Chemistry in new zealand

February 1984, Volume 48 No. 1

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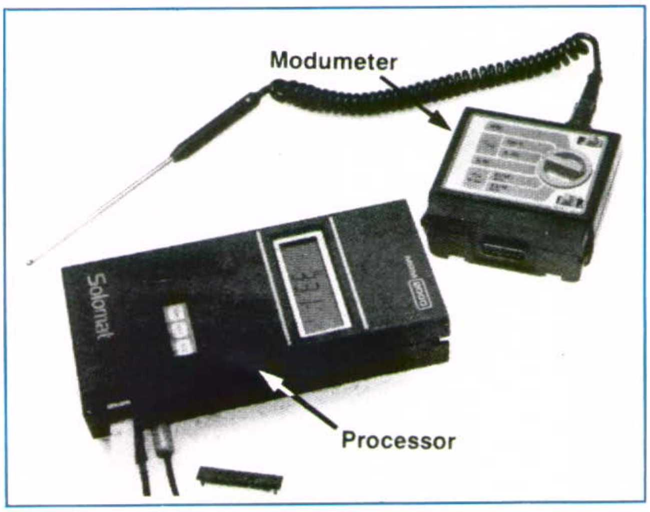

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GUEST EDITORIAL

ARE THERE ANY CHEMISTS IN THE HOUSE?

(An attempt to stir a solid)

If you are reading this then you are probably not the person I really want to talk to . . . It's the other fellow, the non-member, the 9 to 5 chemist, the one who switches off during outside hours and accepts no responsibility for his profession in the real world.

I would like them to supply answers to some of the questions listed at the end of this editorial. They would provide valuable insight into the external appearance of chemists, chemistry and the N.Z.I.C. Unable to tap that valuable source of information, we are forced again to try and reach the other unreachable source — the members themselves!

A number of us have spent many hours in committee meetings (and elsewhere) asking "What do the members want for their next meeting?" The rewards for this effort? Low attendances and regular faces no matter what the topic! What is required of the Institute? Obviously not monthly lectures, speakers etc.

Someone suggested a survey to discover "what members require of the Institute". Cripes, what a waste of time that would be. 90% of you wouldn't know and the rest wouldn't reply anyway. Tell you what, prove me wrong, at the end of this editorial are a few questions. I'll bet that less than 10% will bother to reply. You don't even have to answer all the questions. Pick the one or two most important to you.

This means that from 1500 members there should be 150 replies. (Incredible, there can't be that many stamps out there.) If your fingers are starting to twitch . . . good! Do yourself AND your profession a favour, put pen to paper.

QUESTIONS:

Part 1: Imagine you were the originator of a brand new organisation called the "NZ Institute of Chemistry".

1. What would be the principal aim of the Institute?
2. How would you attempt to achieve it?
3. What public image would the Institute adopt?
4. Compulsary or voluntary membership?
5. Why? (4 above).
6. What would membership offer in practical terms to a) the member? b) the employer?
7. Would you have grades of membership?
8. Why? (7 above)
9. Given that a higher grade may pay more, what extra benefits would be given?
10. Would you have classes of members? e.g. academic? industrial? government?
11. If a chemist is not practising chemistry e.g. systems analyst, manager etc, what would be your attitude?
12. What would be your attitude to associated institutes e.g. Paint, Cosmetic, Food etc.

Part 2: Attempt to answer these questions as being real issues facing "the Institute" now.

13. Having joined the Institute, the majority of members do not attend meetings etc. Why?
14. A lot of chemists are not members. Why?
15. Should the Institute "specialise" or "generalise"?
16. What should be the Institute's attitude toward the government and vice versa?
17. How active should the Institute be in the education system?
18. Should the Institute monitor chemists cf lawyers, accountants, plumbers.
19. In judicial and public affairs, should the Institute or private members provide statements.

LASTLY:

20. How did you first learn of the N.Z.I.C.?
21. Why did you join?

Congratulations! You may have just fallen off the fence. Replies may be sent to : The N.Z.I.C., P.O. Box 5139, Wellesley St, Auckland, Attention The Secretary.

Paul G. Farr

LETTER TO THE EDITOR

Dear Sir,

I see in the Journal for October that my name is mentioned in "Sceptical Chemist" with the inference that I am turning aside from the right and proper course in my attitude to the "nuclear issue". The actual words used were "Dr Sprott has in the past lent his authority to more worthy causes . . ."

What, I wonder, could be more worthy than the search for peace? Certainly not some of the grubby squabbles I have been involved in (and have won) and which may have brought their share of notoriety.

Pacificism has never brought peace, except to slaves. On must admire and would perforce agree with, the views of the idealists who would imagine that we could maintain the status quo, or some acceptable politico-economic system from a position of weakness, were this view not unreal and dangerously so.

Pacificism and weakness lead to war, and war in the future would lead to nuclear war, despite any efforts to ban nuclear weapons. That is the greater risk, by far, than maintaining an invincible nuclear deterrent. It is a sad commentary on the true nature of the human animal, but it is the way of the world and is not likely to change for a long while yet.

When the European Super Power withdraws its totalitarian regime from those other countries under its yoke, and people may live in freedom, and come and go without let or hindrance . . . then and only then can we in the West relax, and beat our nuclear bombs into nuclear power stations.

Yours sincerely

T J Sprott

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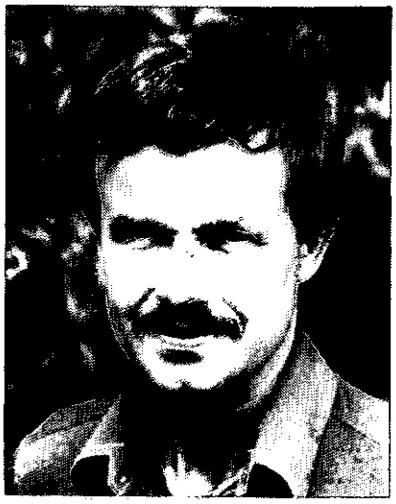
PEOPLE

NZIC BRANCH CHAIRMEN 1984

AUCKLAND — DR W.A. DENNY

Bill Denny received his PhD in chemistry at Auckland University in 1969, and obtained an ICI Postdoctoral Fellowship to Oxford University. After three years there, he was appointed to the staff of the Cancer Research Laboratory at the School of Medicine, University of Auckland, where he became deputy-director in 1981. He is concerned with the design, synthesis and evaluation of new classes of drugs for cancer treatment, with particular research interest in all aspects of drug-nucleic acid interactions and their relevance to biological activity.

He has been a member of the NZIC Auckland Branch committee since 1977, and a member of the editorial committee of "Chemistry in New Zealand" since 1978 (excluding long periods of absence overseas).



