

N.C.L. QUARTERLY REPORT. APRIL-JUNE, 1952.

NATIONAL CHEMICAL LABORATORY OF INDIA

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PROGRESS REPORT FOR THE QUARTER

APRIL to JUNE, 1952.

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PROGRESS REPORT FOR THE QUARTER  
APRIL to JUNE, 1952.

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1. PROGRESS OF CURRENT SCIENTIFIC INVESTIGATIONS (Total 66 projects).  

Progress of work conducted in various divisions is described in Appendix I (Page 1 to 31). The work was conducted on 7 projects in Biochemistry, 9 in Chemical Engineering, 8 in Inorganic, 21 in Organic, 7 in Physical Chemistry, 14 in Plastics & Polymers, Divisions.
2. TECHNICAL AID RENDERED (Total 101 firms and Govt. departments)
  - a) Survey & Information Division advised 46 private firms and 3 Government departments during this quarter, Appendix I (Page 27-29).
  - b) 36 additional private firms, totalling 82 were advised by other divisions of the N.C.L., Appendix II (page 32-33).
  - c) 16 additional Government Departments, totalling 19 were helped by other divisions, Appendix III (page 34-36).
3. OTHER SCIENTIFIC ACTIVITIES (Appendix IV, page 35-36).
  - a) Micro-analysis for Universities and other Laboratories.
  - b) Supply of Cultures of Micro-organisms.
  - c) Fine Chemicals.
  - d) Lectures and visits of important personalities.
4. 8 SCIENTIFIC INVESTIGATIONS COMPLETED (Appendix V, page 36).
5. 11 NEW INVESTIGATIONS STARTED (Appendix VI, page 36-37).
6. 4 PATENTS FILED (Appendix VII, page 37).
7. 19 PAPERS PUBLISHED AND 9 PAPERS COMMUNICATED (Appendix VIII) (page 37-39).
8. CHANGES IN STAFF (Appendix IX, page 39-40).
9. NEW ITEMS OF EQUIPMENT RECEIVED (Appendix X, page 40).
10. CONSTRUCTION AND MAINTENANCE (Appendix XI, page 40).
11. SOCIAL ACTIVITIES (Appendix XII, page 41).

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BIOCHEMISTRY DIVISION

## 1. CITRIC ACID FERMENTATION

a) CARBOHYDRATE METABOLISM IN *A. NIGER*i) Glycolytic system (Jaganathan, V. & Kartar Singh).

Aldolase from *A. niger* has been purified 60-fold. Unlike yeast aldolase, the crude extracts and the purified enzyme from *A. niger* were not inhibited by cysteine or pyrophosphate. Further work on the enzyme is in progress.

The glycolytic enzymes aldolase and tyrosine phosphatase and alcohol dehydrogenases were present in 5 to 10 times higher concentration in submerged cultures of *A. niger* than in surface cultures while the malic dehydrogenase content of both cultures was approximately the same.

## ii) Polyphosphatases of moulds (Bajaj, V.A. (Mrs.), and Krishnan, P.S.).

The effect of supplementing medium with zinc (1 p.p.m.) was investigated further in surface, shake and aeration cultures and it was shown that meta phosphatase was considerably inhibited whereas apyrase and pyrophosphatase were practically unaffected. Zinc had in addition a very marked accelerating effect on acid production by *A. niger* and *A. wentii* and influence on the pH of the mycelial contents and sporulation in surface cultures. Besides the phosphatases studied so far, there exists another powerful phosphatase system, as yet unidentified which acts on a natural substrate, also not identified, liberating orthophosphorus. This enzymic reaction is characterised by the fact that it has a pH optimum about 6, is common to the mycelium and spores of *Aspergillus* and can be demonstrated also in *Penicillium*.

The uptake of phosphorus and of glucose and the distribution of phosphorus in total acid soluble and labile form were investigated in detail and were found to be dependent on the cultural conditions. It was possible to demonstrate an inverse relationship between labile phosphorus content of mycelium and the specific metaphosphatase activity.

It was also found that at certain stages of growth interfering material is present in the mycelium, which leads to erroneous values for phosphorus by conventional methods.

## b) SUBMERGED FERMENTATIONS (Shah, N.R.).

About twenty different strains of *A. niger* which were screened by NCTC as good producer of citric acid on surface growth were tested for submerged citric acid fermentation. None of the strains gave any significant citric acid yield.

c) PILOT PLANT STUDIES ON CITRIC ACID PRODUCTION  
(Rangachari, P.N. and Vakil, J.R.).

A number of samples of chlorinated rubber paints and a sample of Bhilawan shell enamel were used as coating material for the trays in which citric acid fermentations were carried out. Preliminary experiments were done using dextrosol as the carbohydrate. Three samples of chlorinated rubber paints and the Bhilawan enamel gave promising results. Further experiments using commercial sugar are in progress.

d) FORMATION OF DEXTRAN (Shah, N.R.).

Studies on formation of dextran by the use of Leuconostoc cultures have been started.

2. CARBOHYDRATES FOR THE FERMENTATION INDUSTRIES

Preparation of glucose from bagasse (Dhavalikar, R.S.)

Four samples of bagasse are being analysed for lignin, cellulose, pentosans (furfural) and uronic acid.

Identification of the individual sugars in the cellulose and pentosan fractions are also under investigation.

3. ENZYMES

a) TRANSAMINASES (Jagannathan, V.).

The enzyme from *A.niger* which acts on glyoxylate was found to be a transaminase which catalyses the reversible transformation of glutamate and glyoxylate to d-ketoglutarate and glycine. The presence of aspartic-glutamic and alanine-glutamic transaminases was also demonstrated in *A.niger*.

b) PROTEASES

i) Microbial Proteases (Govindarajan, V.S., and Subramanian, S.S.)

Two selected strains of Aspergilli and two of bacteria were studied in different media, purely mineral and with organic supplements for growth and protease production. On purely mineral media, growth was good but enzymic production was either low or absent. Mineral media supplemented with 1-2 percent skimmed milk proved to be as good a medium as whole skimmed milk medium. Submerged growth is as effective as surface growth in enzyme production.

Studies are being continued to evolve a practical medium from available raw material for preparing a powerful bathing enzyme.

ii) Specificity of proteases of Bacillus subtilis  
(Subramanian, S.S.)

The peptide carbobenzoxy L-glutamyl L-tyrosine was synthesised for use as a substrate for the peptidase of *B.subtilis*.

Experiments were carried out on the concentration of the proteases in the culture filtrate of *B. subtilis* by (a) evaporation in vacuo and (b) by freeze-drying (with the cooperation of the Armed Forces Medical College). The former method gave an active concentrate exhibiting both protease and peptidase activity. The second process was not successful but is to be investigated.

c) PECTIC ENZYMES FROM MICRO-ORGANISMS (Babbar, I.J.)

The study of pectic enzymes produced by the fungus Aspergillus aureus showed the presence of a depolymerase with pH optimum at 2.6 to 3.0. The enzyme possessed only feeble polygalacturonase activity but exhibited a pronounced methoxylase activity at pH 6.0. A commercial low methoxyl pectin, Pectin LM, was used for this study. The studies are being repeated with a high methoxyl pectin.

4. PROTEIN CHEMISTRY

a) PREPARATION OF AMINO ACIDS

i) Lysine (Ramachandran, B.V.).

Experiments are in progress on the preparation of lysine from groundnut cake hydrolysate which was first used for the preparation of glutamic acid and arginine. Lysine rich fractions were obtained by passing the hydrolysate through the sodium form of IRC-50 buffered at pH 7. The acid eluate which contained lysine was, however, highly contaminated with mineral salts which render isolation of the amino acid difficult. Investigations are being carried out using the hydrogen, potassium and ammonium form of the resin to establish best conditions for isolation of lysine.

ii) Tryptophane (Mansa Ram).

Work on the preparation of tryptophane was continued. Dessicated beef pancreas was used for the liberation of tryptophane from casein and gave results comparable to those obtained with commercial trypsin. A modified procedure was adopted for the precipitation of mercuric tryptophane complex which resulted in the recovery of the pure amino acid. The yield of tryptophane, however, is not satisfactory and further experiments are in progress to improve the same.

iii) Asparagine and DL-threonine (Trohan, Y.N.)

Experiments were continued on:

- a) Large scale preparation of asparagine from germinated Bengal gram, and
- b) the synthesis of dl-threonine from crotonic acid.

iv) Synthetic peptides (Sivaraman, C.)

For the resolution of D & L-tryptophane by the use of anylase, the enzymic activity of mycelia and culture media of *A. Flavus Oryzae* grown as shake cultures was studied. Enzyme production under the conditions tried was not satisfactory.

The following peptide derivatives were synthesised:

1. carbobenzoxy-L-glutanyl-L-tyrosine
2. carbobenzoxy-L-tryptophyl-L-lysine
3. ~~L~~-benzoyl-L-arginine.

b) PROTEIN METABOLISM

Physiological Effects of Dietary Protein (ICMR Scheme).  
(Ambegaokar, S.D., Chandra Menon, K. & Ramchandran, M.).

Studies on the physiological responses of experimental animals of the 3rd generation maintained on the three different diets reported previously were continued and data on growth, nitrogen balance, basal metabolism, R.B.C. and haemoglobin formation were obtained. The results are in general agreement with those obtained on animals of the 2nd generation.

Muscle haemoglobin formation and plasma protein fractionation studies have been taken up. A method for estimating muscle haemoglobin is being standardised and electrophoretic studies are in progress in collaboration with the Physical Chemistry Division.

c) PREPARATION OF LOW VISCOSITY TRANSFUSION GELATIN  
(Gurdas Singh).

A preparation of gelatin which is non-toxic and non-antigenic has already been obtained in this laboratory. Experiments are being carried out to make this preparation suitable for use as a plasma substitute by reducing the viscosity without appreciable reduction in molecular weight.

d) L-LYSINE CONTENT OF SOME OIL SEED CAKES (Govindarajan,  
V.S., and Ramchandran, B.V.).

The L-lysine content of press cakes of some oil seeds including a few not hitherto examined have been determined by the highly specific decarboxylase method of Gale.

Among the well-known oil cakes, those from cotton seed and ground nut are useful sources of lysine both for large scale preparation of amino acid and in cattle feeding. Exceptionally high proportion of the amino acid was found in the seed cakes of Holoptelea integrifolia.

5. MICROBIOLOGICAL PRODUCTION OF SULPHUR (Sadana, J.C.).

Experiments conducted on increasing sulphate reduction have resulted in the production of a maximum of 4257 ml. H<sub>2</sub>S per litre of sludge in 10 days as compared to 2800 ml. previously reported. Raw sewage as well as effluents before and after digestion from anaerobic digestion tanks gave much lower values of H<sub>2</sub>S.

Sludge was shown to contain some factors which stimulate the growth of sulphate-reducing bacteria. These factors were found to be stable to heat, insoluble in cold but soluble in hot water and were not extracted by acetone, ethyl alcohol and ethyl ether.

Preliminary experiments were conducted to study the mechanism of sulphate reduction.

6. PREPARATION OF STABLE INJECTIBLES FROM CALCIUM GLUCONATE PREPARED IN THIS LABORATORY (Rangachari, P.N. & Vakil, J.R.).

