixth Safety Poster Competition - 83 organised by the Council of Industrial Safety, Bombay.

* **Dr. A. V. Rama Rao** was elected Fellow of the Indian Academy of Sciences for his outstanding contribution in the field of organic chemistry for the year 1984.

Dr. Rama Rao was awarded the K. G. Naik Gold Medal of M. S. University of Baroda for the year 1982 for his outstanding contributions to the field of organic chemistry.

Dr. Rama Rao was invited to deliver two lectures under the Prof. A. Kulkarni Lectureship Endowment, University of Bombay, for the year 1983.

* **Dr. P. K. Ranjekar** was offered a National Biotechnology Board Overseas Junior Associateship for excellence in the area of biotechnology.

* **Dr. A. V. Shenoy** was selected for the Amar Dye Chem Award for 'excellence in research and development' for the year 1984 by the Indian Institute of Chemical Engineers, Calcutta.

* Dr. S. P. Vernekar, Dr. B. B. Idage, Dr. P. P. Wadgaonkar, Dr. N. D. Ghatge and Mr. S. S. Mohite were awarded the prestigious 'Dunlop Award (1985)' for their outstanding basic research in the field of rubber chemistry and technology.

Research Utilization

During 1983-85, 60 NCL processes were in production with a turnover of about Rs. 84 crores. The foreign exchange saving on account of production during this period is estimated at about Rs. 34 crores.

Premia/Royalties

The amounts of premia and royalties received by the NRDC in 1983-85 on account of NCL processes were Rs. 0.50 lakhs and Rs. 3.31 lakhs respectively.

Consultancy

During the period under review, institutional consultancy was offered to 32 firms.

Patents and Publications

22 new patents were filed during these two years. 76 Indian patents (9 sealed, 16 accepted and 51 filed) and 17 foreign patents were in force as on 31-3-85. 378 research papers were published in these two years.

Recognized Guides and Degrees Awarded

Forty-eight NCL scientists are recognized as research guides by different universities and institutes for post-graduate degrees.

Doctorate and Masters degrees were awarded to 70 NCL staff members, research fellows, teacher fellows and guest workers.

RESEARCH UTILISATION
TABLE 1: PRODUCTS MANUFACTURED ON THE BASIS OF NCL KNOW-HOW

Sl. No.	Name of the process/product	Field of utilisation	Name of the manufacturer (Year of commencement of Production)	Production		Capacity installed Nature of release and remarks	
				Qty. value Rs. in lakhs			
				1983-84	1984-85		
1	2	3	4	5	6	7	8
1.	Acetanilide	Intermediate	Hindustan Organic Chemicals Ltd., P. O. Rasayani 410 207 (through project engineers R. L. Dalal & Co., Bombay 400 018) (1969)	2097.00 T 554.01	2417.00 T 638.55	25482.49 T 4168.80	2000 T Non-exclusive
2.*	Acrylic acid/acrylates from acrylonitrile	Petrochemicals, bulk organic chemicals	Indian Petrochemicals Corpn. Ltd., P. O. Petrochemicals, Dist. Baroda-391 346 (1984)	976.00 T 355.00	1677.00 T 609.00	2653.00 T 964.00	
3.	Antipriming compositions	Antipriming in locomotives	Research Designs and Standards Organization M & C Wing, Lucknow 226 011 (1964)	4.00 T 0.48	5.00 T 0.60	169.58 T 16.45	26 T Non-exclusive
4.	Tert-Butyl catechol	Synthetic rubber	Percynic Chemicals, Bombay Silk Mills Bldg., Industrial Estate, Lalbaug, Bombay 400 012 (1972)	7.54 T 9.04	6.15 T 7.37	81.51 T 90.88	50 T Non-exclusive

1	2	3	4	5	6	7	8
5.	Butyl titanate	Varnishes, enamels	Synthochem, 33 A, Laxmibainagar Industrial Estate, Indore 452 006 (1973)	22.96 T 13.78	32.32 T 19.40	266.72 T 138.95	36 T Non-exclusive
6.	Calcium hypophosphite	Pharmaceuticals	Hypophosphite & Co., 79-F, Princess Street, Bombay 400 002 (1967)	—	—	190.00 T 144.30	24 T (Including hypophosphites) Sponsored
7.	Can lining composition	Metal can industry	Arya Chemical Works, 141/2 A, Lenin Sarani, Calcutta 700 013 (1974)	—	—	6.34 T 2.10	500 Kg / day Non-exclusive
8.	Can sealing composition	Metal can industry	—do— (1962)	—	—	587.41 T 44.92	500 kg / day Non-exclusive
9.	Catechol	Pharmaceuticals	Percynic Chemicals, Bombay (1972)	7.80 T 4.68	9.13 T 5.47	81.08 T 48.97	50 T Non-exclusive
10.	Cation exchange resin-styrene DVB base	Deminerallization of liquids	Bharat Process & Mechanical Engineers Ltd., Dakhindari, Calcutta 700 048 (1968-69)	—	—	28662.18 Cft 98.39	10000 Cft Non-exclusive
11.	Cationic dyes for acrylic fibres	Dyes for synthetic fibres	Sahyadri Dyestuffs & Chemicals, 177 Parvati-Vithalwadi Road, Poona 411 030 (1976)	—	—	123.47 T 140.59	120 T Sponsored
12.	Chlorobenzenes	Industrial chemicals	Hindustan Organic Chemicals Ltd., P. O. Rasayani (1976)	4118.00 T 512.69	5095.00 T 634.33	34173.41 T 3036.34	4500 T Sponsored
13.	Chloromethanes	Industrial chemicals	Standard Alkali Chemicals Divn., The Standard Mills Co. Ltd., Mafatlal Centre, Nariman Point, Bombay 400 021 (1974)	—	—	4020.12 T 171.44	3000 T —