WAIKATO — DR L. MAIN

Lyndsay Main was brought up in Taranaki. He went to Victoria Universtiy to study chemistry and graduated MSc with Dr R.W. Hay as supervisor in 1966. After a further year at Victoria as a junior lecturer, he moved to Auckland University where he completed his PhD with Prof. P.B.D. de la Mare in 1970. Postdoctoral work with Dr T.C. Bruice at Santa Barbara followed. He returned in 1972 to take up a position in organic chemistry at Waikato University where, apart from periods of leave at Oxford (1975-6) and Exeter (1980-1), he has been ever since. His research interests are in physical organic chemistry.

A member of the Institute since 1972, he has served on the Waikato branch committee three times, and on conference committees two more times than he cares to remember.

Extramolecular interests are centred on family and friends, and cricket and tennis.

MANAWATU — DR K.R. WHITTLE

Ken Whittle attended Auckland University and obtained a BSc in 1969, a MSc with Honours in 1970 and completed a PhD in 1973 studying the structure of various Group VIII metal complexes under the guidance of Drs Joyce Waters and George Clark.

Since 1973 he has tutored in Chemistry as well as Biochemistry, Mathematics and Physics at the Manawatu Polytechnic. In 1979 he completed three months of Technical Refresher leave visiting a number of Government and industrial laboratories throughout the North Island. Since 1980 he has been Course Supervisor, Technician Studies which includes Science, Engineering and Data Processing in the Technician and General Studies Department. He is also the AAVA Coordinator administrating all NZ Certificate courses at the Polytechnic.

Ken has been a member of the Institute of Chemistry since 1973 and was elected a Fellow in 1983. He has been a member of the manawatu Branch Committee for several years and was Branch Treasurer for four years. In 1983 he joined the Editorial Committee of Chem NZ. Outside interests include his wife and three children as well as being a Spectator Sportsman.

WELLINGTON — DR N.B. MILESTONE

Dr Neil Milestone was recently elected Chairman of the Wellington Branch.

He initially studied at Victoria University of Wellington on a DSIR Study Award and completed his doctorate work at Waikato University in 1973 under Prof. A.T. Wilson, specializing in soil chemistry.

On return to Chemistry Division Dr Milestone joined the Inorganic Materials section where for several years he investigated the effect of concrete admixtures on the setting of cement. In 1976 he travelled to the USA to spend a year at the University of Illinois investigating chemical changes occurring during drying and loading of cement.

For the last few years he has been involved in the Chemistry Division programme on zeolite research and the methanol to gasoline reactions. As part of the Liquid Fuels Trust Board assessment of the Mobil Process he visited the Mobil Research Laboratories in USA during 1980.

At present Dr Milestone is seconded to the Development Finance Corporation working in the Applied Technology Programme. This programme is involved with the commercialization of technologies developed in New Zealand with the aim of increasing New Zealand's standard of technology.

He has served on the local NZIC Branch committee for several years in a number of offices including secretary and public relations and is currently treasurer for the 1984 conference to be held in Wellington.

CANTERBURY — DR H.K.J. POWELL

Kip Powell graduated from Victoria University of Wellington, where he

BRANCH CHAIRMEN

(Continued)

completed MSc and PhD degrees, under the guidance of Prof. Neil Curtis.

He joined the staff at Canterbury University in 1965, just before the move to the "new" Ilam campus. He became a Reader in 1978. He enjoys a responsibility in first year teaching and the opportunity to teach analytical chemistry in advanced courses.

Included in his overseas leave experiences have been periods at the Macaulay Institute for Soil Research in Aberdeen and the Australian Atomic Energy Commission at Lucas Heights. He has found considerable satisfaction in moving outside the familiar university atmosphere while on leave.

He is a past NZIC Council delegate, and branch secretary, and is presently on Council's, Publications and Membership committees.

Research interests include agricultural development of pakihi soils, the metal complex chemistry of fulvic acid, tannins and other naturally occurring complexones, and trace element analysis.

OTAGO — DR J.M. McKENZIE

Joan was born in Southland and after attending Southland Technical College, went to the University of Otago where she gained an MHSc, then a PhD in Human Nutrition from the School of Home Science. She then spent 15 months as a U.S. Public Health Postdoctoral Fellow at the USDA Human Nutrition Laboratory in Grand Forks, North Dakota before visiting laboratories in the United Kingdom and Europe on a Federation of University Women's Postgraduate Scholarship. On her return to New Zealand in 1975 she joined the staff of the Nutrition Department, University of Otago where she is now a Senior Lecturer. In 1980, Dr McKenzie spent a 7 month sabbatical at the Rowett Research Institute in Aberdeen, Scotland. She was the Secretary of the Otago Branch of the NZIC in 1979 and Secretary of the 1982 Conference Organising Committee.

Trace element nutrition is the area of Dr McKenzie's research, particularly of zinc, copper and cadmium. The high trace-element content of Bluff oysters is proving a particularly rewarding study. Outside interests include duckshooting, tramping, church activities, skiing and a 1937 Chevvy.

1984 CONFERENCE

NZIC/NZ Biochemical Society Conference Victoria University of Wellington, August 20—23rd, 1984.

Preparations are in hand for an interesting and varied joint annual conference of the above bodies at Victoria University of Wellington from Monday August 20 to Thursday the 23rd, 1984. The conference committee, under the chairmanship of Gordon Leary (Chemistry Division Director, DSIR) cordially invites all members of both groups to attend. On Friday the 24th of August, a symposium on "Certainty and Probability in Forensic results" is planned, organised by Dr P L Cropp of Chemistry Division, DSIR. The Science Teachers Conference (SICON 84) is being held at the same time in adjacent buildings at Victoria, and both programmes are designed to avoid major clashes and to utilize invited speakers to most effect.

A preliminary notice was distributed at the 1983 Conference and to local branch secretaries; a few copies are still available from the secretary. In the following DRAFT programme, the topic name indicates the main — or initiating — session day and corresponding plenary lecture(s):

Confirmed speakers include Sir George Porter (FRS, Nobel Prize winner), Professor D L Trimm (University of New South Wales), Dr D M Doddrell (Griffith University) and Mr G Connell (NZ Synthetic Fuels Corp.). All NZIC specialist group secretaries are asked to indicate whether time for an AGM (or other business) is required. Although specialist group sessions for presented papers will be running the committee hopes that attendees will use the planned Poster sessions as much as possible.

Further information or queries should be addressed to Dr G Gainsford, (Secretary, 1984 NZIC/NZBS Conference committee Chemistry Division, DSIR, Private Bag, PETONE.