Saccharic acid (Zuckersäure) and saccharinic acid (Saccharinsäure) were prepared in the form of the calcium salts and their stabilising effect on concentrated solutions of calcium gluconate was studied. The latter was found to be a better stabilising agent. Stable solutions containing 10% calcium gluconate suitable for injectibles have been prepared.

7. NATIONAL COLLECTION OF TYPE CULTURES (NCTC). (Govindarajan, V.S., Krishnamachar, V.S., and Ramachandra Rao, T.N.)

Routine subculturing with morphological biochemical characterisation was continued. The following organisms were added to the collection:

Leuconostoc	mesenteroides (helveticus)
L.	mesenteroides (4 strains)
L.	dextranicum (2 strains)
Rhizobium	trifoli
R.	lupini
R.	japonicum
R.	phaseoli

Growth and enzyme content of B. cadavaris on different media and conditions of aeration were studied. Supplementing Gale's media with 1% yeast extract and aeration further increases the growth and yield of enzyme.

CHEMICAL ENGINEERING DIVISION

1. FLUIDISED CALCINATION OF LIMESTONE (Sastry, S.L.)

There was a breakdown in the equipment early in the quarter and because of difficulty in obtaining replacement parts, the unit was repaired and reassembled on a smaller scale.

The effect of preheating the fluidising gas is under investigation. It has been found that the preheating zone has a large influence on the amount of decomposition. For example, at a mass velocity of 120 lbs./hr. ft<sup>2</sup>, temperature 1000°C, and time of blow one minute, complete absence of a preheating zone results in a product analysing 15.7% available CaO; a preheating zone consisting of a 3" packing of stainless steel rings increases the available CaO in the product to 25.8%, while a 5" preheating zone leads to a further increase to 34.9% CaO.

A scheme has been drawn up for production of chemical lime from Indian limestones on a pilot plant scale. It is proposed to study the process and its economics, using vertical, rotary, and fluidised kilns for calcination. A grant for this purpose is being requested from the Chemical Research Committee.



## 2. CHLORINATION OF RUBBER (Desai, A.M., Gill, K.S., Goswami, M., and Singh, S.P.).

The precipitation of chlorinated rubber from its solution was studied. The precipitated product showed a slight coloration, which was removed by treatment with a dilute sodium hypochlorite solution.

Further work on the development of an improved technique of precipitation and a modified precipitator design is in progress.

Investigations were conducted on the dissolution of rubber in carbon tetrachloride on a bench pilot plant scale (666 gms. rubber, 12,800 gms.  $CCl_4$ ) to determine the influence of mastication, catalysts, air bubbling and temperature on the rate of dissolution, the final viscosity of the solution and the solvent loss.

It was found that rubber that had been masticated for 30 minutes could be dissolved at the boiling point of carbon tetrachloride in about 12 hours with negligible solvent loss. The catalyst used was copper oleate, the amount being 6% on the weight of rubber. The final viscosity of the solution was about 2 poises.

## 3. NICOTINE FROM TOBACCO WASTE (Gedoon, J.).

Pilot plant work on this project has been successfully concluded. Several grades of tobacco waste containing 0.5 to 3.5% nicotine have been processed.

Emphasis was placed on studying the performance of the liquid-liquid extraction tower, and comprehensive data were obtained on the following relationships:

- a)  $D/d$  (diameter of tower to diameter of stirring plates), number of plates, and rate of flow.
- b) Extraction efficiency and rate of flow.
- c) Extraction efficiency and number of stirring plates.
- d) Extraction efficiency and nicotine concentration of tobacco broth.
- e) Extraction efficiency and extraction ratio (rate of flow of broth/rate of flow of kerosene).

## 4. PHENOL (Bodekar, S.G.).

Work on the absorption of carbon dioxide in sodium carbonate-bicarbonate solutions is almost complete. The data are being used for the design of an absorber in which sodium phenate will be decomposed by carbon dioxide.

It has been found that the absorption coefficient changes very rapidly between 0 and 6% conversion. For example in a solution having a total sodium normality of 4.26, and at 500 r.p.m. of the turbine type impeller, the absorption coeffi-

-cient kg (lb mols. per cu.ft.hr.atm.p.p.CO<sub>2</sub>) was found as follows:

<u>Conversion %</u>	<u>kg</u>
1.07	0.01115
3.21	0.00713
6.31	0.00616

Other equipment for this project is being fabricated.

5. PHOSPHORUS AND TRIPLE SUPER PHOSPHATE (Bijawat, H.C., Gill, K.S., and Patel, N.B.).

The design of the complete pilot plant for the production of phosphorus, phosphoric acid, and triple superphosphate has been completed. The main units designed were a blast furnace, two blast stoves, recuperator, dust catcher, cyclone separator, spray and packed towers for condensation of phosphorus, a preferential oxidation chamber, an absorption column for phosphoric acid, and an after-cooler system. Auxilliary equipment such as pumps, compressors, burners, and storage tanks, etc., have been specified.

A scheme for a grant-in-aid for this project was prepared and submitted to the Council of Scientific and Industrial Research.

Installation of the pilot plant will commence as soon as funds are available.

6. CELLULOSE PULP, RAYON, ETC. (Mehta, D.J., Potnis, G.V., Uppal, M.M.)

The chemical cotton unit received at the N.C.L. was found, after a few runs, to be unsatisfactory and had to be completely modified and reassembled.

About a dozen varieties of cotton linters have been collected, and are being converted to chemical cotton by treatment with caustic soda. The average cellulose content of the various varieties of cotton linters is about 88.5%, whereas the chemical cotton produced so far averages 99% in alpha cellulose content. Further work for determining optimum conditions to prepare high quality chemical cotton from indigenous raw materials is in progress.

A stainless steel digester needed for acid pulping process has been tested.

A variety of indigenous raw materials such as bamboos, grasses, woods, etc. are being collected from various parts of the country.

A scheme for a grant-in-aid for a pilot plant for this project has been prepared and submitted to the Council. Full scale work can start only after funds are allocated for the project. The Bombay State Government has agreed to contribute rupees 5 lacs for the pilot plant provided the Council contributes an equal amount.

7. ETHYLENE AND ITS DERIVATIVES FROM ALCOHOL (Bijawar, H.C.,  
Joshi, H.K., and Pai, M.U.).

A bench pilot plant consisting essentially of a catalytic reactor, condenser and a scrubber, has been fabricated and assembled. The plant has been tested for the smooth flow of materials, and some of preliminary qualitative runs have been carried out.

Five catalysts, three of which are precipitated aluminium hydroxides and the remaining two are dehydrated alums, have been prepared. The hydroxides have been precipitated from three different aluminium salts, viz., (1) aluminium nitrate (2) aluminium sulphate and (3) ammonium alum. The precipitation was carried out in each case in hot boiling solutions with ammonia, and the precipitate was washed free of most of the soluble salts by alternate boiling with water and centrifuging. Air-dried hydroxide of the proper consistency was formed into pellets by pressing through a specially designed extrusion press and the pellets were air dried.

The dehydrated alums were prepared by a special procedure reported in the literature. The final dehydration was done at 220°C.

It is also proposed to undertake trials with activated bauxite as a catalyst.

The equipment is being calibrated for flow rates of alcohol through the feeding nozzle, and the flow meter for flow of gases. Regular quantitative runs will then be undertaken to establish the optimum temperature, space velocities, catalyst life, etc., and to determine which catalyst is best for efficient and economical operation of the process.

8. ACTIVATED CARBON AND CARBON BLACK (Geddon, J., & Kincl, F.A.).

Investigations on the chemical engineering problems, particularly corrosion and materials of construction, associated with the manufacture of activated carbon by the zinc chloride process have been completed.

A semi-commercial pilot plant with a capacity of half a ton of activated carbon per day is being designed for some interested parties.

The unit for making carbon black from fuel oil is being fabricated in the N.C.L. Workshop, and delivery of refractories is awaited.

9. QUICK LIMING OF HIDES (Kincl, F.A., & Potnis, G.V.)

Studies were made to reduce the period of liming of hides used in the production of gelatine and glue by pretreatment of the hides before liming with a dilute solution of a halide of an alkaline earth metal.

It was found possible to reduce the liming period by 2 to 4 weeks depending on the temperature, condition of stock, choice and concentration of pretreating agent, etc.

The results obtained so far are being studied and correlated.

## INORGANIC CHEMISTRY DIVISION

### 1. MIXED FERTILISER FROM SEA BITTERNS (Soshadri, K.)

Wadala bittern of density  $30^{\circ}$  Be was concentrated to  $35^{\circ}$  Be and used as the raw material for treatment with ammonia and carbon dioxide. This procedure, which eliminated 72% of the sodium chloride with loss of only 7.1 and 6.4 per cents of magnesium sulphate and chloride respectively, was found simpler than purifying the end product by fractional crystallisation, reported earlier. One litre of the concentrated bittern yielded 430 gms. of a mixed fertiliser of the following composition:

Ammonium chloride	...	58.4	per cent
Ammonium sulphate	...	25.5	,,
Sodium chloride	...	4.3	,,
Potassium chloride	...	5.0	,,
Hydrated magnesium chloride	...	1.8	,,
Hydrated magnesium sulphate	...	5.0	,,

The precipitate of light magnesium carbonate (290 gms/litre), a bye-product of the reaction, gave on calcination pure white magnesia, having bulk density 106-114 g/litre. The product compares favourably with imported high-grade light calcined magnesia of commerce, and has the following average analysis:

MgO - 98.62, CO<sub>2</sub> - 0.14, Fe<sub>2</sub>O<sub>3</sub>+Al<sub>2</sub>O<sub>3</sub>- 0.12, SiO<sub>2</sub>- 0.07,  
CaO - 0.64, SO<sub>3</sub> - 0.37, Na - 0.02 per cent.

Laboratory experiments using two gallons of the concentrated bittern per batch are in progress.

### 2. PHOSPHATES AND POLYPHOSPHATES (Gadre, G.T.)

#### a) SEMI-ACIDULATED PHOSPHATES

Laboratory experiments with varying proportions of sulphuric acid and Kossier rock phosphate showed that by using 75% of the theoretical quantity of acid required for making mono-calcium phosphate, the product obtained after curing contains 90% of its total phosphoric acid, soluble in neutral ammonium citrate solution. The use of half the theoretical quantity of the acid renders 80% of the total phosphoric acid 'available'.

#### b) MIXED N-P FERTILISERS

Work was completed on making a stable, free-flowing mixed fertiliser containing 8.4% nitrogen and 15% P<sub>2</sub>O<sub>5</sub> from rock phosphate, by treatment with hydrochloric acid and ammonium sulphate. The process is likely to solve problem of the disposal of bye-product hydrochloric acid of the industry.

Nitro-phosphate fertilisers, using phosphate rock, nitric acid and ammonium sulphate are under investigation. It has been

observed that even dilute nitric acid is capable of rendering the major part of phosphoric acid soluble. Three molecules of the acid renders 85% of the phosphoric acid citrate-soluble.

### c) SODIUM TRIPOLYPHOSPHATE

Samples of tripolyphosphate were prepared from commercial trisodium phosphate and phosphoric acid, and their identity established by X-ray powder diagrams. These diagrams also tallied with those of sodium tripolyphosphate samples obtained from M/S. Blockson Chemical Co., Illinois, and Calgon Inc., Pittsburg. Further work is in progress.

This work was done in collaboration with the Physical Chemistry Division.