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1	2	3	4	5	6	7	8
14.	Diethyl-m-aminophenol	Dye Intermediate	Sahyadri Dyestuffs & Chemicals, Pune (1970)	36.50 T 47.45	62.50 T 93.75	709.03 T 798.25	150 T Sponsored
15.	Dihydroiso Jasmone and peach aldehyde	Perfumery chemicals	S. H. Kelkar & Co. Ltd., Lal Bahadur Shastri Marg, Mulund, Bombay 400 080 (1965)	—	—	61.62 T 21.07	2 T Non-exclusive
16.	Dimethoate	Pesticides	(i) Mico Farm Chemicals Ltd., Lotus Court 165, Thambu Chetty Street, Madras 600 001 (1979) (ii) Shaw Wallace & Co. Ltd., 4, Bankshall Street, Calcutta 700 001 (1979)	9.36 T 7.02	14.99 T 11.24	52.99 T 37.73	100 T Non-exclusive
17.	Dimethylaniline (Continuous process)	Industrial chemicals	Sahyadri Dyestuffs & Chemicals, Division of Deepak Nitrate Ltd., Pune (1976)	—	—	2450.18 T 761.86	3000 T Sponsored
18.	Endosulfan	Pesticides	Bharat Pulverising Mills Pvt. Ltd., Shriniketan, 14 Queens Road, Bombay 400 020 (1980)	—	—	24.16 T 20.54	600 T Non-exclusive
19.	Ethion	Pesticides	Shaw Wallace & Co. Ltd., Calcutta (1979)	—	—	33.06 T 26.24	15 T (Pilot Plant) Non-exclusive
20.	Ethylenediamine	Bulk organic chemicals	Diamines & Chemicals Ltd., The Bharat Vijay Mills Ltd. Premises, Kalol 382 721 (1982)	—	—	78.00 T 31.00	2000 T of (Ethylenediamine and) polyamines
21.	Ethylene oxide condensates	Surface active agents	Hico Products Ltd., 771, Mogal Lane, Mahim, Bombay 400 016 (1965)	2198.00 T 703.36	2365.00 T 804.10	20449.14 T 4886.21	2500 T Sponsored

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1	2	3	4	5	6	7	8	
22. Ferrites-Hard	Electronics	Dr. Shet Magnetics Pvt. Ltd. 1069, V Block, 1st floor, Rajajinagar, Bangalore 560 010 (1978)	N. A. 0.67	N. A. 1.00	4.00 T 3.98	20 T Non-exclusive		
23. Foundry core binder (Sinol core binder)	Core binder steel foundries for high dimensional accuracy	Card Chem. Industries, B-12, Co-op. Industrial Estate, Balanagar, Hyderabad 500 037 (1980)	—	—	9919 ltrs 0.61	Not available Non-exclusive		
24. Hydroxycoumarin	Pharmaceuticals	Unichem Laboratories Ltd., Unichem Bhavan, S. V. Road, Bombay 400 060 (1974)	—	—	273.69 Kg 1.06 (including warfarin)	540 Kg Non-exclusive		
25.* Ibuprofen	Drug	The Chemical Industrial & Pharmaceutical Laboratories Ltd., (CIPLA), Bombay 400 008 (1983)	Reported to be in production Data not available					
26.* Immobilized enzyme	Pharmaceutical	Hindustan Antibiotics Ltd., Pimpri, Pune 411 018 (1984)	—	940 Kg N. A.	940 Kg N. A.	—		
27. β -ionone	Perfumery, intermediate for vitamin A	S. H. Kelkar & Co. Ltd., Bombay (1975)	0.13 T 0.49	0.302 T 1.31	1.66 T 6.62	4.4 T Non-exclusive		
28. Maleic hydrazide	Agrochemical	Micro Chemicals (India), Scheme No. 1, Road No. 3, Nai Abadi, Mandasaur 458 001 (1978)	—	—	2.22 T 1.24	1 T Non-exclusive		
29. p-Menthane hydroperoxid	Synthetic rubber	Camphor & Allied Products Limited, P. O. Clutterbuckganj 243 502, Dist. Bareilly (1976)	23.02 T 12.20	12.67 T 6.72	165.03 T 71.07	60 T Exclusive		