	Day/Date	Morning	Afternoon	Evening
Monday	20 August	Registration, Opening	Spectroscopy as a Structural Tool	Opening Mixer
Tuesday	21 August	Biochemistry POSTER Session	Workshops: Instrument Applications & Quality Assurance	AGM and Address
Wednesday	22 August	Catalysis & Energy	Visits (DSIR, etc)	Conference Dinner
Thursday	23 August	Physical/Electrochem. Joint Education (SCICON)	Specialist Groups POSTER Session	End of Conference
Friday	24 August	Forensic Science Symposium		

N.Z.I.C. CHEM 13 NEWS EXAM MARK PERKINS NAYLAND COLLEGE, NELSON

This is a fifty multichoice exam set by the University of Waterloo, Ontario, Canada, for the North American high school students. Readers of the Chem 13 News magazine (available through the N.Z.I.C., Box 29183, Christchurch) will no doubt have seen the annual advertisement for entries.

For a couple of years I'd entered students from Nayland College and felt it was a worthwhile exercise, but felt it would be preferable if they were being compared to other New Zealand students. In corresponding with Professor Friesen of the University of Waterloo the concept of offering it within New Zealand with Institute of Chemistry backing arose. Consequently the 1983 trial was born. All the Chem 13 News team required was acknowledgement for setting the questions and the N.Z.I.C. guaranteed a $50 prize to the chemistry department of the winning students' school.

Advertising was achieved via the Education Gazette and the Institutes address list of Chem 13 News subscribers. The response was astonishing. Seven hundred and twenty-two entries from forty-six schools. Not all papers were sat however. Computer cards from three hundred and forty-one sixth formers, two hundred and eighty-two seventh formers and twenty-three supervisors were completed.

This large number of entries did create a few extra problems. Not only in terms of printing and distribution but also with the experimental marking and sorting programmes. I had initially intended to print 200 papers thinking it was better to do too many than not enough! However, it did mean that the main purposes of the trial, which were to gauge interest and identify problem areas, was certainly achieved.

Congratulations go to Stefan Brew and Michael Woodhams of Takapuna Grammar who were first equal with scores of 78. They were closely followed by Ralph Chivers (77.5) from Rangiora High School and David Flaws (76) from Tauranga Boy's College. The top sixth form students were Murray Wu and Chris Adams from Wellington College, both with scores of 73. Two marks were awarded for a correct answer, 0.5 off for a wrong answer, but no penalty for a nil response.

Where to in 1984? This partly depends on the amount of sponsorship obtainable but would like to see:

—individual prizes in both sixth and seventh form

—school prizes in both sixth and seventh form

—certificates to recognise high achievement.

Suggestions on obtaining sponsorship or using it, would be most welcome.

What about students in Polytechnics and Technical Institutes?

What about students in other Pacific Basin countries?

I have received an inquiry for 1984 from Samoa and this year accepted entries from Australia, papua New Guinea, and England via the Correspondence School.

Finally I must thank the Institute of Chemistry and Chem 13 News for making it possible, and Stephen Gunn for writing the Computer Programmes.

PROCESSING WITH MAGNETIC PARTICLES PART 2.

B.A. Bolto
CSIRO Division of Chemical and Wood Technology, Melbourne

E.J. Fish
Austep Pty Ltd

D.E. Weiss
CSIRO Planning and Evaluation Advisory Unit, Melbourne

This paper is the second part of the plenary lecture presented to the 1983 NZIC Conference by Dr Weiss, the inaugural RACI/NZIC exchange Fellow. The first part, dealing with water treatment applications, appeared in the December issue of Chemistry in New Zealand pages 141-144.

Dr Don E. Weiss was educated at the South Australian School of Mines and the University of Adelaide from which he graduated BSc in 1945 and DSc in 1960. After a year in the paper industry and another at the Commonwealth Serum Laboratories, Dr Weiss joined CSIR's Division of Industrial Chemistry in 1948. Prior to his current appointment as Director, Planning and Evaluation Advisory Unit, responsible for the strategic planning within CSIRO, he was the head of the Division of Chemical Technology from 1973 to 1979.

Dr Weiss was the 1983 president of the Royal Australian Chemical Institute and is the only member of the RACI to win all of its five major awards.

(2) Magnetic Ion-Exchange Resins

By incorporating magnetic particles with synthetic polymers of different types, and in different ways, a diverse range of magnetic ion-exchange materials are being explored by CSIRO and some are being developed commercially by ICI Australia Pty Ltd.

Magnetic resins have been made in a variety of physical forms. Homogeneous resins, containing magnetic material evenly distributed within the resin network, have been prepared by adding the magnetic filler to conventional polymerizations. The resins are then obtained as granules, following grinding after bulk polymerization[8,9], or as spherical beads by suspension polymerization[6] (Figure 5). In the production of granules, some magnetic particles are left exposed on the surface of the resin, but they are conveniently removed by approropriate washing with acid[8,9].

DR D.E. WEISS

Heterogeneous resins having a shell structure have also been developed (Figure 5), in which the active polymeric chains are grafted onto a magnetic polymeric core, formed by incorporating the magnetic particles within an inert cross-linked polymer[7,10]. Resins of this type react five times faster than do conventional resin structures of the same size. Typical dimensions are an overall diameter of 100 to 300 microns, with a shell thickness of 20 to 40 microns.

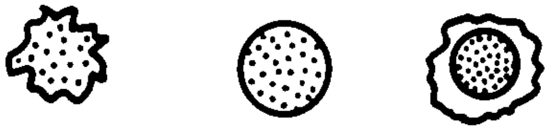


Fig. 5. Types of magnetic ion exchange resins. From left to right, homogeneous granules, homogeneous beads and heterogeneous shell resins.

A number of magnetic fillers have been investigated, with the main emphasis on gamma-iron oxide, because of the small particle size (about 0.1 microns) of the commercial material, and its ready dispersion within the polymer phase. The magnetic properties are then near optimum, with substantial magnetism being retained when the magnetic field is removed, so that the resin will flocculate strongly when outside the applied magnetic field. As well as being a function of the type of magnetic material employed, the settling rates depend also on the amount of it present, and on the size and structure (whether homogeneous or shell) of the composite particles, and on the strength of the magnetic

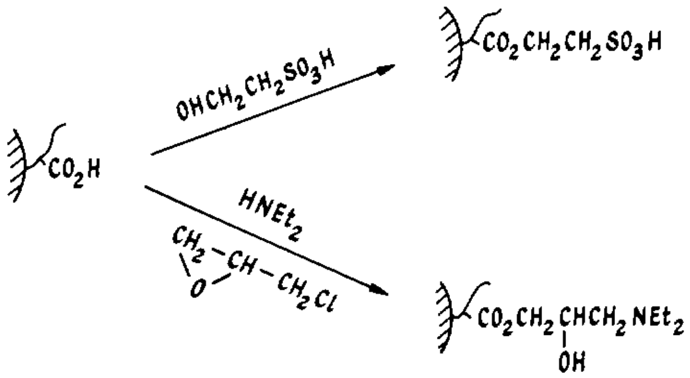
field. An acceptable method of magnetization is to pass the resin between the poles of a 1000 tesla horse shoe magnet. The settling curves for a series of homogeneous weakly basic resins of varying magnetic content and bead size have been documented[8].