### 3. SOREL CEMENT (Singh, M.M.)

Various formulae have been ascribed to this magnesium oxychloride cement in which the ratio of oxide to chloride fluctuates between 3:1 to 8:1. The usual method is to mix the oxide and the chloride of proper specifications in a suitable amount of water at the time of setting.

A new approach has been made in getting a dry mixture which sets on mixing only with the requisite amount of water. After successful preliminary experiments with imported magnesium chloride of B.P. grade, the indigenous material from Pioneer Magnesia Works is being tried.

### 4. TITANIUM DIOXIDE PIGMENT (Shukla, S.O.)

A dozen firms dealing in paints and pigments, including Travancore Titanium Products, Ltd. have been supplied a pound each of the titanium dioxide made in the laboratory. Their reports are awaited.

Complete laboratory data on (a) titanium tetrachloride by chlorination of bauxite sludge from Aluminium Corporation, Asansol, and (b) titanium dioxide pigment by hydrolysis of titanium tetrachloride have been submitted in the form of two reports.

The sulphuric acid method of obtaining titanium dioxide from bauxite sludge is still under investigation. Samples of satisfactory pigment quality have not been obtained so far.

### 5. RARE ELEMENTS

#### a) GERMANIUM DIOXIDE FROM SPHALERITE (Nair, C.K.N., Rajan, K.S.)

Different methods of extraction are being examined. In the hydrochloric acid distillation process, a part of germanium is retained as sulphide in the distillation flask. A much higher amount is extracted by autoclaving with a 50% solution of sodium hydroxide. Of the several methods tried for isolation of germanium from the alkali extract, precipitation from strongly acid solutions as the disulphide was found to be the most satisfactory.

b) RARE EARTHS FROM INDIAN MONAZITE SAND (Sarma, B.)

The possibility of obtaining rare earth chlorides by reacting the unground sand with chlorine or chlorides is under investigation. Nearly 40% of the mineral is attacked by heating with a mixture of charcoal and chlorides of sodium and calcium at 700-750°C. Chlorination at elevated temperatures has yielded interesting results which are to be confirmed.

c) ZIRCONIUM COMPOUNDS (Gupta, J., Rajan, K.S., Shankar Das, M)

The work on the extraction of zirconia from zircon sand with sodium hydroxide was continued.

A cationic exchange resin prepared in the Plastics and Polymers Division has been successfully used for the removal of practically all impurities except hafnium from a solution of zirconium oxynitrate. A carbonaceous cation exchanger has also been prepared for this purpose.

Experiments for the removal of hafnium by partition chromatography of the oxychloride over silica gel and activated cellulose are in progress.

6. INSTRUMENTAL ANALYSIS (Das Gupta, A.K., Lole, M.Y., Nair, C.K.N., and Sarma, B.)

Increasing demands are made on the services coming under this category for the routine analysis of samples from the Laboratory and outside organizations. The Perkin Elmer flame photometer set up recently has been extensively used for the quick estimation of sodium, potassium and calcium.

Several estimations of the gamma isomer in benzene hexachloride have been carried out for outside parties with the Tinsley polarograph.

A furnace and pyrometer, designed and fabricated in the laboratory, and a complete glass assembly with vacuum system have been set up for measuring radon in mineral waters.

Qualitative spectrographic analysis of samples, including purified zirconium salts, has been carried out with the Hilger Large Quartz Spectrograph. A new small instrument, 'SPECTRINAL', used for the quick detection of 35 metallic elements in solution, has been set up and calibrated.

7. CHEMICAL ANALYSIS (Danodaran, V., Dhar, S.K., Subbaraman, P.)

Over a hundred analyses, mostly routine, have been carried out during the period. These include the complete analyses of water from Sivaji lake, Lonavala; dairy salt (English and indigenous), residues from copper extraction at Ghatsila and Sodium tripolyphosphate samples.

8. NEW ANALYTICAL METHODS (Das Gupta, A.K., Dhar, S.K., Nair, C.K.N.)

The polarographic reduction of tetravalent germanium has been carried out at pH values higher than 4. Two waves for reduction in two stages can be obtained only around pH 8. The

total wave height, both with single and double waves, is proportional to the concentration of permanganium.

An indirect method for colorimetric estimation of calcium for which suitable methods are not known, has been worked out. The method consists in estimating oxalohydroxamic acid in a calcium hydroxamate precipitate by dissolving it in acetic acid and measuring the colour intensity of its ferric complex at 500 millimicrons. The colour of ferric acetate does not interfere.

## ORGANIC CHEMISTRY DIVISION

### 1. INVESTIGATIONS OF NIM (Mitra, C.R.)

#### 1) FAT CONTENT OF THE NIM SEED SHELL AND ABSORPTION OF OIL BY THE SHELL

With a view to establish the desirability or otherwise of decorticating the nim seed before crushing, experiments have been carried out which show that the dry seed shell contains about 7 per cent of fatty matter and the shells as such (not defatted) absorb about 4 per cent of oil.

#### ii) APPLICATION OF PROCESSES OF REFINING AND PURIFICATION OF NIM OIL TO SEED OIL OF PONG'AMIA GLABRA VENT(KARANJA)

The comparative physical and chemical characteristics of the original as well as the 'refined' Karanja oil have been determined. The results show that the oil has been refined to the desired extent for industrial utilisation.

The acid analysis of the 'refined' Karanja oil is in progress. Hydroxy stearic acid, reported by earlier workers, could not, however, be detected by usual fractional crystallization.

#### iii) STUDIES IN THE BITTER CONSTITUENTS OF NIM

Total hydrolysis of nimbin: Nimbin (1 mol.) requires 5 mols. of caustic potash for complete hydrolysis. A neutral component melting at 240-42°C has been obtained from the hydrolysate of nimbin.

#### iv) ULTRAVIOLET ABSORPTION OF NIMBIN

A characteristic curve has been obtained with well defined absorption peaks at 240 and 310  $\mu$ .

### 2. EXTRACTION OF VEGETABLE OILS THROUGH AQUEOUS MEDIUM (Joshi, B.N., Gupta, A.S., Varma, J.P.)

Experiments on the extraction of the oil through an aqueous medium have been carried out with coconut, peanut cake and Kamala seeds.

Coconut: The percentage yield of the oil extracted from

coconut using NaCl and Na<sub>2</sub>SO<sub>4</sub> solution has been found to be 53-54% as against an oil content of 60%. Standardization of conditions to achieve the optimum yield of oil is being worked out.

The physical and chemical constants of the oil extracted by this method lie within the range of standard values. The nitrogen content of the coconut cake obtained by aqueous extraction has been found to be 3.2-3.3% (cf. pressed cake 3.2-3.4%).

Pea nut cake: Solvent-cum-water extraction of peanut cake gave a yield of 6% as against an oil content of 11%. Further work is in progress.

Kanala seed oil: Interesting results have been obtained in the solvent-cum-water extraction of Kanala seeds. The amount of oil obtained by this process using petroleum ether along with water, was found to be more than that obtained by the solvent alone. During these experiments two fractions of the oil were obtained, one of which insoluble in petrol ether was found to be miscible with linseed oil and preliminary examination of such a mixture has shown that the drying properties are improved. Optimum conditions for improved yields are being worked out.

### 3. IMPROVEMENT AND MODIFICATION OF SUGARCANE WAX (Kulkarni, A.B., and Mhaskar, V.V.)

Under different experimental conditions a number of samples of modified waxes to satisfy the I.G. wax specifications have been prepared, and their solvent take-up and retention have been determined.

The recovery of chrome alum from the oxidation liquors has been carried out on a large scale. A successful chemical treatment was found out for recovery of chrome alum from liquors stored for a long time.

### 4. CONSTITUENTS OF MEHDI, INDIAN HENNA (Nagarkatti, A.S.)

A process has been developed for the isolation of lawsone from mehdi leaves. Extraction with dilute aqueous solution of sodium bicarbonate and acidification of the extract has yielded lawsone together with some other impurities.

The presence of gallic acid in the extracts has been indicated by the ferric chloride colouration test. Experiments to isolate the acid are in progress.

### 5. UTILISATION OF CHLOROSULPHONIC ACID FROM 'WASTE DISPOSALS FOR THE MANUFACTURE OF SACCHARINE' (Joshi, C.G., and Kulkarni, A.B.)

a) Experimental conditions were established for the recovery of potash chrome alum as a by-product from the oxidation liquor obtained in the manufacture of saccharine. About 75% alum on basis of potassium dichromate consumed was obtained.

b) The lower boiling and the highly fuming fraction of the 'Disposal acid' was studied and it was found, that it contained about 35% chlorine and probably a sulphuryl molecular compound of sulphuryl chloride and sulphur trioxide in the proportion of 1:5.



6. ELIMINATION OF SAPONIN FROM MAHUA OIL CAKE (Bassia Latifolia)  
(Dutta, N.L.)

A convenient method has been developed to remove the saponin from mahua oil cake. The powdered cake after treatment with dilute mineral acids for a few days, was washed thoroughly with water and dried. The meal thus obtained was tasteless and free from saponins. Further work is in progress.

7. CHEMICAL EXAMINATION OF GLORIOSA SUPERBA LINN (Subbaratnam, A.V.)

As a result of preliminary investigations on the alkaloidal constituents of the fresh tubers of *G. superba*, colchicine, m.p. 151-52°C, colourless needles from ethyl acetate, and a new alkaloid which has been provisionally named (Gloriosine'  $C_{22}H_{25}O_6N$ , m.p. 248-50°C,  $[\alpha]_D^{34} = -200.5^\circ$  (c. 1.172 in  $CHCl_3$ ) rectangular plates from alcohol, have been isolated by chromatographic fractionation of the total purified alkaloid from the drug (yield = 0.1% on the weight of the dry tubers).

8. MICRODETERMINATION OF BROMINE (Shah, G.D., Subba Rao, D.)

In continuation of the work on micro-determination of chlorine by the Dichromate method in Organic substances containing both nitrogen and sulphur as additional elements, this method is extended to estimate bromine in such types of compounds. Several such compounds have been synthesised and analysed for their bromine content by this method.

9. MICRO DETERMINATION OF ACONITIC ACID (Pansare, V.S., Subba Rao, D.)

The conditions for the micro-determination of the aconitic acid are being standardised and the modifications made so far give results within 1% of the theoretical value. Investigations are in progress to obtain more accurate results.

10. PECHMANN CONDENSATION (Dalal, L.H. (Miss), and Shah, G.D.)

Resorcinol and methyl  $\beta$ -resorcyate were condensed with ethyl acetoacetate in presence of borontrifluoride-ether complex and the reaction products are being studied.

11. STUDIES IN THE CONSTITUENTS OF CHANA (Cicer arietinum Linn.)  
(Bose, J.L.)

In view of the recently reported estrogenic activity of the isoflavone, genistein (J.Chem.Soc., 1951, 3447), o-alkyl ethers of isoflavones of chana germ, particularly biochanin A are being prepared with a view to investigate their estrogenic activity.

In an attempt to note the changes, if any, in the isoflavone molecules when period of germination is prolonged, the crystallisate from the extractive of germinated chana (germination period 22 days), is being investigated. The extractive was supplied by the Biochemistry Division.