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1	2	3	4	5	6	7	8
30.* Methyl Chlorosilane	Intermediate	Hico Products Ltd., Bombay	255.00 T 102.00	284.00 T 110.00	539.00 T 212.00	Collaborative Non-exclusive	
31. Monochloro acetic acid	Intermediate for weedicides, carboxymethyl cellulose, etc.	Hico Products Ltd., Bombay (1975)	436.00 T 71.93	335.00 T 66.98	2616.37 T 379.60	720 T Non-exclusive	
32. Monoethylaniline	Intermediate for explosives	The Atul Products Ltd., Atul 396 020, Dist. Valsad (1975)	61.12 T 23.84	72.57 T 28.31	731.52 T 254.25	100 T Non-exclusive	
33. 1-Naphthyl-acetic acid	Agro chemicals, Plant growth regulator	Micro Chemicals (India), Mandasaur (1975)	—	—	5.10 T 5.10	1.5 T Sponsored	
34. Nicotine Sulphate from tobacco and tobacco waste	Insecticides	Urvakunj Nicotire Industries, Petlad-Cambay Road, Dharmaj 388 430, Dist. Kaira (1963)	178.20 T 83.86	215.61 T 130.00	1347.80 T 426.64	150 T Non-exclusive	
35. Nitrile Rubber	Oil resistant rubber formulations, adhesives	Synthetics and Chemicals Ltd., 7, Jamshedji Tata Road, Bombay 400 020 (1974)	718.60 T 101.00	389.91 T 57.48	4833.51 T 819.58	2000 T	
36. p-Nitrophenol	Intermediate	Hindustan Organic Chemicals Ltd., P. O. Rasayani (1978)	—	—	4.00 T 1.16	900 T Non-exclusive	
37. Nonyl phenol	Surface active agent	Aniline Dyestuffs and Pharmaceuticals Pvt. Ltd., Mahalaxmi Chambers, 22, Bhulabhai Desai Road, Bombay 400 026 (1974)	—	—	178.73 T 25.31	1000 T Sponsored	

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1	2	3	4	5	6	7	8
38.	Opium alkaloids	Pharmaceuticals	Govt. Opium & Alkaloid Works Undertaking, Neemuch 458 441 (1975)	4.57 T 149.74	2.69 T 132.02	47.63 T 1443.90	16.66 T of various alkaloids (morphine, codeine, narcotine, papavarine and thebaine) Exclusive. 50 T (for both capinone and meracene) Sponsored.
39.	Perfumery products based on longifolene (capinone)	Perfumery	Comphor & Allied Products Ltd., Dist. Bareilly (1968)	13.83 T 27.17	13.46 T 26.45	178.58 T 245.03	—do—
40.	Perfumery products based on Δ^3 -carene (meracene)	Perfumery	—do—	7.75 T 5.66	10.21 T 7.45	111.22 T 58.59	—do—
41.	β -Phenethyl alcohol	Perfumery	Sunanda Aromatic Industries, Mysore—K. R. S. Road, Mettagalli P. O. Mysore 571 106 (1970)	—	—	1072.83 T 603.13	270 T Sponsored
42.	Phenthoate	Insecticides	Bharat Pulverising Mills Pvt. Ltd., Bombay (1975)	—	—	27.10 T 17.55	600 T Sponsored
43.	Phthalate-butyl octyl	Plasticizers	Herdillia Chemicals Ltd., Air India Bldg., Nariman Point, Bombay 400 021 (1979)	8.00 T 1.52	—	309.43 T 58.25	5000 T (including other phthalates) Non-exclusive
44.	Phthalates-diethyl and dimethyl	Plasticizers	The Mysore Acetate and Chemicals Co. Ltd., A-19 Acetate Town, Mandya 571 404 (1970)	287.10 T 51.66	376.82 T 67.83	2474.79 T 427.28	600 T Non-exclusive
45.	Phthalates-dioctyl and dibutyl	Plasticizers	Amines and Plasticizers Ltd., 'D' Bldg., Shiv Sagar Estate, Dr. Annie Besant Road, Worli, Bombay 400 018 (1971)	3270.00 T 600.00	4017.00 T 864.00	42546.18 T 6700.55	5000 T Non-exclusive