Strong and weak electrolyte magnetic resins of homogeneous structure have been made in both cation and anion exchange forms. Except for the weakly acidic type, these are the standard polystyrene derivatives, crosslinked with divinylbenzene, and containing sufonic acid, benzyldiethylamine or benzyltrialkylammonium chloride sites. The weakly acidic resin is a divinylbenzene crosslinked poly(acrylic acid). Weakly basic magnetic resins can be made, from aliphalic amines crosslinked with epichlohydrin[6], or as the analogous-formaldehyde resin[11]. More recently, basic resins which are readily made in magnetic form, have utilized poly(vinyl alcohol) which has been crosslinked with glutaraldehyde and functionalized with chloracetaldehyde, followed by amination[12].

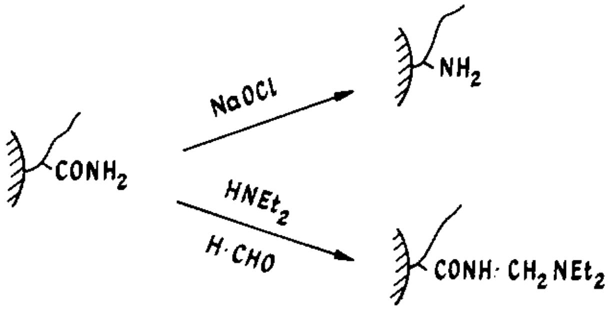
The most successful shell resin has been a poly(acrylic acid) graft onto a magnetic crosslinked poly(vinyl alcohol) core. The first version, made by a simple hydrogen peroxide route[10], proved to be susceptible to mineral acid in the long term, because of the grafting link being of an orthoester structure[13]. A later procedure which uses ceric ion as the initiator gives a much more stable structure, the links now being through carbon-carbon bonds formed at vicinal dihydroxy locations of the chain[14].

Other functionalities can be introduced into the shell structures by grafting them with amines or organic ammonium salts, as shown in Table 2, but the levels obtained are low[10]. Excellent grafts are obtained with acrylamide, but other neutral monomers are less effective, as is methacrylic acid. No graft at all could be obtained with the strongly acidic monomers (or other salts) sodium 2-sulfoethyl acrylate and methacrylate, sodium vinylsulfonate and 2-acrylamido, 2-methylpropanesulfonic acid.

The range of functionalities can be extended by modifying the poly(acrylic acid) or polyacrylamide graft[15,16]. For example, the former can be esterified with isethionic acid or reacted with epichlorohydrn and diethylamine to give sulfonic acid or tertiary amino sites respectively:



Likewise, the polyacrylamide versions can be converted by the Hofmann reaction to shells containing primary amino groups, or by the Mannich reaction to form tertiary amino groups:



However, the above modified resins, even when devoid of ester or amide groups, are not stable in alkali[16].

More recently chemically stable magnetic resins have been prepared by aminating magnetic poly(vinyl chloride) beads with polyethylenimine and other amino polymers[17]. The weakly basic shell resins have been converted to a strongly basic version by quaternization, and to a chelating species by reaction with chloracetic acid. Analogous systems are planned in which a magnetic polyamine core is reacted with a chlorinated polymer to give a shell containing chloro groups, which may then be converted to amino, quaternary ammonium, thiol, sulfonic acid or chelating groups.

Finally, another approach to magnetic resins is to utilize the 'plum pudding' format, in which the active polymer is in the form of microparticles 5-14 microns in diameter. The active polymer is bound together with the magnetic filler into a composite bead by means of an inert hydrophilic polymer such as crosslinked poly(vinyl alcohol). The overall bead size is still smaller than that of conventional resins, at about 300 microns compared to 300 to 1200 microns. This type of magnetic resin is used for the continuous operation of the 'SIROTHERM' desalting process*, in which hot water is used as the regenerant[18,19]. The same format can be exploited to readily obtain a magnetic resin of any functionality, although it must be realized that the inert binder will occupy 40 per cent of the

---

*'SIROTHERM' is the registered trade mark of ICI Australia Pty Ltd for thermally regenerable ion exchange resins and associated plant.

TABLE 2: Grafting to Magnetic Poly(vinyl alcohol) beads

Grafting Monomer	Ion Exchange Capacity of Product, meq/g
Acrylic acid	7.0
Methacrylic acid	2.5
2-Dimethylaminoethyl methacrylate	0.14
2-Dimethylaminopropylacrylamide	0.15
2-Vinylpyridinium chloride	0.05
4-Vinylpryidinium chloride	1.1
2-Methyl-5-vinylpyridinium chloride	0.04
1-Ethyl-4-vinylpyridinium para-toluenesulfonate	0.5
2-Hydroxy-3-methacryloxypropyltrimethylammonium chloride	1.1
2-Methacryloxyethytrimethylammonium methyl sulfate	0.5
Acrylamide	6.3
Vinyl acetate	2.6
Vinylbenzyl chloride	0.2

volume of each bead, so that the exchange capacity on a volume basis is correspondingly reduced. For 'SIROTHERM' this can be avoided by having either the basic or acidic component as the matrix, to give an active matrix structure[20].

(3) Magnetic Activated Carbons

There are practical situations, particularly in the food and pharmaceutical industries, in which it is desirable to absorb low molecular weight, unwanted, constituents from a turbid process stream without reducing the concentration of larger product molecules. Variations of the new water treatment technologies can then be utilized. Materials such as activated carbon, kaolin, silica, and many other mineral oxides are frequently used to remove unwanted impurities from a process stream by adsorption. However, these adsorbents have two major disadvantages: a lack of specificity, resulting in competition between the desired product molecules and the contaminant for the adsorption sites, and difficulty in the removal of the loaded adsorbent from the usually turbid process stream. By encapsulating both the absorbent and a magnetic material in a polymer matrix of controlled porosity, it is possible to overcome both problems[21]. An idealized version of a magnetic carbon microbead is shown in Figure 6. The size of the molecules which come into contact with the adsorbent can be controlled by the degree of crosslinking of the polymer matrix, while the presence of a magnetic material enables rapid recovery of loaded absorbent beads, without the accompanying solids from the slurry. For practical purposes, the magnetic adsorbents should be mechanically strong, spherical, of small particle size for rapid kinetics and chemically inert (i.e., should not affect product quality). This procedure has been tested by Kraft Foods Ltd for a product derived from yeast cells, where it is essential to remove bitter-tasting isohumulones without removing the valuable proteins and nucleic acids[22]. The handling properties of the magnetic material allow ready separation of the saturated adsorbent from other suspended solids inevitably present in the process stream, prior to regeneration and reuse.