12. SOLVOHOL-B SUBSTITUTES (Bose, J.L.)

Experiments on direct etherification of the reaction mixture

containing glycerol- $\alpha$ -chlorohydrin as well as of the pure chlorohydrin were reported and the usefulness of the former procedure was established. The  $\gamma$ -diethyl ether of glycerol, prepared from dichlorohydrin was also found to have solvent properties similar to that of the  $\alpha$ -ethyl ether. Attempts to synthesise the others by the alternative route, through the glycerides, are in progress.

### 13., SYNTHETIC EXPERIMENTS IN THE $\gamma$ -PYRONE SERIES (Dutta, N.L. and Bose, J.L.)

Simultaneous acetylation and ethyl orthoformate condensation of 2,4-dihydroxy-4'-nitro deoxybenzoin yielded a product identical with 2-methyl-7-hydroxy-4'-nitroisoflavone m.p. 310°, (mixed m.p. with an authentic sample underpressed), instead of a product similar to 'Ketone A' reported earlier. Further work on the constitution of 'Ketone A' is in progress.

2-Methyl-7-acetoxy-isoflavone was synthesised by drastic acetylation of 2,4-dihydroxy deoxybenzoin. Deacetylation of the product with concentrated sulphuric acid at 0°C or with boiling dilute sodium carbonate solution gave good yields of the corresponding hydroxy isoflavone.

Reduction of 7-methoxy-4'-nitro isoflavone with alcoholic acetic acid and zinc dust or with dilute acetic acid and iron powder yielded crystalline 7-methoxy-4'-acetylamino isoflavone m.p. 310-15°C (decomp.). The corresponding base was obtained by the action of sodium bicarbonate in the acetate. It crystallised from alcohol in pale yellow needles, m.p. 208-9°C, and is being further characterised.

### 14. ESSENTIAL OILS

#### 1) MALABAR LEMON GRASS OIL (Bhattacharyya, S.C.)

The examination of this oil has been concluded. Unlike lemongrass oil, it does not contain any citral as indicated by the bisulphite value. Its main constituents are camphene and bornool which constitute about 50% of the oil. The presence of limonene is also indicated. Some higher boiling constituents, probably, sesquiterpenes are also present in very small amount. The oil may prove a suitable raw material for synthesis of camphor, as both camphene and bornool are intermediate components involved in its preparation.

#### ii) CINNAMYL ALCOHOL (Bhattacharyya, S.C. & Chakravarty, K.K.)

The method for the preparation of this compound from cinnamic aldehyde has been standardized. In isopropyl alcohol or a suitable mixture of isopropyl alcohol and anhydrous benzene, aluminium isopropoxide has been found to be a suitable reducing reagent. The end point of the reaction is easily indicated by the boiling point of the azeotrope, thus making repeated tests for detection of acetone unnecessary. With suitable proportion of isopropyl alcohol, less than 10% of the theoretical amount of isopropoxide gives about 80% yield of pure cinnamyl alcohol which could be collected by direct distillation.

iii) SPEARMINT OIL (Bhattacharyya, S.C., & Chakravarty, K.K.)

Six samples of spearmint oil from mentha viridis totalling about 4 lbs. have been collected by steam distilling spearmint (Mentha viridis) grown on the N.C.L. plantation. For the best plot an approximate yield of over 40 lbs. per acre has been recorded. The samples of the oil are under investigation. The oil differs somewhat in optical rotation from foreign varieties of spearmint. It appears to contain considerable proportion of a volatile component which is heavier than water.

15. CONSTITUTION OF KARLOLENIC ACID (Gupta, S.C., & Gupta, S.S.)

The presence of a hydroxyl group in the new acids has been directly established by acetylation in cold ethereal solution with acetyl chloride. The corresponding acetyl values for  $\alpha$  and  $\beta$  Karlolonic acids were found to be 165.2 and 164.3, the theoretical value being 167.0. Hydrogenation of these acetyl compounds in the presence of platinum catalyst yielded acetyl derivative of  $\omega$ -hydroxy stearic acid (m.p. 72°C) in both the cases.

The mixture of dibasic acids obtained by permanganate oxidation of Karlolonic acid, has been esterified for separation and identification of the components by fractional distillation under vacuum.

16. FATTY ACID ANALYSIS OF KAMALA OIL (Gupta, S.C., & Gupta, S.S.)

Analysis of oil obtained from a fresh supply of seeds is in progress. Unlike the previous sample, the oil contains little polymerised material and as such is richer in its content of Karlolonic acid.

17. SOLVENTS FOR THE EXTRACTION OF KAMALA OIL (Gupta, S.C.)

Kamala oil has been extracted from the seed meal by using various solvents, such as trichlorethylene, carbon tetrachloride, chloroform, ether sulphuric, petrol ether, acetone and benzene. The quantities in each case were found out and their various characteristics are being determined.

18. PREPARATION OF SPAR VARNISHES AND ALKYD RESINS FROM KAMALA OIL (Sharma, P.G.)

Spar varnishes at different temperatures have been prepared from Kamala oil. They all dry in air giving air-drying, smooth and uniform films. Microscopic glass slides coated with the above varnishes were sent to the members of Indian Central Oil-seeds Committee to show to them that Kamala oil does give flat and smooth films contrary to the statement of Mr. D.D. Suri, Turf Survey Officer that Kamala oil only gives wrinkled surfaces.

19. STABILIZATION OF EDIBLE FATS BY SPICES AND CONDIMENTS (Sethi, S.C.)

The apparatus for carrying out the standard accelerated test for rancidity by A.O.M. method has almost been set up.

About 1½ maund of groundnut oil for the test has been obtained by getting the seeds crushed in a local phario. It has

been alkali refined and the oil stored in 2 lb. glass bottles at 0°C.

Extracts of dry ginger using alcohol and petrol ether have been prepared.

## 20. REFINING OF COTTON-SEED OIL (Bhasin, M.M.)

Conditions have been worked out for the alkali refining of crude dark coloured cotton seed oil. The oil thus refined has been bleached with decolorising carbon. Direct sunshine also helps in bleaching the colour. A refined oil of Lovibond colour (1" cell) 1.0 R and 5.0 Y has been obtained.

## 21. CHEMICAL ANALYSIS OF THE OIL FROM THE SEEDS OF STERCULIA FOETIDA (Bhasin, M.M.)

*Sterculia foetida* (Janali Badan - Hindi) is a common garden and avenue tree in Bombay State. Its seeds kernels contain 52.4 per cent of a pale yellow oil. Work on the analysis of this oil is in progress.

### PHYSICAL CHEMISTRY DIVISION

#### 1. OSMOTIC COEFFICIENTS

##### 1) SYSTEMS OF NON-AQUEOUS SOLVENTS (Iyengar, B.R.Y., and Kulkarni, S.B. (Miss).)

The thermistor data on solutions of benzil in organic solvents reveal that the resistance differential per unit molal concentration ( $K = \Delta R/m$ ) is proportional to the product of latent heat (L. m.cals.), vapour pressure of the solvent ('p' m.m. Hg) and square of molecular weight ( $M^2$ ). The actual relationship is

$$K = 1.39 M^2 L.p$$

for a pair of Stantel thermistors. The following table illustrates the applicability of the above relationship to experimental data:

<u>Compound</u>	<u>K (obs.)</u>	<u>1.39 M<sup>2</sup>.L.p</u>
n-butyl alcohol	10.7	10.3
n-propyl alcohol	24.7	25.4
Chlorobenzene	27.8	24.2
Toluene	41.6	42.3
Heptane	59.5	61.8
Dioxane	60.0	63.1

The efficiency  $\frac{K \text{ observed}}{K \text{ theoretical}}$  of the same pair of thermistors was checked as a function of temperature and was found to increase with temperature (efficiency = 64, 72 and 80% at 30°, 35° and 40°C for water.

Molecular weights of two alkaloids (prepared by Organic Division) were determined in alcohol and toluene solutions and

were found to be in close agreement with their respective formula weights.

ii) OSMOTIC COEFFICIENT: A THEORETICAL BASIS FOR STUDIES IN SYSTEMS OF NON-AQUEOUS SOLVENTS (Iyengar, B.R.Y.)

Based on the concept of simultaneous diffusion and heat transfer it is possible to derive the following relationship:

$$K = \Delta R/n = \frac{RB}{T^2} \cdot \frac{M^2 L}{1000 M_a (P-p) \cdot h/k} \quad \text{where,}$$

$K = \Delta R/n$  = resistance differential per unit molar concentration;  $M$ ,  $L$ , and  $p$  are the molecular weight, latent heat of vaporization, and vapour pressure, respectively, of solvent,

$R$  = resistance of thermistor at temperature  $T^{\circ}$  (abs.),

$B$  = characteristic constant of the thermistor,

$M_a$  = mean molecular weight of air,

$P$  = total pressure, and

$h/k$  = ratio of the heat transfer coefficient to the mass transfer coefficient.

It is interesting to note that the dimensions ( $R H^{-1} M^{-1} L T^2$ ,  $R$  and  $H$  being the dimensions of resistance and heat respectively) of the constant  $C$  in the observed relationship,  $K=C.M^2.L.p$  are the same as that of the multiplicand of  $M^2.L.p$  in the theoretical relationship given above.

2. LIGHT SCATTERING BY COLLOIDAL SOLUTIONS (Bhatnagar, H.L.)

As trial experiments the turbidity and depolarisation ratios of solutions of two fractions of poly-methylmethacrylate were measured. The molecular weights calculated from turbidity measurements were of the order of 20,000 and 83,000. The plot of depolarisation ratio V.S. concentration curve went through a minimum, as had been observed by Doty for solutions of other polymers. This has yet to be explained on a theoretical basis.

Methods of obtaining optically pure solvents are being further investigated in order that accurate dissymetry measurements may be made.

Another sample of sodium lauryl sulfate is being purified in order that work on solutions of this soap may be continued.

3. ELECTROPHORESIS

a) ELECTROPHORESIS OF COLLOIDAL ELECTROLYTES (Hira Lal)

In order to calculate mobilities from electrophoresis results it has been necessary to determine partial specific volumes of potassium laurate and lauryl sulphonic acid at 25<sup>o</sup> and 0.2<sup>o</sup>C. This work has been completed.

b) PHYSICO-CHEMICAL PROPERTIES OF  $\alpha$ - $\beta$  LENS PROTEINS (Hira Lal)

Preliminary experiments on electrophoresis, diffusion, viscosity and partial specific volume of  $\beta$ -lens protein (bovine) have been carried out. Further work shall be resumed after these proteins are made available in pure form.

### c) ELECTROPHORESIS OF METALLO-PROTEINS (Rao, M.S.N.)

Experiments on the binding of copper by egg albumin in phosphate buffer of pH 6.8 and ionic strength 0.1 were not successful on account of the very limited solubility of the resultant cupric phosphate.

Preliminary experiments on the binding of copper by egg albumin in acetate buffer (pH 4.8, ionic strength 0.1) indicate that the amount of copper bound by the albumin is of the same order as the copper bound by serum albumin under similar conditions of pH and ionic strength. The effect of the bound copper on the electrophoretic behaviour of the albumin is under investigation. The electrophoresis of samples of rat sera is being done for the Biochemistry Division.