1	2	3	4	5	6	7	8
46.	Polyurethane coating	Coatings	Cipy Chemicals, 229, Rasta Peth, Pune 411 011 (1977)	1086.00 Ltrs 0.55	1556.00 Ltrs 0.82	10304.00 Ltrs. 3.88	30 T Non-exclusive
47.	Polyurethane printing rollers	Printing	Sree Saraswathy Press Ltd., 32, Acharya, P. C. Ray Rd., Calcutta 700 009 (1965)	—	—	662 Nos 14.25	3000 Nos Non-exclusive
48.	Quinapyramine Sulphate/Chloride drugs	Veterinary	Chintamani Fine Chemicals, S. No. 64/5, Bhide Baug, P. O. Vadgaon Budruk, Sinhagad Road, Pune 411 041 (1982)	—	70.00 Kg 5.6	79.00 kg 6.45	N. A. Non-exclusive
49.	Radiosonde thermistors	Meteorology	The Bhagyanagar Laboratories, 11-1523/8, Golkonda Cross Rd., Hyderabad (1974)	—	—	215000 Nos 38.79	N. A. Non-exclusive
50.	D. C. Recording polarograph including potentiometric strip chart recorder for captive consumption	Polarographic analysis	(i) Elico Pvt. Ltd., Sanatnagar Indl. Estate, Hyderabad 500 018 (1974) (ii) Chromatography & Instruments Co., 121/122, Makarpura Ind. Estate, Baroda 390 010 (1974)	—	—	195 + 3 Units 30.46 84 Units 13.45	50 Units Non-exclusive 100 Units Non-exclusive
51.	Silica gel	Humidity control	Minco Products, 17, Thirwotyyur High Road, Madras 600 081 (1963)	12.50 T 1.80	13.00 T 2.00	4962.70 T 19.52	18 T Sponsored
52.	70% Sorbitol from dextrose monohydrate	Pharmaceuticals, Vitamin C synthesis	(i) Maize Products, Divn. of Sayaji Mills Ltd., P. O. Kathawada, Maize Products, Ahmedabad 382 430 (1976) (ii) The Anil Starch Products Ltd., P. B. No. 10009, Anil Rd., Ahmedabad 380 025 (1976)	1439.00 T 143.90	1977.00 T 237.24	9225.20 T 911.81	2000 T Non-exclusive 1000 T Non-exclusive

1	2	3	4	5	6	7	8
53.	Direct Reading spectro-photometer/calorimeter	Biochemical research, spectroscopic analysis in visible range	Scientific Instruments Co. Ltd., Tej Bahadur Sapru Rd., Allahabad 211 001 (1974)	12 Nos 0.95	18 Nos 1.42	212 Unit 14.27	100 Unit Non-exclusive
54.	Staple pin adhesive	Adhesive for staple pins	Esdee Paints, Near Power House, Kolshet Rd., Thane 400 607 (1979)	1212.00 Ltrs 0.58	1472.00 Ltrs 0.70	5637.00 Ltrs 3.98	N. A. Non-exclusive
55.	Terpineol	Perfumery	Dujodwala Industries, Tulsiani Chambers, 8th Floor, 814, Nariman Point, Bombay 400 021 (1976)	—	—	400.00 T 112.50	200 T Non-exclusive
56.	P-Toluidine from p-nitrotoluene vapour phase reduction	Organic by intermediate	Sudarshan Chemical Industries, 162, Wallesey Road, Sangam Bridge, Pune 411 001 (1977)	121.0 T 46.20	84.00 T 45.65	615.00 T 236.26	300 T Sponsored
57.	Trichloro-benzene	Intermediate	Mycol International Agencies, Lotus Court, 165, Thambu Chetty St., Madras 600 001 (1978)	—	—	2.30 T 0.16	100 Kg/batch Non-exclusive
58.*	Vinblastin Sulphate B.P. and Vincristine Sulphate B.P.	Pharma-ceuticals	The Chemical & Pharmaceutical Laboratories Ltd., Bombay (1984)	Reported to be in production Data not available	—	5.83 T 7.82 (Estimated)	NA Non-exclusive
59.	Vitamin C	Pharma-ceuticals	Hindustan Antibiotics Ltd., Pimpri, Pune 411 018 (1975)	—	—	—	125 T Non-exclusive
60.	Warfarin	Rodenticide	Unichem Laboratories Ltd., Bombay (1974)	—	—	384.29 Kg	840 Kg Non-exclusive

* During the period under review production has been newly reported on these items (5).
Note : The following processes had appeared in Table I of the previous reports. As and when the production is reported on these items they will be included in Table I (i) Calcium silicate (ii) Carbimazole (iii) Oxalic acid from bark of Ain tree

VALUE OF PRODUCTION BASED ON NCL TECHNOLOGIES

Year	No. of items manufactured	Value of production (Rs. in lakhs)
1980-81	61	3056.60
1981-82	62	2928.62
1982-83	58	3019.11
1983-84	58	3685.16
1984-85	60	4703.84
		17393.33

SECTORWISE VALUE OF PRODUCTION OF NCL TECHNOLOGIES (1984-85)

Type of industry	No. of processes in production	Value of production during 1984-85 (Rs. in lakhs)
1. Public sector	8	2014.50
2. Large scale private sector	25	2539.16
3. Medium and small scale sector	27	150.18
	60	4703.84