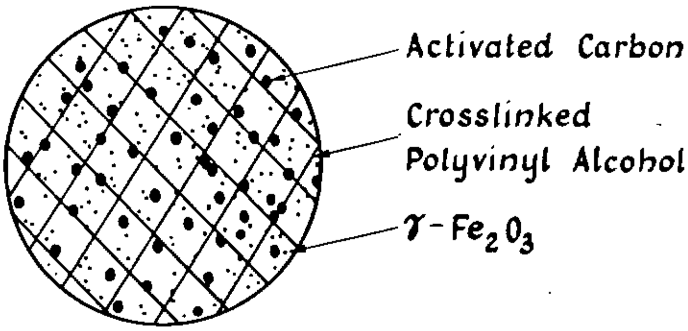


Fig. 6. Idealised version of a magnetic carbon microbead.

(4) Magnetic Filter Aids

In many situations, filter aid filtration possesses a significant capital-cost advantage over rapid sand filtration, particularly for small-scale applications. However, the cost of filter aid consumed is usually prohibitive, except at low raw water turbidities. The problem could be overcome by developing some means of recovering and reusing the filter aid. Such an approach would have the added advantage of reducing the sludge disposal problem.

Work on the recovery of conventional filter aids has met with limited success. CSIRO has developed a novel filter aid material which can be successfully cleaned and reused. A filter aid is required to form an incompressible bed with a high void volume. It must, therefore, consist of fine, irregular, closely-sized particles. In addition, a recoverable filter aid must be tough and be readily separated from accumulated dirt, for example by differential settling.

In the course of work on magnetic ion exchangers, it was found that polymer particles containing magnetized iron oxides have properties which make them promising candidates for use as a recoverable filter aid. In particular:

1. Fine magnetized particles settle much more rapidly in water than non-magnetized material even of much greater size. This provides a simple way of separating magnetic filter aids from clay and algae.
2. Magnetic particles link up along flux lines to form "daisy chains". These persist in a settled bed, leaving large, tortuous channels, seen in Figure 7. Such a bed has a small resistance to the flow of water, but effectively removes suspended matter.

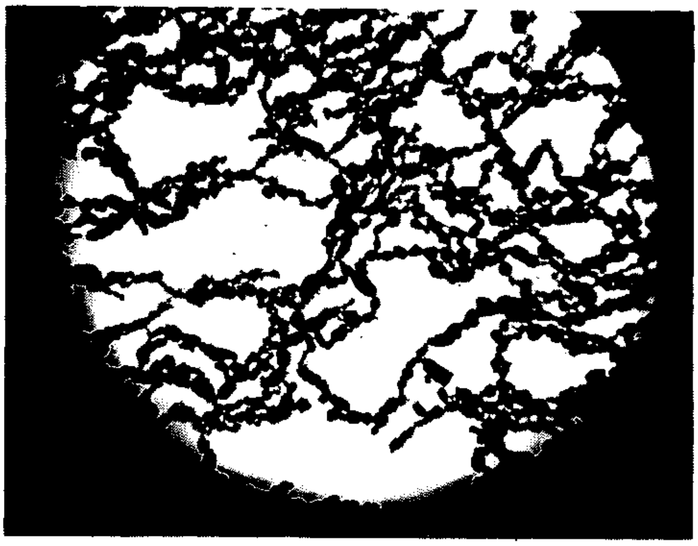


Fig. 7. Magnetised filter aid.

3. The particles can be readily fluidized. Moderate flow velocities are sufficient to overcome the magnetic forces, enabling the magnetic filter aid to be backwashed, cleaned, and returned to the filter. Cleaning can be accomplished by sedimentation or elutriation, and is enhanced by agitation in a 50 Hz alternating magnetic field. However, hydrocylones have proved most convenient for cleaning.
4. Magnetic particles can be made with a wide variety of polymer matrices. Any reasonably tough, hydrophilic polymer is suitable and the choice can be made largely on the grounds of cheapness. Magnetite is a suitable, low-cost magnetic oxide.

CSIRO/ICI Australia have prepared irregular magnetic particles possessing the above properties and investigated their use as filter aids in a small pilot filter[23]. Promising results have been obtained in filtering some natural waters and industrial solutions.

(5) Counter-current Contactor for Magnetic Particles

For maximum efficiency, adsorption or ion-exchange processes require counter-current movement between the adsorbent and solution. Over the last twenty years a number of so called "continuous" ion-exhange processes have been developed and some are in commercial use, particularly in Europe. However most of these are not truly continuous since the water flow is stopped to permit resin transfer. These requirements greatly add to the complexity of such plants. Their competitive advantage has been further eroded by the development in recent times of reverse-flow fixed-bed systems which achieve counter-current conditions.

The development by CSIRO of magnetic resins, and the SIROTHERM desalination process which can particularly benefit from the steady-state conditions, and simplicity of control, inherent in a trully continuous contactor, has stimulated reexamination of the problem of continuous contacting. Collaborative work between CSIRO, ICI

Australia Pty Ltd and Austep Pty Ltd has resulted in the successful demonstration, at a pilot plant scale, of a truly continuous 50kL/day contactor for magnetic resins (and other adsorbents)[19]. Initial field trials concerned the dealkalization (removal of temporary hardness) of a bore water. Decolourisation of pulp mill effluent is another application on which some work has been done. Later work has been applied to the 'SIROTHERM' process. As shown in Figure 8, the contactors for both adsorption and regeneration consist of vertical towers containing a number of parallel perforated plates. Slowly rotating agitators between these regulate the degree of flocculation of the magnetic resin as it moves down the column against an upflow of water. The headloss over the tower is small and the process can operate with high resin recirculation rates.

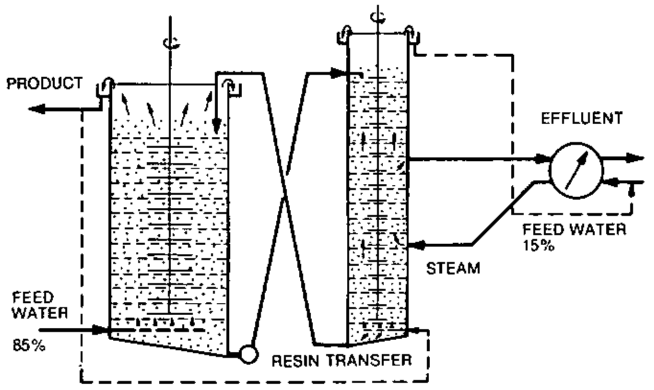


Fig. 8. Diagrammatic flowsheet of continuous 'SIROTHERM' process.

The pilot plant data show that the process offers substantial reduction in resin inventory, as it uses a resin of smaller particle size (200-300 microns) than conventional resin (e.g. 530-710 microns) and thereby accelerates reaction kinetics. Also it is much simpler to operate. Comparisons based on the dealkalization pilot plant[24] are shown in Table 3.