### 4. SPINNING-TOP ULTRACENTRIFUGE (Iyengar, B.N.Y. & Karath, I.S.K.)

With an additional storage tank for compressed air, the air compressor was found to give satisfactory performance, and the temperature drift described previously was eliminated. The sedimentation velocity of isoelectric egg albumin (concentration 2.0 to 3.0%) was determined using the 37 mm. rotor and McBain-Loyda insert to prevent convection. The runs were of short duration (15-16 minutes) with air pressure of 20 p.s.i.g., the speed of the rotor being between 1400 to 1500 r.p.s. After some trouble with leakage, a rubber gasket cut out of 'Good-Year' surgical gloves was found to be good enough to prevent leakage of the solution during centrifugation. The values of sedimentation velocity of isoelectric egg albumin at 30°C were found to vary from 2.31 to 5.53 Svedberg units (accepted value being 3.55 at 20°C). The apparatus is being checked and set for obtaining more constant and reproducible results.

### 5. STUDIES WITH X-RAY DIFFRACTION SPECTROMETER

#### a) X-RAY STUDIES OF SINGLE CRYSTALS (Biswas, A.B., and Sharma, B.D.)

A rotation-oscillation camera and a two-circle optical goniometer are being installed for studies on single crystals and preliminary trials are in progress.

In connection with this study, succinic acid was synthesized, since it was not otherwise available. As soon as the single crystal camera is set up, the crystallography of this and other amic acids will be undertaken.

#### b) X-RAY DIFFRACTION AND OTHER PHYSICO-CHEMICAL STUDIES OF n-ALKYL MALONIC ACIDS (Biswas, A.B., & Sharma, B.D.)

In connection with our work regarding the x-ray diffraction and other physico-chemical studies, it was necessary to synthesise a series of alkyl malonic acids. So far n-propyl and n-butyl malonic acids have been synthesized in very pure, snow-white crystalline state and also in very good yields. Usual procedure followed was condensation of the appropriate alkyl halides and sodio malonic ester in absolute alcoholic medium. The esters thus formed were isolated, purified, saponified, extracted with ether; the residue acidified and extracted with

other again to get the free alkyl malonic acid. The acid was purified by crystallisation from benzene, and beautiful snow white flakes were obtained.

Work on the synthesis of higher alkyl halides is in progress.

c) SODIUM TRIPOLYPHOSPHATE FROM TRISODIUM PHOSPHITE  
(Gharpurey, M.K. - in collaboration with Inorganic Div.)

X-ray diffraction patterns of powdered synthetic samples were compared with those of standard samples from commercial firms. The results show that mixtures of the low temperature and the high temperature forms (forms II & I, respectively) are usually obtained for temperatures less than about 580-600°C, while the high temperature form is obtained only at higher temperatures.

Samples from mixtures of monosodium and disodium phosphates, and also from mixtures of sodium meta- and pyro-phosphates, prepared for comparison, also showed similar dependence on temperature of preparation.

d) X-RAY HEATING CAMERA (Marsden, S.S. & Sanjana, N.R.)

A number of tests were carried out on the x-ray diffraction heating camera described previously. Several difficulties had to be overcome and the effect of various experimental variables checked. It appears that it will not be possible to use the camera with the x-ray spectrometer as had been expected, but it will be necessary to use it with the film technique. After a few more tests, the study of the sodium laurate-sodium chloride-water system at elevated temperatures will be undertaken.

e) CLAY MINERALS (Sanjana, N.R.)

A sample of Mooltani clay was studied on the x-ray diffraction spectrometer. The clay was found to be of the montmorillonite group. X-ray diffraction of a sample after the standard glycerine treatment indicated that it belongs to the sub-group of a swelling montmorillonite.

A sample of lamellar mineral sent by M/S. Jain Bros. of Bombay was also examined on the x-ray diffraction spectrometer. Although the firm thought that it was a vermiculite, it did not give the x-ray diffraction patterns of the several vermiculites mentioned in the literature.

The clay sample from the Wadala salt beds described in a previous report was run on the x-ray spectrometer. It gave the diffraction pattern corresponding to that of a Malliss clay. Treatment with glycerine indicated that it is a non-swelling clay.

f) SHARK-RAY COLLAGEN (Marsden, S.S.)

Several photographs were taken of samples of shark ray collagen prepared by the Biochemistry Division. It gave a fiber diagram of high angle diffractions typical to that of collagen from other sources. No small angle diffractions were observed. However, additional photographs will have to be taken under different experimental conditions to see if they exist.

## 6. OPTICAL AND NUCLEAR PHOTOGRAPHIC EMULSIONS (Chatterjee, D., Gujral, J.S., Sinha, K.P.)

After concluding a series of successful experiments with hide-gelatine, investigations were extended to the study and preparation of sensitive bromo-iodide negative emulsions using bone-gelatine. Under suitable conditions, the results have been found to be exceptionally satisfactory in density, contrast and gradation of tones coupled with its specific rigidity, firmness and adhesive power to the glass support, being much better than that of hide-gelatine used so far. The potentiality of the emulsions was dependant primarily on the initial condition of precipitation of the silver halides. Further work is in progress in standardising various parameters.

A hand-operated 'Emulsion-Press', lined with silver, has been designed to shred the set-jelly into a convenient size of 'noodles' to facilitate washing with lesser swelling. The emulsion press is being fabricated in the Workshop.

Some of the experiments dealing with the fundamental mechanism of photo-sensitivity of silver bromide grains have been carried out carefully. A series of experiments were done for measuring the conductivity of saturated solutions of silver bromide and silver sulphide in water. Measurements were also done with various mixtures of silver sulphide and silver bromide solutions. A very strong interaction has been noticed. Further work is in progress.

## 7. SYNTHETIC RUTILE (Lakshbir Singh)

The laboratory gas has been found to be unsuitable for the conventional design of the Verneuil's furnace. Suitable modifications are being attempted.

### PLASTICS AND POLYMERS DIVISION

## 1. CHLORINATION OF RUBBER (Raghunath, D., & Ramakrishnan, C.S.)

In continuation of the work reported previously, chlorination of rubber solution in carbon tetrachloride was carried out at 20°C, simultaneously passing nitrogen to carry away the HCl liberated. The partially chlorinated rubbers were subjected to quantitative ozonization to find out the changes in unsaturation during chlorination. The results when compared with the previous results show that addition of HCl does take place to some extent if it is not removed by nitrogen. However, it was also found that reduction in unsaturation due to chlorine also occurs at the same time. Substitution reaction seems to be prominent in all cases until a chlorine content of about 12% is reached.

A comparative study of the reaction between phenyl iodo-dichloride and rubber in solution was undertaken as it is known that the predominant reaction with this reagent is one of addition. Results obtained so far show that there is a linear decrease in unsaturation with increase in chlorine content from 9% to 50%, whereas with gaseous chlorine the decrease in unsaturation proceeds in several stages.



## 2. HYDROHALOGENATION OF NATURAL RUBBER (Pande, J.B., & Raghunath, D.)

Work on halogenation and hydrohalogenation of natural rubber is now directed towards obtaining X-ray photographs of treated rubbers of known halogen content. Natural rubber dispersions have been treated with  $Cl_2$ ,  $Br_2$ ,  $I_2$ ,  $HCl$ ,  $HBr$  and  $HI$  at such temperatures as would give high halogen content. These samples have been purified in the usual manner.

## 3. LATEX IMPREGNATION OF BELTING (Pande, J.B., & Raghunath, D.)

Large scale trials of impregnating 15' long belt pieces originally requested by the firm could not be carried out owing to lack of timely confirmation from the firm. Since complete accord is now reached plans for large scale trials are under way.

## 4. SELLOTAPE ADHESIVES (Rao, N.V.C.)

A process for the preparation of pressure sensitive adhesive tape, using cellophane paper as the base, has been developed. Attempts to remedy the difficulty of the tape sticking permanently to its back side proved to be successful and it was found that a primary coat, consisting of materials compatible with both the cellophane base and the adhesive layer, was necessary. In one set of experiments, the primary coat consisted of a latex composition with a phenolic resin incorporated in it. The adhesive coat was a dispersion of rubber with resinous ingredients, in a suitable solvent. Test samples of the tape have been kept for ageing and the adhesive properties of the same appear to be quite satisfactory.

## 5. USE OF NATURAL RUBBER IN INKS AND PAINTS (Pande, J.B.)

The colloidal nature of rubber can be advantageously used in stabilising pigment dispersions in various industrial compositions, such as paints and inks. Oil-based compositions of paints, duplicating inks, etc., demand that the rubber used must be compatible with the composition. Ordinary natural solid rubber, however, would not mix with such compositions unless it is degraded and depolymerised to an extent when the molecular weight approaches 1000 to 2000. Polyisobutylene, polymethyl pentadiene of the same molecular weight range show similar behaviour. Work was undertaken to obtain such rubbers whose molecular weight approaches 1000 to 2000. Satisfactory compositions were prepared for ink (duplicating and inside wall paints) and these compositions did not possess any stringiness due to the presence of rubber.

## 6. STYRENEATED ALKYDS (Sarin, K.K.)

Experiments were carried out for studying the co-polymerisation of styrene with tobacco-seed oil fatty acids. Benzoyl peroxide was used as a catalyst and the reaction was carried out at 130-140°C. The copolymerisation between 2-methyl styrene and tobacco seed oil fatty acids, and the preparation of modified alkyds therefrom has been reported earlier. In a series of experiments various molar proportions of styrene would be used to study the rate of reaction between styrene and tobacco-seed oil fatty acids.

## 7. COATINGS FROM MODIFIED ALKYDS (Joshi, R.M., & Kapur, S.L.)

Several formulations of different proportions of tobacco oil modified alkyds with cashew nut shell liquid, bhilawan nut shell liquid, and phenol formaldehyde resin were prepared and the properties of the films obtained from these compositions are being examined. It has been observed that the addition of increasing proportions of phenol formaldehyde resin in the modified alkyd has definite effect on the texture of the wrinkles formed. Further work is in progress.

## 8. LOW TEMPERATURE STOVING ENAMELS FROM UREA RESINS (Sarin, K.K.)

With the object of developing a coating composition based on modified urea resins which should bake at comparatively lower temperature of 100-110°C so that it could be applicable on articles like wood, fabric, and cloth, etc., a series of experiments were conducted to find out the effect of residual acidity of the blending alkyd on the stoving characteristics of urea resins. Use of unsaturated maleic anhydride alkyds is being tried to achieve the desired results.

## 9. SURFACE COATINGS FROM BHILAWAN NUT SHELL LIQUID (Kapadia, F.H.)

### a) LOW STOVING BOBBIN ENAMEL

Experiments were conducted for the development of low temperature stoving enamel from BNSL for coating textile mill bobbins. It is observed that by bodying BNSL with nitrated turpentine, it is possible to formulate enamels which would stove satisfactorily at 90-100°C if followed by baking the films for a few minutes at 150-200°C.

### b) VARNISH FOR RUBBER SHOES

Films obtained by the use of highly bodied BNSL in certain solvents were found to be tackfree but they lacked required flexibility. The incorporation of rubber to these formulations seems to improve flexibility. Further work is in progress.

## 10. SOLUTION PROPERTIES OF POLYMERS (Kapur, S.L.)

Semi-permeable membranes from denitrated cellulose nitrate have been prepared and are working satisfactorily in the osmometer. Osmometer has been installed in a specially built thermostat. It was found that using acetone as a solvent in these measurements, temperature of the thermostat should not be more than 25°C, otherwise it leads to slow vaporisation of the solvent which affects the measurements and gives erroneous results. A few measurements have been taken at 25°C and further work is in progress. Intrinsic viscosities of all these solutions are also being determined simultaneously at the same temperature.