TABLE II: PROCESSES RELEASED AND AWAITING PRODUCTION

Sr. No.	Name of the process	Field of utilisation	Name of the party (Year of release)	Nature of release	Remarks
1	2	3	4	5	6
1.	Adhesive for renewable resources	Adhesive	Carborundum Universal Ltd., 28, Rajaji Road, Madras 600 001 (1985)	Sponsored	Recently released
2.	Aniline	Organic intermediates	Hindustan Organic Chemicals Ltd., Rasayani (1973)	Non-exclusive	—
3.	Anisidine by liquid phase hydrogenation of nitroanisoles	Intermediate for dyestuffs	Amar Dye-Chem Ltd., Rang Udyan, Sitladevi Temple Rd., Mahim, Bombay 00 016 (1974)	Sponsored	—
4.	Antioxidant TEDQ (2, 2, 4-trimethyl-6-ethoxy-1, 2-dihydroquinoline)	Rubber antioxidant	—do— (1976)	Non-exclusive	—
5.	Atrazine	Herbicide	—do— (1978)	—do—	—
6.	Butenediol	Pesticides, polymers	Hindustan Organic Chemicals Ltd., Rasayani (1980)	Collaborative work	—
7.	1, 3-Butylene glycol	Petrochemicals, bulk organic chemicals	Indian Petrochemicals Corpn. Ltd., Dist. Baroda (1976)	Sponsored	—
8.	Butyl titanate	Varnishes, enamels	Monopol Chemicals Pvt. Ltd., 901, Rahaja Chambers, Nariman point, Bombay 400 021 (1984-85)	Non-exclusive	Recently released
9.	Camphene from pinene	Pharmaceuticals, perfumery	Resin & Terpene Industries 812/813, Tulsiani Chambers, 212, Nariman Point, Bombay 400 021 (1978)	Sponsored	—

1	2	3	4	5	6
10.	Carboxin	Pesticides	(i) Bharat Pulverising Mill P. Ltd., Bombay (1978) (ii) Laxmi Traders, 2 India Exchange Place, Calcutta 700 001 (1980)	Non-exclusive	Under implementation
11.	Conversion of crotonaldehyde to maleic anhydride	—	Deccan Sugar Institute, Manjari, Pune 412 307 (1983-84)	Sponsored	—do—
12.	Carboxylation of ethanol to propionic acid	—	Deccan Sugar Institute, Manjari, Pune (1983-84)	Sponsored	Recently released
13.	Catalytic vapour phase oxidation of toluene to benzaldehyde	Intermediates for pharmaceuticals, perfumeries, etc.	Indian Organic Chemicals Ltd., Khopoli 410 203 Dist. Raigad (1981)	Sponsored	—
14.	Citrate plasticizers-tributyl/acetyl tributyl citrate	Plasticizers	Sturdia Chemicals Ltd., Neville House, J. N., Hardia Marg, Ballard Estate, Bombay 400 038 (1980)	Sponsored	—
15.	Clonal multiplication of cardamom by tissue culture	Agriculture	(i) A. V. Thomas & Co., 22, Marshalls Rd., Egmore, Madras 600 008 (1984-85) (ii) Cardamom Research Institute, Cardamom Board, Banarji Road, Cochin 682 018 (1984)	Non-exclusive	Recently released
16.	Dapson	Drug	CIPLA, Bombay (1984)	Sponsored	—do—
17.	Dextropropoxyphene hydrochloride	Drug	Centaur Laboratories, Kumar Engineering Works Compound, Kalina, Santacruz (East), Bcmby 400 029 (1983-84)	Sponsored	—do—
18.	Diazepam	Anti-anxiety drug	Orion Chemicals, Mulchand Mansion, Princess St., Bombay 400 002 (1975)	Non-exclusive	—
19.	Dibutyl tin oxide	PVC stabilizers	Dura Chemical Corpn. Ltd., Wakefield House, 11, Spratt Road, Ballard Estate, Bombay 400 038 (1977)	Non-exclusive	Under implementation

1	2	3	4	5	6
20.	Dichloropropionic acid (Dalapon)	Pesticides	(i) Hico Products Ltd., Bombay (1975) (ii) Jaydee Agrochemicals P. Ltd., Majwaji Ka Bagh, Moti Dugri Road, Jaipur 302 004 (1975) (iii) IDL Agrochemicals Ltd., 11th floor, Hindustan Times House, 18-30 Kasturba Gandhi Marg, New Delhi 11000	Non-exclusive —do— —do— —dc— —dc— —dc—	— — — In trial production — Turn-key plant offered through project engineers; In trial production —do—
21*	Dimethoate	Pesticides	PNM Company, Thindal, Perundurai, Main Road, Erode 638 009 (1978)	—dc—	—
22.	DVO acid chloride	Intermediate	National Organic Chemical Industries Ltd., Mafatal Centre, Nariman point, Bcmby 400021	—dc—	—
23*	Endosulfan	Pesticides	Hindustan Insecticides Ltd., Hans Bhavan, Wing I, Bahadur Shah Zafar Marg, New Delhi 110 002 (1976)	—dc—	—
24.	Ethephon	Pesticides	(i) Varson Chemicals P. Ltd., 9th Mile, Hosur Rd., PO : Singasanda, Bangalore 560 068 (1978) (ii) Sudarshan Chemical Industries P. Ltd., Pune (1984-85) (iii) Hycount Agro, Sherry Land, Quilon 691 005 (1984-85)	Non-exclusive —do— —do—	—do—
25.	Flematic skin oil	Veterinary drugs	TTK Pharma P. Ltd., Old Trunk Road, Madras 600 043 (1984)	Non-exclusive	—
26.	Flexible magnets	Refrigeration gaskets, toys, educational kits	Dr. Shet Magnetics P. Ltd., Bangalore (1976)	Non-exclusive	—
27.	Fumed silica	Bulk inorganic chemicals	Century Rayon, PB No. 22, Murbad Rd., Shahad 421103 Thane (1976)	Sponsored	—