Table 3: Comparisons between Dealkalization with various processes

Plant Size	Conventional Fixed-bed	Asahi Continuous	Magnetic Resin
Resin volume/m^3	23	12-16	4
Vessel volume/m^3	90	30-34	33

A 1 ML/day demonstration plant is under construction in Perth using continuous magnetic 'SIROTHERM' resins in an adsorber having a diameter of 1.5m. The purpose is to obtain large-scale design data for the contactor as well as to demonstrate the advantages of operating the 'SIROTHERM' process in a truly continuous mode.

Other Applications

Besides their potential application to ion-exchange and adsorption processes for municipal water treatment and a variety of industrial uses (e.g. hydrometallurgy) pioneered by CSIRO and its many collaborators other uses for magnetic particles are being studied throughout the world[25]. Many utilise the recent development of techniques for achieving very high magnetic field gradients. Of particular interest is the potential for using magnetic particles in a variety of ways as supports for enzymes, antibodies or even whole cells[26] in biotechnology. Calculation shows that the rates of fermentation processes are generally well within the range which would permit the use of a continuous adsorption process to remove the product continuously, thereby removing substrate inhibition, and enhancing fermentation kinetics.

Conclusions

There can now be little doubt that the large variety of magnetic materials that can be used, and the recent commercial demonstrations that they can be handled advantageously on a large scale, will ensure growing use of these new technologies in water and wastewater purification, and in other fields such as hydrometallurgy and biotechnology.

Acknowledgements

Thanks are due to the Editors of the following journals for permission to reproduce the following diagrams: to the Society of Chemical Industry, Figure 1; to Chemistry in Australia, Figures 3 and 4; to the Journal of Macromolecular Science, Figure 6; to Chemical Engineering Progress, Figure 7; and to Water Science and Technology, Figure 8.

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ASPECTS OF PRESSURE SENSITIVE ADHESIVES

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Dennis Hills has been associated with the rubber industry for 25 years, has published widely in the field, and is New Zealand's only Fellow of the Plastics and Rubber Institute. Thirteen years in the manufacture of industrial rubber goods were followed by three years in marketing and technical service (mainly related to adhesive products). He has been in this present position of scientist, Christchurch Industrial Development Division, with DSIR since 1974, and has a national responsibility for technical service to the rubber industry. An interest in community education and industrial training saw him receive the University of Canterbury's new Certificate in Continuing Education in 1983.

This paper was presented at the Adhesives Symposium of the NZIC's Polymer Group held in Auckland in April 1983.

Adhesives in general may be categorised in many ways and pressure-sensitive adhesives are no exception. In terms of their physical form when applied to a surface, they may be prepared from water-borne dispersion (latex or emulsion), from solvent-solution, or from 100% solids hot melts. Alternatively, flexible adhesives may be grouped on the basis of their chemistry, i.e., whether based on natural rubber, on synthetic rubbers, or on other flexible polymers (plastics). The purpose of this paper is to outline some of the physical and chemical aspects of pressure-sensitive adhesives, which for convenience will be referred to by the abbreviation "PSA".

A pressure-sensitive adhesive is defined by ASTM[1] as follows: 'A viscoelastic material which in solvent-free form remains permanently tacky. Such material will adhere instantaneously to most solid surfaces with the application of very slight pressure'. The property fundamental to this behavious is TACK, which refers to the ability of the adhesive mass to immediately "wet" (or make intimate contact with) the surface to which it is applied. The tack of a PSA may be measured as 'the force required to separate an adhesive and the adherend at the interface shortly after they have been brought into contact under a defined load of known duration at a specified temperature'. This property is also known as "quick stick".

It is thus a measure of the liquid nature of the adhesive, and the word "tack" is used here in a different sense to contact adhesives, where tack (or "agressive tack") is a function of time. There is a "tack range" or "open time" during which two freshly coated surfaces may be joined before crystallisation makes film fusion impractical. The distinctive property of PSA's is the aggressive and permanent tack of dry solvent-free films at room temperature.

The liquid nature of PSA's must be balanced with adequate cohesion (internal strength) — the 'state in which the particles of a single substance are held together by primary or secondary valence forces. As used in the adhesive field, the state in which the particles of the adhesive (or the adherend) are held together'.[1] Low cohesion materials (such as water) give good flow and wetting properties, but are of no use as adhesives. On the other hand plastics, as typical of high cohesion materials, have essentially no flow properties. A second condition for wetting (the relative surface energies of the materials in question) can be disregarded in this discussion.

The balance between tack and cohesion for PSA's is achieved in one of two ways:

(a) By designing a heterogenous system comprising a continuous, relatively tough phase providing cohesive strength, and a discontinuous, partially incompatible mobile phase providing wetting at the surface, e.g., rubber/resin mixtures.

(b) By using an essentially homogenous material which depends on monomer/comonomer types and ratio for the desired cohesion/mobility characteristics, e.g., acrylic copolymers.

As most pressure-sensitive adhesives are based on either natural rubber/resin mixtures or acrylic copolymers, these will now be considered, although it must be pointed out that many synthetic rubbers can also be used, either alone or in combination with natural rubber.

PSA Chemistry and Performance

Pressure-sensitive tapes based on natural rubber have been in use for nearly 140 years. Initially, they were used solely for surgical purposes, but later came to be used for masking purposes in car painting. Tapes for industrial painting and packaging came into common use in the 1940's, since which time synthetic rubbers or blends of natural and synthetic rubber have been used. Adhesives based on acrylic copolymers appeared in the late 1950's.

Natural rubber has a high molecular weight (30,000-10,000,000) and a high viscosity. It derives its strength from an ability to crystallise when stretched. Milling (with or without a peptising agent) reduces the molecular weight and increases tack at above-ambient temperatures. Modification by the addition of tackifiers is necessary to develop pressure-sensitive tack. Early PSA's used naturally-occurring resins and plasticizers such as lanolin, while more recent types use these or rosin esters, polyterpenes or synthetic resins, alone or in a combination. The mechanism by which a brittle, tack-free solid resin combines with a tough tack-free rubber to give a material with a high degree of tack is not fully understood. It has been found that useful tack is obtained over a relatively narrow range of resin-to-rubber concentrations. This is illustrated in a generalised form in Figure 1.