## 11. BATTERY CONTAINERS FROM INDIGENOUS ASBESTOS (Roddy, P.P.)

M/S. Associated Battery Makers (Eastern) Ltd., Calcutta have been supplied 250 lbs. of Indian asbestos. They have also been advised to buy the other components themselves. The results of the trial experiments which are being conducted by M/S. Firestone

Tyre and Rubber Co., Ltd., and M/S. Standard Batteries Ltd., are still awaited.

## 12. UTILISATION OF WASTE MICA (Reddy, P.P.)

Bonding of mica flakes with shollac and shollac modified with hexa and aluminium chloride was attempted. Water absorption test was carried out on the bonded sheets and found to be quite high (8-10%). Experiments were carried out using mica powder (40 mesh) and shollac. The bonded sheets showed very good water resistance. Bonded mica sheets were made using mica powder and phenolic resin. It was found that water absorption was considerably reduced when mica powder, instead of mica flakes, was used. The effect of particle size of the mica powder on the water absorption of the bonded mica sheets made with several binders was measured using Shore Durometer (Type C) and the sheets were found to be quite hard.

## 13. CHEMICAL DEGUMMING OF RAMIE (Sarin, K.K.)

Experiments were conducted for the chemical degumming of ramie in cold solutions. Increased concentrations of alkalis for prolonged periods of immersion remove the resinous material from the fibers but the strength of fibers gets adversely affected.

## 14. ION EXCHANGE (Bafna, S.L., Govindan, K.P., Krishnaswamy, N., and Shah, H.L.)

### a) CATION EXCHANGE RESINS

Cation exchange resins were prepared by the condensation of bhilawan nut shell liquid (BNSL) with sulphuric acid followed by sulphonation of the polymer thus prepared. Alternatively BNSL was condensed with formaldehyde and the polymer so obtained was further treated with sulphonating agents. Both these resins have capacities similar to those from cashew nut shell liquid (CNSL).

### b) PHYSICO-CHEMICAL STUDIES

In continuation of the work reported earlier, the capacities of the ion exchange resins from CNSL (a, b and d) were found to vary over the entire pH range as follows:

<u>Resin No.</u>	<u>Variation of pH</u>	<u>Variation of capacity in m.e.g./m. (dry resin).</u>
(a)	1.3 - 12.8	0.19 - 1.51
(b)	0.93 - 12.6	2.44 - 5.75
(d)	0.94 - 12.8	2.01 - 5.16

The increase in capacity is due to the presence of carboxylic acid groups.

The capacity of the resins (b) and (d) were determined in the dynamic systems at various levels of regeneration.

The titration curve of a cation exchange resin sample prepared from naphthalene according to Indian Patent application

No.47,468 was studied. It was found that the capacity due to the sulphonic acid groups was 3.5 n.e.q./gm.; the maximum capacity obtained was 3.8 n.e.q./gm., thus showing the presence of carboxylic acid groups to the extent of about 10%.

### c) DEIONISATION OF CANE JUICE

In continuation of the work reported earlier, a number of resin combinations and systems were studied to find out a suitable process for the deionisation of cane juice.

In conventional deionisation by employing a strongly acidic cation exchange resin followed by a weakly basic anion exchange resin, it was found possible to obtain water-white syrups deionisation. Inversion of cane juice is minimised if the temperature is kept at about 20-30°C. Purity rise of 7 to 10 units was obtained.

In reverse deionization by employing a strongly basic anion exchange resin followed by a weakly acidic cation exchange resin there was found to be no inversion and a purity rise of 7 to 8 units was obtained.

In mixed bed deionization, employing a mixture of suitable cation and anion exchange resins, water white syrups were obtained with substantially no inversion and a purity rise of 7 to 10 units.

The cane juice was passed through a cation exchange resin in the sodium cycle to eliminate the formation of evaporator scales.

Similarly the cane juice was passed through a cation exchange resin in the ammonium cycle. Surprisingly there was a substantial rise in purity (about 2 to 3 units).

By re-using a part of the spent regenerants, regeneration efficiency of the order of 125% on the weight of the ash in the cane juice has been obtained.

The advantages of deionization of cane juice are as follows:

1. Increase in yield of sugar (about 5 to 10%) on weight of sugar.
2. Improved quality of sugar.
3. Formation of an edible syrup, instead of molasses.
4. Prevention of shut-downs due to evaporator scales.

A detailed economic analysis has been made and it has been found that deionisation of cane juice would be an economical process. As a result of this work, M/S. Walchandnagar Industries Ltd., Walchandnagar have agreed to put up a laboratory scale plant to try out the process.

### d) MIXED BED DE-IONISATION

In continuation of the work reported earlier, combination (1), which consisted of a mixture of Amberlite IRC-50 ( a weak acid cation exchanger) and Amberlite IR-4B ( a weak base anion exchanger), was used for experiments with a synthetic brackish

water. The results show that there is very good removal of calcium; however, the reduction in solids content was not satisfactory. The anticipated theoretical regeneration efficiency was not obtained as the separation of the two resins in the system was not satisfactory. The effect of column height was also studied.

#### c) REGENERATION TECHNIQUES

A study of the regeneration techniques is of vital importance as the cost of de-ionisation in any process depends on the amount of regenerants used. For regenerating strongly acid cation exchangers, usually about 22-300% of the theoretical amount of acid is required. By using a special technique of regeneration, which involves reuse of the regenerants, regeneration efficiencies of the order of 110%-120% of the theoretical have been obtained.

### 15. LIGNIN PLASTICS

#### a) LIGNIN BASED LAMINATES (Kapadia, F.H., & Kapur, S.L.)

Work has been started on lignin obtained from the waste liquors of the paper industry. This is being utilised for the preparation of various lignin impregnated papers. Paper sheets containing various percentages of lignin have been prepared and are being examined for their laminating properties.

#### b) LIGNIN AS A FILLER IN PLASTICS (Kapadia, F.H.)

Lignin obtained from the hydrolysis of bagasse (a by-product of the sugar industry) is being investigated as a filler in plastics.

Considerable economy in phenol-formaldehyde resins, used for moulding and laminating purposes may be achieved by extending them with lignin. The moulding characteristics of these compositions containing various percentages of lignin, and the strength properties of the products are being investigated.

### 16. MOULD DESIGN (Ghosh, A.)

The designs of an injection mould for the 3/8 oz. Francis Shaw injection moulding machine and a flow test compression mould for thermosetting materials have been prepared. It is proposed to get these moulds fabricated in the Workshop.

### 17. ASBESTOS PAPER (Kapur, S.L.)

Attempts were made to prepare asbestos paper for indigenous asbestos, in collaboration with the Handmade Paper Centre, Poona. Comments on these samples were received from M/S. Tata Chemicals and further experiments have been planned to make this paper conforming to the required specifications.

SURVEY & INFORMATION DIVISION

I. INFORMATION SERVICE

A. TECHNICAL (Mathur, H.H., Sahni, M.M., & Shastri, D.K.)

(a) The following table summarises the work conducted at this division in connection with the services rendered to various industrial firms during this quarter:

<u>S.No.</u>	<u>Name of the Party.</u>	<u>Subject.</u>
1.	Dr. B. Prasad, Cuttack.	Information on acid resisting paints.
2.	M/S. Shree Ganpati Button Industries, Boawar.	Utilization of donut wastes.
3.	Shri Chaturbhai Patol, Banaras City.	Extraction of nicotine from tobacco wastes.
4.	M/S. Southern Industrial Corporation, Madras.	Rust proofing of iron screws.
5.	M/S. Sabco Industries, Indore.	Preparation of office pastes.
6.	Seven firms.	Manufacture of lead pencils.
7.	Mr. R.V. Subba Rao, Madras.	Preparation of disinfectant from pine oil.
8.	M/S. Khosla Rice Mills, Sarna (East Punjab).	Preparation of activated carbon from paddy husk.
9.	M/S. K.S.P.S. Natarjan & Co., Tuticorin.	Manufacture of caustic soda.
10.	M/S. Krishna Chemical & Pharmaceutical Works, Calcutta.	Manufacture <sup>and</sup> of general properties of casein.
11.	M/S. Mysore Chalk Factory, Banaloro.	Manufacture of white chalk sticks.
12.	Mr. R.K. Asundi, Banaras.	Information on glass to quartz seals.
13.	M/S. National Research Industries, Nagpur.	Preparation of tooth pastes.
14.	M/S. Acme Agencies, Ahmedabad.	Extraction of bhilawan shell liquid.
15.	Mr. Raj Kumar, Amritsar.	Gilding of glass.
16.	M/S. Bharat Starch & Chemicals Ltd., Calcutta.	Information on Undi oil and Dhupa fat.

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|-----|---|--|
| 17. | Mr. K.L. Kolhatkar, Satara.                   | Cleaning of old mirrors.   |
| 18. | The Bombay Mineral Supply Co. Ltd., Jannagar. | Upgrading and purification of bauxite ore.                                 |
| 19. | Mr. Sajjad F. Bandukwala, Bombay.             | Refining of oils.  |
| 20. | M/S. Ahuja Colour Chemical Co., Udaipur.      | Information on the hardness factor of pisa fat.                            |
| 21. | M/S. Vegetable Starch Industries, Ahmedabad.  | Preparations from tamarind seed.   |
| 22. | M/S. The Gwalior Sugar Co. Ltd., Dabra (M.B.) | Manufacture of pressed boards and paper from bagasse.                      |
| 23. | M/S. Perneshri Das Padam Chand, Delhi.        | -do-   |
| 24. | The Institute of Home Industries, Gadag.      | Preparation of adhesive pastes, fountainpen ink and disinfectants.         |
| 25. | Mr. V. Rajagopal Naidu, Palghat.              | Manufacture of camphor.  |
| 26. | Mr. U.V. Hingorani, Agra.                     | Information on sugarcane wax.  |
| 27. | Mr. W.H. Young, California, U.S.A.            | Information on 'Multani Matti'.  |
| 28. | Mr. S.M. Anwarwal, Bhirkhoj.                  | Manufacture of katha.  |
| 29. | M/S. Chandra Singh Purshottan, Bombay.        | i) Decolorization and testing of honey.<br>ii) Preparation of sugar candy. |
| 30. | Mr. Ramanlal K. Mehta, Ahmedabad.             | Manufacture of sodium hydrosulphite.                                       |
| 31. | Mr. V.R. Vaish, New Delhi.                    | Manufacture of hard coir boards.   |
| 32. | Mr. A.C.K. Perchan, Chevannur.                | Manufacture of slate pencils.  |
| 33. | M/S. Panchal Engineering Works, Bulsar.       | Utilization of wood waste.   |
| 34. | M/S. Kothari Saw Mills, Bombay.               | Utilisation of wood waste.   |
| 35. | M/S. Madho Prasad Mahabir Prasad, Calcutta.   | i) Uses of Stannic chloride.<br>ii) Tinning of vessels.                    |
| 36. | M/S. Danji Jethabhai and Sons, Bombay.        | Manufacture of magnesia cement and gypsum boards.                          |

37.	Mr. H. Abdul Razzaq, Saharanpur.	Manufacture of incandescent gas mantles.
38.	M/S. Kashmiri Lal Khanna and Co., Delhi.	-do-
39.	M/S. Victory Hosiery, Howrah.	-do-
40.	Dr. L.N. Sud, Calcutta.	Manufacture of fountainpen ink.
41.	M/S. Diamond Co.(India), Bilga (Punjab).	Manufacture of sodium sali- cylate.
42.	M/S. Daulat Ram Jinendar Prasad Jain, Delhi.	Preparation of boot polishes.
43.	M/S. Sonawala Industries, Ltd., Bombay.	i) Availability of pyrites in India. ii) Manufacture of mercuric chloride from mercury. iii) Manufacture of copper sulphate from copper scrap.
44.	M/S. S.M. Pandit and Co., Bulsar.	Preparation of papad khar, sodium sulphide and refined salt.
45.	M/S. Malabar Spice Co.Ltd., Alleppey.	Information on lemon grass and Cardamom oils.
46.	M/S. Jetmull Bhojraj, Gangtok.	Preparation of orange juice, jam and marmalade.