1	2	3	4	5	6
28.	Hexachlorocyclopentadiene (HCCP)	Pesticides	Hindustan Organic Chemicals Ltd., Rasayani (1981)	Collaborative work	—
29.	Items having short shelf life	Sealants, adhesives	Hindustan Aeronautics Ltd., (Nasik Division) Ozar Township PO, Nasik 422 007 (1980)	Sponsored	—
30.	Ketoprofen	Drug	CIPLA, Bombay (1983-84)	Sponsored	Recently released
31.	1-Menthol from Δ^3 -carene	Perfumery	Bhavana Chemicals Ltd., Laxmi Insurance Bldg., Sir PM Rd., Bombay 400 001 (1978)	Sponsored	Under implementation
32.	Morpholine	Intermediate for rubber chemicals	(i) Bombay Wire Ropes Ltd., Kavesar Village, Ghodbunder Road, Thane (1975) (ii) Catalyst (India) P. Ltd., Embassy Centre, 10th floor, 207, Backbay Reclamation, Nariman Point, Bombay 400 021 (1975)	Non-exclusive —do—	— —
33.	Multiplication of Napier grass by tissue culture	Agriculture	National Organic Chemical Industries Ltd., Mafatal Centre, Bombay 400 021	Sponsored	—
34.	Multiplication of teak by tissue culture	Forestry	Forest Development Corpn. of Maharashtra Ltd., 6-A, Nawab Layout, Tilak Nagar, Nagpur (1981)	Sponsored Under field trials	—
35.	Nacelon	Perfumery	Comphor & Allied Products Ltd., 133, M. G. Road, Jehangir Bldg., Bombay 400 023 (1984-85)	Non-exclusive	Recently released
36.*	Nicotine sulphate	Insecticides	Kraun Fine Chemicals P. Ltd., Chikodi, Karnataka (1983-84)	Non-exclusive	—
37.	Nitrofen	Weedicide	Amar Dye-Chem. Ltd., Bombay (1978)	Non-exclusive	—
38.	p-Nitrophenol	Intermediate	Catalyst (India) P. Ltd., Bombay (1975)	—do—	—
39.	Phenylglycyl chloride	Drug intermediate	Sudarshan Chemical Industries Ltd., Pune (1983-84)	Sponsored	Recently released

1	2	3	4	5	6
40.	Polycrystalline silicon-ultrapure	Electronics	Grindwell Norton Ltd., Devenhalli Rd., Old Madras Road, Bangalore 560 049 (1982)	Sponsored	Recently released
41.	Polysulphide liquid rubber	Adhesives, sealants	(i) Rathi Rubber Products, 27, Shankarshet Rd., Pune 411 009 (1981) (ii) Mudoz Corporation, 3, Moghe Bhawan, Gokhale Rd., Dadar, Bombay 400 028 (1981) (iii) Transpeck Industry Ltd., Vadodara (1983-84) Rathi Rubber Products, Pune (1981)	Non-exclusive —do— —do— Non-exclusive	— — Recently released —
42.	Polysulphide sealant compound (Sp. by HAL, Nasik)	Sealants	Rathi Rubber Products, Pune (1981)	Non-exclusive	Recently released
43.*	Polyurethane coating	Coating	Simple Coatings, Fahmeeda Manzil, Bhoipura Bhopal (1984-85)	Sponsored	—
44.	Propylene oxide from propylene (extension to propylene glycol)	Petrochemicals	Indian Petrochemicals Corpn., Ltd., Dist. Baroda (1978)	Non-exclusive	In trial production
45.	Silver paste for mica capacitor electrodes	Electronics	(i) Jyoti Refinery, 216, Lakad Ganj, Nagpur (1978) (ii) Ramans (India) 9882/6, Ambala City, (1978) (iii) Luxmi Traders, Calcutta (1981) Amar Dye-Chem Ltd., Bombay (1978) —do— (1976) The Anil Starch Products Ltd., Ahmedabad (1976) Duro Meto Chem P. Ltd., Nirlon House, 254-B, Dr. A. B. Road, Worli, Bombay 400 025 (1976) Nand Industries, 324, Shaniwar Peth, Pune 411 030 (1978)	Non-exclusive —do— —do— —do— (Technical aid) Sponsored Non-exclusive Sponsored	— — — — — —
46.	Simazine	Herbicide			
47.	Sodium sulphide	Various industries			
48.	Sorbitol from glucose (continuous process)	Pharmaceuticals			
49.	Staple pin adhesive	Adhesive for staple pins			
50.	Substitute for side seam cement	Adhesive			