A typical formulation for a rubber/resin PSA is:

Pale Crepe (milled)	100
Poly-β-pinene resin (mp 70°C)	75
Petroleum Oil	5
Polymerised trimethyl dihydroquinoline	2

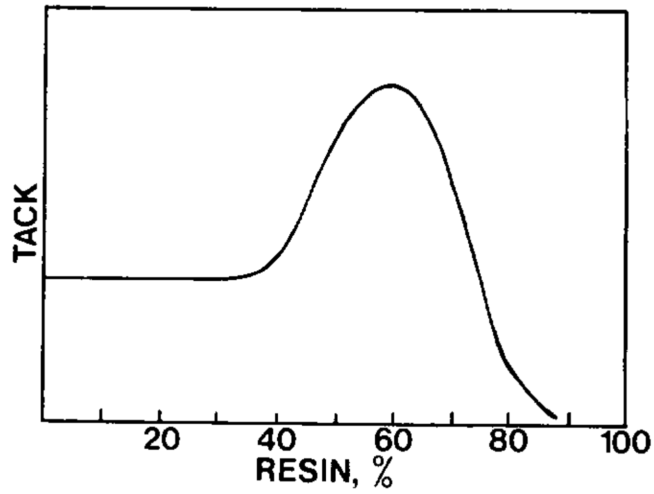
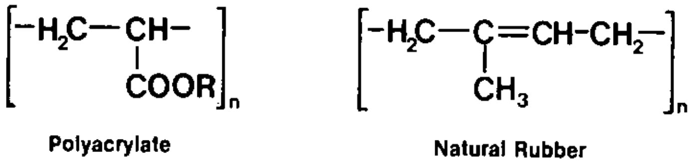


Fig. 1 A typical tack curve for the addition of an amorphous resin to rubber-based adhesives.

The ingredients, shown as parts by weight, are natural rubber, tackifier, plasticizer, and antioxidant, respectively. Other ingredients may include fillers, pigments and curing agents. Antioxidants are necessary to improve the resistance to oxidation of natural rubber — it is very susceptible to metal-catalysed oxidation — due to the presence of unsaturation in the backbone of its molecules, as illustrated in Figure 2 where a comparison is shown with the basic structure of polyacrylates.



$$\left[-H_2C-\underset{\underset{COOR}{|}}{CH}-\right]_n$$

Polyacrylate

$$\left[-H_2C-\underset{\underset{CH_3}{|}}{C}=CH-CH_2-\right]_n$$

Natural Rubber

Fig. 2: Basic structures for polyacrylates and natural rubber.

As mentioned earlier, acrylic copolymer PSA's are based on a different chemical approach, that of essentially pure polymeric systems. Additives play little or no part, and properties such as tack, cohesion and low temperature flexibility are controlled by the monomer/comonomer selection and degree of polymerisation/crosslinking. Bemmels[2] notes that acrylate PSA's are normally a copolymer of a higher alkyl acrylate such as 2-ethyl hexyl acrylate with a small amount of a polar comonomer, e.g., acrylic acid, acrylamide, maleic anhydride, diacetone acrylamide and long chain alkyl acrylamides. As illustrated in Figure 2, the polymers are completely saturated and therefore inherently inert to oxygen or ozone degradation. For this reason, antioxidants are not needed.

In the comparisons which follow, "rubber" refers to rubber/resin adhesives based on natural rubber (unless specified) and "acrylic" refers to PSA's based on materials that can also be described as polyacrylates, acrylic copolymers, etc. The effect of ageing (oxidation) on PSA's depends on the polymer type. For example, oxidation products from natural rubber are softer than the original material, while SBR (styrene butadiene rubber) tends to become embrittled. Advantage may be taken of this difference by blending the two materials. Antioxidants become consumed while performing their function, and their life depends on the length of exposure and on the temperature. Oxidation is a chemical reaction, and its rate roughly doubles with each 10°C increase in temperature. While acrylics are essentially inert to oxidation, consider the problem of applying rubber as a hot melt. Heating the material to temperatures in excess of 170°C can cause severe oxidation, unless inert gas blanketing is employed during processing.

Elevated service temperatures usually have a greater effect on rubber adhesives. While they are generally superior to acrylics on cohesive strength at room temperature and the rubber portion is little affected, low melting point tackifiers can cause softening of the entire mass. Hot melt rubber PSA's are especially prone to cohesion loss through heat-induced softening. Acrylics are less thermoplastic than the corresponding rubber adhesive. In general, cohesion is related to molecular weight, and only in water-borne dispersions does molecular weight have no effect on the viscosity of the liquid adhesive. Solvent-solutions and hot melts have molecular weight-induced viscosity as a limiting factor.

Low temperatures cause flexible polymers to stiffen and become brittle, thus reducing the liquid properties of PSA's. Acrylic adhesives, especially if in the form of a thin film, may be more difficult to adhere to a surface at a low temperature but will probably give good service once in place. Monomer selection for acrylics can give good low temperature properties while retaining cohesion at higher temperatures. Rubber PSA's can be prepared with special low temperature plasticizers, but this can result in severe cohesion loss and thus restricts the upper limit on service temperature.

Adhesion strength varies with time as illustrated in Figure 3 for rubber PSA's. The trend shown is less pronounced in the case of acrylics, and in a product to be described later, adhesion depends on the chemistry of the substrate. Rubber adhesives are generally non-polar materials. The reverse is true for the polar acrylics. In both cases, however, softer adhesives (achieved through lower molecular weight in the case of acrylics or plasticizers in the case of rubber adhesives) are less sensitive to the polarity of the substrate.

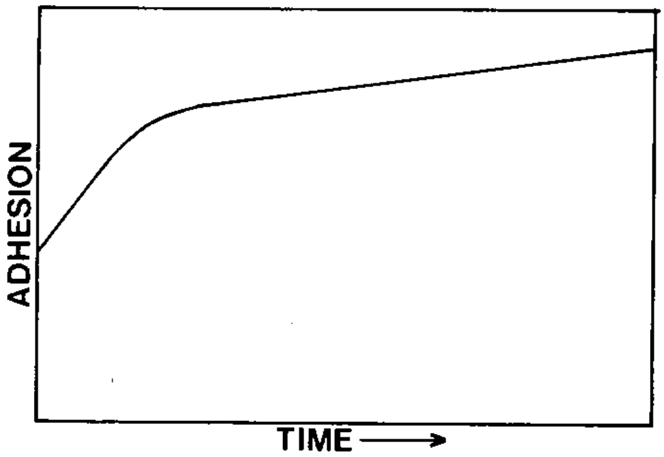


Fig. 3: Change of adhesion strength with time for rubber/resin adhesives (generalised)

Polarity also affects solvent resistance. Non-polar rubber-based PSA's swell or dissolve in non-polar solvents but resist the effects of the oxygenated polar solvents (such as ketones and esters). Again, the reverse is true for the polar acrylics. With inorganic chemicals, rubber PSA's tend to be more resistant to acid or alkaline attack.

Migration is more of a problem with rubber PSA's. Antioxidants or plasticizers may migrate to the surface in contact with the adhesive, causing staining. Both rubber and acrylic PSA's can be softened by the absorption of plasticizers and oils. The two types vary also in such matters as colour stability. Fries[3] notes that both rubber and acrylic PSA's have a place, but no one type or form is optimum for all applications.