(b) Information, in response to enquiries on the subjects noted below was supplied to the following Government Departments:

- |    |  |  |
|----|--|--|
| 1. | The Chief Conservation<br>Engineer, Damodar Valley<br>Corp., Hazaribagh.   | Prevention of rotting of bags<br>by superphosphate.          |
| 2. | The Chemist Incharge,<br>Village Industries Research<br>Laboratory, Poona. | Extraction of saponin from<br>Shikakai and its applications. |
| 3. | The Meteorologist-in-charge,<br>Meteorological Office, Poona.              | Information on recording inks.                               |

#### B. COMMERCIAL (Guha, S.R.)

(a) About 15 enquiries from various firms were attended to in respect of availability and cost of various chemicals.

(b) Market survey on availability of bagasse with the sugar mills was conducted.

#### II. BOTANICAL WORK (Joshi, P.C.)

(a) Enquiries were attended to for the following:



1. Shri Y.N. Kotwal, Bombay.
  - i) Identified the fruit of Crescentia Cujete L., and
  - ii) Supplied information on its uses and chemical constituents.
2. Forest Department, Saurashtra State.
 

Supplied information on tapping of gum arabic.

(b) The following essential oil-bearing and other experimental plants are under cultivation on the farm:

1. Mentha viridis L. (Spear-mint).
2. Polianthes tuberosa L. (Tuberoso).
3. Jasminum grandiflorum L. (Jasmine).
4. Pelargonium sp. (Rose geranium).
5. Hibiscus Abelmoschus L. (Musk Mallow).
6. Dioscorea spp. (Yams).
7. Manihot esculenta Crantz (Tapioca).
8. Two Chinese and one American varieties of sweet-potato - Tie Shin Tun, F.A.17 White, Golden Skin Yam.

Thirty five different plant materials were collected from around Poona, Punjab plains and Simla hills for chemical investigation.

### III. ABSTRACTS FOR ATOMIC ENERGY COMMISSION (Ramanjanoyulu, J.V.S.)

Preparation of abstracts of scientific papers on the subjects of atomic energy, radioactivity, nuclear physics, etc. was continued during the period under review and abstracts for the month of June, 1951 were communicated to the Atomic Energy Commission, New Delhi.

### IV. INDUSTRIAL SECTION (Dave, C.D., Kelkar, D.D., & Lolo, A.M.)

(a) Preparation of monographs on 'Writing Inks' and 'Lubricating Greases' was described in previous report. Further work on monographs on 'Lead Pencils' and 'Boot Polishes' has been taken up. Material for these is being collected.

(b) Department of Public Health, Bombay State, asked for such methods for clarification of water in which use of 'alum' or of substances that involves sulphuric acid in their manufacture could be avoided or reduced to a minimum. Experiments were taken up and it has been suggested to them that if soda silicate is used along with alum, proportion of the latter could be reduced considerably. Further experiments are in progress.

(c) Forty-five parties were advised in starting chemical industries on a small scale. Seven persons visited the Industrial Section in connection with demonstrations and two were trained in a number of projects on small scale industries.

### V. THE LIBRARY (Krishnan, A.)

1690 publications were added during the quarter under review. An upto-date set of British, A.S.T.M. and Indian Standards

has been received.

Following donations were received:

- Prof. J.W. McBain.                   ... 23 books and several back numbers of periodicals.
- Imperial Chemical Industries  
(India) Ltd., Bombay.           ... 13 booklets on dyes.
- Dr. N.V.C. Rao.                   ... Several loose numbers of periodicals on rubber technology.

The number of periodicals subscribed has increased from 320 to 347.

APPENDIX - II

TECHNICAL AID RENDERED TO INDUSTRY

<u>S.No.</u>	<u>Name of the Party.</u>	<u>Subject.</u>
1.	Four firms.	Refining of sugar cane wax.
2.	M/S. Ford Motor Co., Bombay.	Testing of motor-car parts.
3.	Mr. M.K. Venkatraman, Nellore.	Information on polyvinyl alcohol.
4.	M/S. Varli Chemicals, Bombay.	i) Setting up of a citric acid plant; ii) Preparation of amino acids.
5.	Five firms.	Extraction of nicotine from tobacco wastes.
6.	M/S. Modern Moulders, Calcutta.	Manufacture of phenol formaldehyde moulding powders.
7.	M/S. Fat & Oils Ltd., London.	Hydrogenation of rapeseed oil.
8.	M/S. Gwalior Oils, Soaps, & United Industries Ltd., Gwalior.	Extraction of oil from press-mud.
9.	Shri Ramashwar Das, Rahtak.	Extraction and utilization of linseed oil.
10.	M/S. Parsons Ltd., Bombay.	Analysis of salt samples (English and Indian).
11.	M/S. Union Fertiliser Co., Bombay.	Manufacture of triple superphosphate.
12.	M/S. Bhor Industries Ltd., Bhor.	Manufacture of glue from hides and drying equipment for glue.
13.	M/S. Madhusudan Oil Mills, Bombay.	i) Methods of increasing pungency of mustard oil. ii) Utilisation of chlorosulphonic acid.
14.	The Central Organisation for Oil Industry & Trade, Bombay.	Aqueous extraction of vegetable oils.
15.	Mr. P.S. Bharati, Coimbatore.	Extraction of calcichin.
16.	Dr. V. A. Sarabhai, Ahmedabad.	Information on benzotrifluoroacetic anhydride.
17.	M/S. Indesona Ltd., Bombay.	Preparation of cellulose pulp <i>(for rayon)</i>

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|-----|---|--|
| 18. | M/S. Tayaballi Dawoodbhai,<br>Bombay.             | Preparation of cellulose pulp<br>for rayon.  |
| 19. | M/S. Modi Industries,<br>Modinagar, U.P.          | Hydrogenation of castor oil.   |
| 20. | M/S. Kaiser Trading Co.,<br>Calcutta.             | Refining and tests for used<br>lubricating oil.  |
| 21. | Paint Research Station,<br>Teddington, U.K.       | Information regarding karna oil<br>and varnishes prepared from it.                     |
| 22. | Shri Kishan Chand, Ashran<br>Sevagan.             | Information about work done on<br>vegetable oils as illuminants.                       |
| 23. | M/S. Imperial Chemical Indus-<br>tries, Bombay.   | Extraction of Karna oil with<br>trichloroethylene.                                     |
| 24. | M/S. Vivekanand Mills,<br>Bombay.                 | Utilization of tobacco seed oil<br>in paints and varnishes.                            |
| 25. | Four firms.                                       | Information regarding karna<br>oil.  |
| 26. | M/S. Tharot Pulverising<br>Mills, Bombay.         | Analysis of benzene hexachlo-<br>ride samples.   |
| 27. | Mr. N.S.R. Iyengar, Mysore.                       | Analysis of tobacco wastes<br>samples.   |
| 28. | M/S. Toshniwal Bros., Bombay.                     | Supplied a sample of air-drying<br>wrinkle finish varnish.                             |
| 29. | Dr. M.K. Patel, Bombay.                           | Information on artificial<br>plastic teeth.  |
| 30. | Mr. S.C. Banerjee, Poona.                         | Analysis of tobacco wastes<br>samples.   |
| 31. | Mr. Hans Raj Varnani, Kanpur.                     | Information on casein plastics.  |
| 32. | The Principal, College of<br>Science, Kanpur.     | Information on silica springs<br>and Puddington type surface<br>balances.              |
| 33. | Central Analytical Laboratory,<br>Patiala.        | Refining of castor oil.  |
| 34. | M/S. Dyer Mookia Breweries<br>Ltd., Sila Mills.   | Analysis of 13 samples of<br>'Yeast Health Drink' for<br>Vitamin 'B' content.          |
| 35. | Shri Gopal Chemical & Oil<br>Industries, Madras.  | Information on nutritive<br>value of oils.   |
| 36. | Shri Gopal Paper Mills Ltd.,<br>Jamnagar (Amala). | Ultraviolet absorption spectrum<br>analysis of a sample of lignin<br>from Gabal grass. |

APPENDIX - III

LIST OF THE GOVERNMENT DEPARTMENTS HELPED

<u>S.No.</u>	<u>Name of the Department</u>	<u>Subject</u>
1.	Chief Elect. & Mechn. Engineer, Govt. of Rajasthan, Jaipur.	Water Treatment by ion- exchange.
2.	All India Radio, Dharwar.	Analysis of water for air- conditioning purposes.
3.	Technical Development and Establishment Laboratories, Kanpur.	Preparation of soaps from pisa fat.
4.	Armed Forces Medical College, Poona.	Test for free chlorine in Lonavala lake water.
5.	Agricultural College, Poona.	Isolation of colchicine from Gloriosa superba.
6.	Plant Quarantine Station, Bombay.	Analysis of 16 samples of benzene hexachloride.
7.	Forest Utilisation Officer, Poona.	Analysed a sample of cashew- nut shell liquid.
8.	Govt. Inspector of Railways, Bombay.	Testing standard wire droppers used in electric railway traction.
9.	Atomic Energy Commission, Bombay.	Analysis of sample of tailings from Indian Copper Corp., Ghatsila.
10.	Deputy Engineer, Kirkee Water Supply Sub-division, Poona.	Composition of Fascote R. solution.
11.	Plant Protection Advisor, Ministry of Agriculture, New Delhi.	Analysis of benzene hexachlor- ide for $\gamma$ -isomer.
12.	Central Glass & Ceramic Research Institute, Calcutta.	Testing laboratory porcelain ware.
13.	Indian Air Force, New Delhi.	Analysis of aviation oxygen.
14.	Indian Institute of Sugar Technology, Kanpur.	Analysis of two samples by flame photometer.
15.	Public Health Engineer, Govt. of Bombay, Bombay.	Deionisation of brackish water.
16.	Sugarcane Breeding Institute, Coimbatore.	Study of growth factors for sugar cane.

## OTHER SCIENTIFIC ACTIVITIES

### (a) Micro-analysis for Universities and other Laboratories

Forty-one analyses were carried out for various elements and functional groups. The details are as follows:

1. Central Laboratories for Scientific and Industrial Research, Hyderabad (Dn.), ... 40 analyses.
2. M/S. Shri Gopal Paper Mills Ltd., Calcutta. ... 1 analysis.