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1	2	3	4	5	6
51.	Sulphur monochloride	Industrial chemical	Phosphate Co. Ltd., 14, Netaji Subhash Road, Calcutta 700 001 (1976)	Non-exclusive (Technical aid)	—
52.	Synthesis of basic drugs and intermediate	Drug intermediate	Dexo Laboratories P. Ltd., 6-3-348 Dwarakapuri colony, Hyderabad 500004 (1984-85)	Sponsored	Recently released
53.	Theophylline, aminophylline and caffeine	Pharmaceuticals	(i) Pefco Foundry & Chemicals Ltd., Plot No. 10, Off Dr. Moses Road, Worli, Bombay 400 018 (1978) (ii) Nufarm Chemicals, Faridabad (1984-85)	Non-exclusive	In trial production
54.	Thionyl chloride	Various industries	Dharamsi Morarji Chemical Co. Ltd., Prospect Chambers, 317/21, Dr. D. N. Road, Bombay 400 001 (1977)	Collaborative work	—
55.	N-Tridecyldiisopropylamine	Intermediate	BASF (India) Ltd. Sudam Kalu Ahire Marg, PB No. 19108, Bombay 400 025 (1981)	Sponsored	—
56.	Vitamine B ₆	Drugs	(i) Lupin Laboratories, 159, CST Road Kaline, Santacruz (E) Bombay 400098 (1983-84) (ii) Themis Chemicals, Plot No. 69, GIDC Vapi (Dist. Valsad) Gujarat	Non-exclusive	Recently released

*These process have also appeared in Table I along with other licensees.

In addition to the processes listed above the following sponsored processes were also completed during 1983-84 and 1984-85; and due to the nature and objective of these schemes no production was envisaged. (i) Aromatic polymers/polyamides, (ii) Enzyme reagents, (iii) Physics and chemistry of oxide surfaces, (iv) Studies on fluidization with reference to acrylonitrile reactor and (v) Scler grade polysilicon.

The process on clofibrate which was included in Table II of the Annual Report 1982-83 has now been dropped as the party is not likely to implement the know-how on techno-economic reasons.

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LIST OF PROCESSES AVAILABLE

(As in March 1986)

Sl. No.	Name of the process/ product	Field of utilisation	Major raw materials	Range of total capital requirement	Remarks
1	2	3	4	5	6
1.	Acetanilide	Drug and dye intermediate	Aniline and acetic acid	C	Released, in production. turn-key plant available through project engineers
2.	Aniline	Organic intermediate	Nitrobenzene, hydrogen and catalyst	C	Released
3.	Atrazine	Herbicide	Cyanuric chloride, ethylamine and monoisopropylamine	C	Released
4.	<i>tert</i> -Butyl catechol	Stabilizer and poly- merization inhibitor for synthetic rubber	Catechol, <i>tert</i> -butyl alcohol and catalyst	A	Released, in production
5.	Butyl titanate	Insulating varnish, special paints, catalyst	Butanol and titanium tetrachloride	B	Released, in production
6.	Can lining composition (based on nitrile rubber latex)	Lining cans for storing mineral oils, greases, food	Synthetic rubber latex, synthetic resins and rubber chemicals	A	Released, in production
7.	Can sealing composition (based on natural rubber)	Metal can industry	Natural rubber latex and rubber chemicals	A	Released, in production
8.	Carboxin	Pesticide	Acetoacetanilide, sulphuryl chloride, benzene and 2-mercaptoethanol	C	Released
9.	2-Chloroethyltrimethyl ammonium chloride	Plant growth regulator	Trimethylamine and ethylene	A	—
10.	Diazepam	Anti-anxiety drug	<i>p</i> -Nitrochlorobenzene, benzyl cyanide, dimethyl sulphate, iron powder and chloroacetyl chloride	A	Released
11.	Dichloropropionic acid (Dalapon)	Weedicide	Propionic acid, chlorine and soda ash	C	Released

A— Capital requirement less than Rs. 10 lakhs
B— Capital requirement between Rs. 10 lakhs and Rs. 20 lakhs
C— Capital requirement above Rs. 20 lakhs

These figures are tentative and purely
indicative, and are subject to revision
from time to time.

1	2	3	4	5	6
12.	Dimethoate	Pesticide	Phosphorous pentasulphide, methanol, monochloroacetic acid, methyl amine and caustic lye	C	Released, in production
13.	Dimethylaniline (batch process)	Dyestuff and explosives intermediate	Aniline and methanol	C	Released
14.	N, N'-dimethyl biguanide HCl and phenethyl biguanide HCl	Drugs	Dicyandiamide, dimethyl amine/ β -phenylethylamine and solvents	A	Released
15.	Endosulfan	Pesticide	Hexachlorocyclopentadiene, butenediol, thionyl chloride and epichlorohydrin	C	Released, process available on turn- key basis through project engineers
16.	Ethylenediamine	Bulk organic chemical	Ethylene dichloride, ammonia and caustic soda	C	—do—
17.	Ethephon	Pesticide	Phosphorus trichloride, ethylene oxide, hydrochloric acid and sulphuric acid	A	Released
18.	Ethion	Pesticide	Phosphorus pentasulphide, ethyl alcohol, dibromo- methane and caustic soda	C	Released, in production
19.	Ethylene from ethyl alcohol	Organic intermediate	Ethyl alcohol and catalyst	A	Released
20.	Ethylene dichloride from ethyl alcohol	Solvent and organic intermediate	Ethyl alcohol, chlorine and catalyst	C	—
21.	Ferrites-Hard	Electronics	Iron oxide, barium carbonate, additive and binder	B	Released, in production
22.	Gaskets from cork granules	Gaskets	Cork granules, nitrile rubber and rubber chemicals	A	Released
23.	Maleic hydrazide	Plant growth regulator	Maleic anhydride and hydrazine hydrate	A	Released, in production
24.	Methyl chlorosilanes	Basic material for silicon	Ferrosilicon and methyl chloride	C	Released, in production
25.	Microfilters	Industrial filtration	Pulp, melamine and formal- dehyde	A	Released
26.	Monochloroacetic acid	Intermediate for weedicides, carboxy- methylcellulose, etc.	Acetic acid, chlorine and catalyst	B	Released, in production
27.	Monochlorobenzene	Bulk organic chemicals	Benzene and chlorine	C	Released
28.	Monoethylaniline	Intermediate for explosives	Aniline, ethyl alcohol and catalyst	B	Released in production