### (b) Supply of Cultures of Micro-organisms

Cultures of various micro-organisms were supplied to the following parties free of cost:

<u>S.No.</u>	<u>Name.</u>	<u>Cultures supplied</u>
1.	Dr. H.N. De, Indore.	L.casci, L.formentum, and L. delbruckii.
2.	M/S. Cooperative Distilleries, NCTC 3095 (distillery yeast), Saharanpur, U.P.	
3.	Dr. R.G. Chitre, Bombay.	L.mesenteroides, L.citrovorum, L.casci, and L.delbruckii.
4.	Dr. S.P. Roy Chowdhary, New Delhi.	NCTC 2155.
5.	Dr. A. Sreenivasan, Bombay.	E. coli.
6.	Indian Agricultural Research Institute, New Delhi.	L. casci.
7.	Mr. J. Thaliath, Trivandrum.	S. ellipsoides.

### (c) Fine Chemicals

The following chemicals were prepared and supplied:

1.	Diazo aminobenzene.	Road Research Institute, Delhi.
2.	Styphnic acid.	Biochemistry Division, N.C.L.
3.	Chlormethyl ether.	Plastics & Polymers Division, NCL.
4.	Furan acrylic acid.	-do-
5.	Boron trifluoride acetic anhydride complex.	Physical Research Laboratory, Ahmedabad.
6.	Boron-trifluoride-ether complex.	Baroda University, Chemistry Department, Baroda.

(d) Lectures and Visits of important personalities

1. Air Marshal G.E. Gibbs, visited the Laboratory on June 3, 1952.
2. Dr. V.M. Dandekar, Professor, Gokhale Institute of Economics and Politics, Poona, delivered a lecture on 'Statistical approach to Scientific Problems' on June 5, 1952.
3. Vice-Admiral, M. Pizoy, Commander-in-Chief of the Indian Navy visited the Laboratory on June 16, 1952.

APPENDIX - V

SCIENTIFIC INVESTIGATIONS COMPLETED

1. Preparation of arginine from oil cakes (Biochemistry)
2. Estimation of lysine content of oil cakes (Biochemistry)
3. Extraction of nicotine from tobacco waste (Chemical Engineering).
4. Chlorination of bauxite sludge (Inorganic).
5. Hydrolysis of titanium tetrachloride (Inorganic).
6. Refining of cotton seed oil (Organic).
7. Shoe Polishes (Organic).
8. Isolation of colchicine from the plant 'Gloriosa Superba' Linn. (Organic).
9. Electrophoresis of colloidal electrolytes (Physical Chemistry).

APPENDIX - VI

NEW INVESTIGATIONS STARTED

Biochemistry Division

1. Formation of dextran.
2. Preparation of stable injectibles from calcium gluconate.

Chemical Engineering Division

3. Liming of hides.

## Inorganic Chemistry Division

4. Chlorination of monazite sand.

## Organic Chemistry Division

5. Chemical analysis of the oil from the seeds of *Sterculia foetida*.
6. Chemical examination of Malabar lemon grass oil.
7. Extraction of essential oil from spearmint.

## Physical Chemistry Division

8. X-ray diffraction studies in shark-ray collagen.

## Plastics & Polymers Division

9. Lignin Plastics.
10. Use of natural rubber in inks and paints.
11. Latex compositions for can sealing.

## APPENDIX - VII

### PATENTS FILED

- |                    |   |
|--------------------|---|
| 1. Ind.Pat.47,179  | Improvements in or relating to sugarcane wax - A.B. Kulkarni.   |
| 2. Ind. Pat.47,382 | A process for the modification of cashewnut shell liquid for use in surface coatings, baking enamels, air-drying varnishes or the like - J.S. Aggarwal and H.H. Mathur. |
| 3. Ind.Pat.47,439  | A process for the manufacture of mixed N-P Fertiliser - G.T. Gadre and J. Gupta.  |
| 4. U.S.Pat.270,526 | Improvements in or relating to the utilisation of the seed oil of <i>Mallotus philippinensis</i> Muell.Arg. (Karala) - J.S. Aggarwal, V.N. Sharna, and S.C. Gupta.      |

## APPENDIX - VIII

### PAPERS PUBLISHED AND COMMUNICATED

#### 1. Published

##### (a) Research Papers

1. Bafna, S.L. and Shah, H.A. - Studies in Ion-exchange



Part I, Studies of three synthetic cation exchange resins, J. Ind. Chem. Soc., 187 (1952), 29.

2. Bafna, S.L., Pai, M.U., and Shah, H.A. - Ion-exchangers, Part I - Sulphonation of Indian Coal; J. sci. industr. Res., 11B, 134 (1952).
3. Bafna, S.L., Bhagwat, W.V., and Maheshwari, G.L. Reactions of Iodine, Part I - Reaction between Iodine and Sodium formate in dark, Part II - Reaction between Iodine and formic acid, Part III - Reaction between iodine and sodium malonate; J. sci. industr. Res., 11B, 226, 228, 237 (1952).
4. Bhasin, M.M., Gupta, J. and Aggarwal, J.S. - Recovery of nickel and fat from spent nickel catalyst, Ibid, 249 (1952).
5. Gedeon, J., Ueber Randia Saponine und Saponine; Arch., 285, 127 (1952).
6. McGee, C.G. & Iyengar, B.R.Y., Determination of Osmotic Coefficients, Part I, Construction and Calibration of Thermistor Bridge, Ind. Jour. Phys., 26 (1952), 61.
7. Ranakrishnan, C.S., Spontaneous decomposition in vacuum of natural rubber ozonides, J. sci. industr. Res., 245 (1952).

§b) Review Papers

8. Aggarwal, J.S. - Drying oil resources of India, Paintindia, 2 (1), 47 (1952).
9. Aggarwal, J.S., Recent developments in oil and varnish technology, Ibid, 2(1) 50 (1952).
10. Bafna, S.L. - Cashewnut shell liquid, Ibid, 2(1), 63 (1952).
11. Gupta, A.S., Solvent segregation <sup>of</sup> oils, Ibid, 2(1), 67 (1952).
12. Joshi, B.N., and Varma, J.P., Recent developments in dehydrated castor oil; Ibid, 2(1), 58 (1952).
13. Kapur, S.L., Second order transitions in high polymers, Ibid, 2(2), 14 (1952).
14. Mitra, C.R., Refined nim oil (<sup>a</sup>Melia azadirachta) - a potential raw material for soap and allied industries, Ind. Soap Jour., 17 (1952), 281.
15. Sarin, K.K., Raw materials for paints and allied industries, Paintindia, 2 (1), 45 (1952).

16. Sarin, K.K., Kapur, S.L., and Aggarwal, J.S. - Alkyd and polymerised conjugated fatty acids, Paintindia, 2(1), 76 (1952).
17. Sethi, S.C. From oils to varnish resins, Ibid, 2(1), 70 (1952).
18. Sharma, P.G., Testing of paints, Ibid, 2(1), 37 (1952).
19. Varma, J.P., Chemically processed oils, Ibid, 2(1), 66 (1952).

## 2. Papers communicated

1. Bafna, S.L., and Shah, H.A. - The mechanism of the condensation of ethyl acetoacetate with resorcinols (To Current Science).
2. Danodaran, M., and Sivaraman, C., The Gornicidal activity of some pyridinium salts containing unsaturated hydrocarbon radicals (To Journal of Bacteriology, U.S.A.).
3. Dutta, N.L. and Bose, J.L. - Isoflavones, Part I - Some nitroisoflavones (to J.sci.industr.Res.).
4. Gadro, G.T. and Gupta, J., phosphate fertilisers, Part I - Dicalcium phosphate (to J.sci.industr.Res.).
5. Gedeon, J. and Goswami, M. - A process for the manufacture of nicotine sulphate from tobacco waste (to Indian Tobacco Jour.).
6. Gupta, S.C., Sharma, V.N. and Aggarwal, J.S. - Chemical examination of kanala seeds, Part II - Constitution of the new acid isolated from the oil (to J.sci. industr. Res.).
7. Sarin, K.K. and Kapur, S.L. - Urea rosin coating composition (to J.sci. industr. Res.).
8. Sethi, S.C. and Aggarwal, J.S. - Stabilisation of edible fats by spices and condiments, Part I (to J. sci. industr. Res.).
9. Subbaratnam, A.V. - A note on the alkaloidal constituents of Gloriosa superba Linn. (to J. sci. industr. Res.).

### APPENDIX - IX

#### CHANGES IN STAFF

#### Biochemistry Division

Mr. John Tatpati joined as a Laboratory Assistant (Jr.).

### Chemical Engineering Division

1. Mr. M.M. Uppal, Senior Scientific Assistant left.
2. Mr. P.K. Sarda joined as a Junior Scientific Assistant.

### Inorganic Chemistry Division

1. Mr. P.R. Subbaraman joined as a Senior Scientific Assistant.
2. Dr. S.O. Shukla, Senior Scientific Assistant, left.

### Organic Chemistry Division

1. Mr. S.C. Sethi, J.S.A. was promoted as Senior Scientific Assistant.
2. Mr. V.V. Mhaskar joined as a Junior Scientific Assistant.
3. Mr. M.M. Bhasin, Lab. Assistant (Sr.), was promoted as Technical Assistant to the Vegetables Oils Research Committee.

### Physical Chemistry Division

Mr. I.S. Krishna Kanath joined as a Senior Scientific Assistant.

### Plastics and Polymers Division

Mr. Arthur Ghosh, joined as a Senior Scientific Assistant.

### APPENDIX - X

#### NEW ITEMS OF EQUIPMENT RECEIVED

1. Grubb Parsons infrared absorption spectrometer	...	...	1
2. Rotation-oscillation x-ray camera	...	...	1
3. Optical goniometer	...	...	1
4. Lead pump	...	...	1
5. Speedivarc vacuum pump	...	...	1

### APPENDIX - XI

#### CONSTRUCTION AND MAINTENANCE

The new animal house, a few hundred feet to the north east of the main building, was made ready during the quarter under report.

The old boiler house to the north of the Chemical Engineering Division has been converted into a Chlorination Laboratory.

## APPENDIX - XII

### SOCIAL ACTIVITIES

#### N.C.L. CLUB

The N.C.L. Club completed first year of its existence on June 30, 1952. The chief activities of the Club comprising of indoor and outdoor games, sports, exhibition of educational information and feature films, Art and Drama, Reading Room and Photography, provided a healthy recreation to the members of the staff in general and residents of the N.C.L. Colony in particular. The total membership of the Club at present has gone up to 211.

During the quarter under report, fourteen 35 mm. films and half that number of 16 mm. films were exhibited in the Auditorium. A variety entertainment programme consisting of two one-act plays, one in Hindi and the other in English and other items of vocal and instrumental music and dance was arranged by the Art and Drama Section of the Club.

The Foot-ball team took part in the Maharashtra Foot Ball Association League and achieved a fair success. It is of special interest to mention that children of the Colony are taking keen interest in playing cricket and football. Youngsters' team in cricket arranged quite a number of friendly matches with the children of the other colonies.

The number of books in the Library has gone up to 350. About 25 periodicals are being subscribed and the rising attendance of the Reading Room shows the great interest the members are taking.

A new activity during this period consisted in publishing the Club Bulletin, the first two issues of which were distributed during the quarter under review.

#### School

The number of the children in the school has fallen from 27 to 20 owing to the transfer of some of the grown up children to the regular schools in the town. The school has made a steady improvement in equipment and training.

#### N.C.L. Co-operative Consumers Society

The N.C.L. Co-operative Consumers Society is doing roaring business in its new premises and is greatly helping the Colony residents by providing over increasing items of provisions and daily needs.

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