1	2	3	4	5	6
29.	Morpholine	Intermediate for rubber chemicals, textile chemicals, optical brighteners, etc.	Diethanolamine, sulphuric acid and caustic soda	C	Released
30.	Necelone	Perfumery chemical	Longifolene		Released
31.	Nicotine sulphate from tobacco and tobacco waste	Insecticide	Tobacco/tobacco waste, lime, kerosene and sulphuric acid	A	Released, in production
32.	<i>p</i> -Nitrophenol	Intermediate for parathion and paracetamol	<i>p</i> -Nitrochlorobenzene, sodium hydroxide lye and hydrochloric acid	C	Released, in production
33.	Phthalate-butyl octyl	Plasticizer in non-electrical applications	Phthalic anhydride, butyl alcohol and 2-ethyl hexanol	C	Released, in production
34.	Phthalates-dibutyl/dioctyl	Plasticizers	Phthalic anhydride and butyl alcohol/2-ethyl hexanol	C	Released, in production
35.	Phthalates-dimethyl diethyl	Plasticizers	Phthalic anhydride and methyl/ethyl alcohol	C	—do—
36.	D. C. Recording polarograph	Polarographic analysis	Component parts and boxes	A	—do—
37.	Polyol for making polyurethane rigid foam	Rigid foams	Cardanol, formaldehyde and a suitable amine	A	—
38.	Polysulphide liquid rubber	Adhesives, sealants, etc.	Ethylene chlorohydrin, <i>p</i> -formaldehyde, sodium sulphate, sulphur, sodium hydroxide and iron sulphide	A	—
39.	Polyurethane coating	Coating for leather, rubber, wood, glass, etc.	Castor oil, toluene diisocyanate and solvents	A	Released, in production
40.	Polyurethane printing rollers	Printing rollers	Castor oil, polyethylene glycol and toluene diisocyanate	A	—do—
41.	Quinapyramine sulphate and chloride	Veterinary drug	<i>p</i> -Aminoacetanilide, ethyl acetoacetate, ammonium acetate, dimethyl sulphate and guanidine carbonate	C	Released in production
42.	Radiosonde thermistors	Meteorology	Metallic oxides, platinum foil and components	A	Released, in production

2	3	4	5	6	
43.	Rubber blowing agent	Rubber chemicals	Hexamine, sodium nitrite, hydrochloric acid and stabilizers	A	Released
44.	Rubber reclaiming agent	Rubber chemicals	Xylene and sulphur monochloride	A	Released
45.	Silica gel (desiccant type)	Humidity control	Sodium silicate and sulphuric acid	A	Released, in production
46.	Silicon tetrachloride	Industrial chemical	Ferrosilicon, chlorine and hydrochloric acid	C	—
47.	Silver paste for mica capacitor electrodes	Electronic industry	Silver nitrate, acetone, caustic soda, glass and filler	A	Released
48.	Simazine	Herbicide	Cyanuric chloride and ethylamine	C	Released
49.	70 % Sorbitol from dextrose monohydrate	Pharmaceuticals and Vitamin C synthesis	Dextrose monohydrate, hydrogen and catalyst	C	Released, in production
50.	Direct reading spectrophotometer/colorimeter	Biochemical research and spectroscopic analysis in visible range	Components and boxes	B	—do—
51.	Staple pin adhesive	Adhesive for staple pins	Synthetic resin and solvent	A	—do—
52.	Terpineol	Perfumery	Turpentine oil	B	—do— (pilot plant available with NRDC)
53.	Theophylline, aminophylline and caffeine	Drugs (caffeine also used in beverages)	Dimethylurea, monochloroacetic acid, acetic anhydride	C	Released
54.	Thermistors	Temperature measurement and control electronic devices	Oxides of high purity components and binder	A	Released in production
55.	Trichlorobenzene	Intermediate	Non-gamma BHC residue and caustic lye	B	Released, in production
56.	Vinblastine sulphate, vincristine sulphate	Drugs	Vinca rosea leaves	C	Released
57.	Vitamin B ₆	Drug	—	A	Released
58.	Xanthates— potassium ethyl and potassium amyl	Froth-flotation	Ethyl/amyl alcohol, potassium hydroxide and carbon disulphide	A	Released