Some Physical Aspects of PSA's

For best results with PSA's such as those used on tapes, the cohesiveness of the adhesive layer must be greater than its adhesiveness to prevent splitting of the adhesive if the tape is to be removed from the other object (such as another layer of tape). In shear applications, the internal strength appears to be the determining factor. In some cases, such as masking tapes which must have the ability to be removed cleanly, a partial gel structure is desirable.

Reference to a common product (cellulose adhesive tape) will illustrate a number of points (Figure 4). For example, why does the adhesive always remain on the one surface of the cellulose film? In simple terms, a self-adhesive tape is composed of a BACKING (1 in the diagram) upon which has been applied an adhesive layer (3). The adhesive would wish to adhere equally well to either side (face) of the backing, but this is prevented by the use of a KEY-COAT (or PRIMER or ANCHOR COATING) shown as (2) in the diagram, to ensure that under normal conditions, the adhesive remains on the same side of the backing. This is due to the fact that the key coat adheres more readily to the adhesive than does the adhesive to the backing. Further assistance is often provided in the form of a RELEASE COATING (4) which reduces the tendency of the adhesive to cling to the "back side" of the next layer of tape when in roll form. These comments apply generally to a wide range of products coated with PSA's.

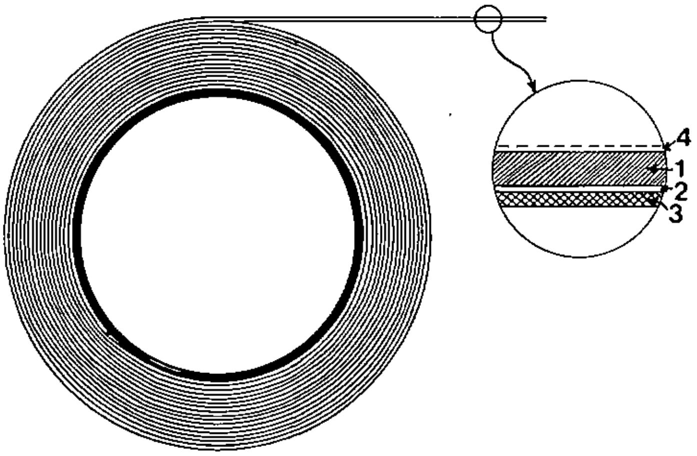
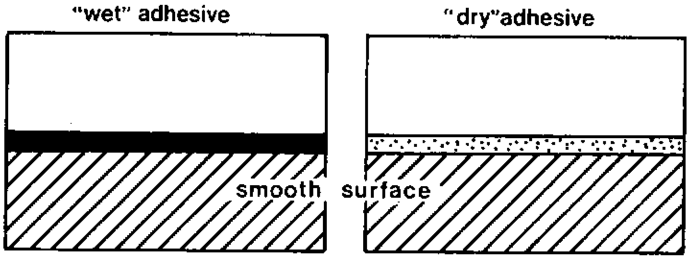
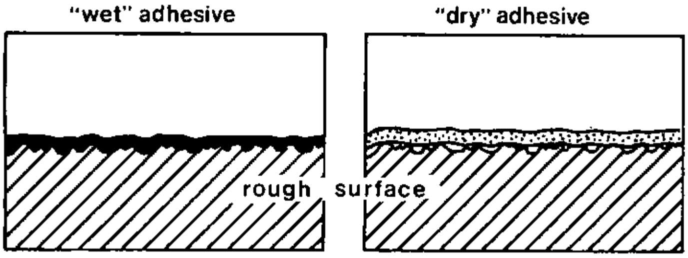


Fig. 4: Typical construction for a roll of cellulose adhesive tape.



(a) A "wet" adhesive tends to come into intimate contact with a smooth surface, and the bond achieved is a function of the area of contact.

(b) A "dry" adhesive will also tend to come into intimate contact with a smooth surface, and the bond achieved will again be a function of the area of contact.



(c) A "wet" adhesive will tend to fill all the irregularities in the surface, and the bond achieved will be a measure of the increased area of contact.

(d) A "dry" adhesive will tend to rest on the "peaks" of the irregularities, thus greatly reducing the area of contact and giving a poorer bond.

Fig. 5: The relationship between adhesive type and surface type.

The physical nature of the substrate can influence the bond achieved. The cellulose tape just described will adhere better to a smooth surface than to one which is rough. Unlike the use of "wet" adhesives or paints, where it is usually desirable to roughen the surface (thereby increasing the area of contact and giving greater total adhesion), the use of "dry" adhesives such as PSA's is dependent upon the contact gained under slight pressure (Fig. 5). Thick and/or soft adhesive layers (which may have poor cohesion) are needed for other than very smooth surfaces, such as porous, fibrous, pitted, etc., materials. It goes without saying that for best results, surfaces should be free from oils, water, dust, or other materials likely to interfere with adhesion.

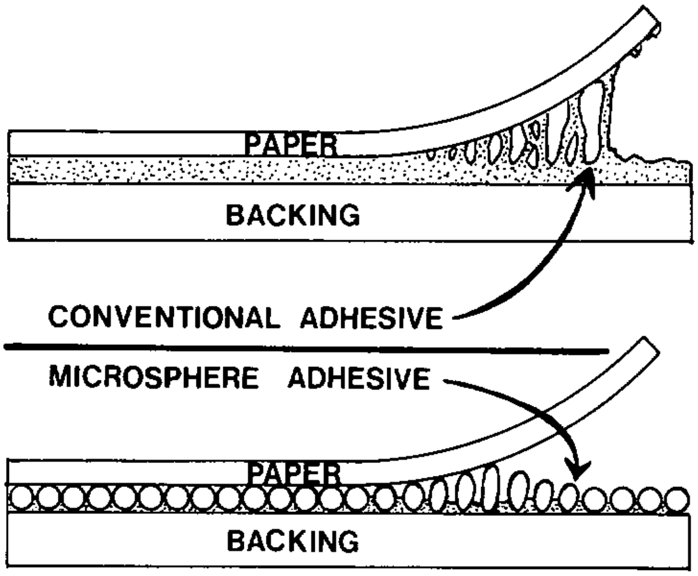


Fig. 6: The relatively small surface contact area between resilient microspheres and paper makes the adhesive easily removable from any surface; a conventional adhesive may not be able to be removed so easily.

Adhesive Form can also influence behaviour. While most adhesives on self-adhesive products are in the form of a relatively smooth film, some types are applied in other forms. For example, Hogan[4] refers to 3M's "Post It" with a low-tack adhesive to allow paper to be repeatedly placed on, and removed from, the surface of a bulletin board. Conventional adhesives increase in adhesion strength with time, but the polyacrylate adhesive in this case is applied as "microspheres" — small spherical particles held to the backing material by a key coat. The result is a peel adhesion value of 60 grams (POINT contact with the surface) compared to 1200 grams for a tape coated with a conventional acrylic adhesive (PLANAR contact), and the 60 gram value does not increase with time. The removal of paper from these two types of surface is illustrated in Figure 6.

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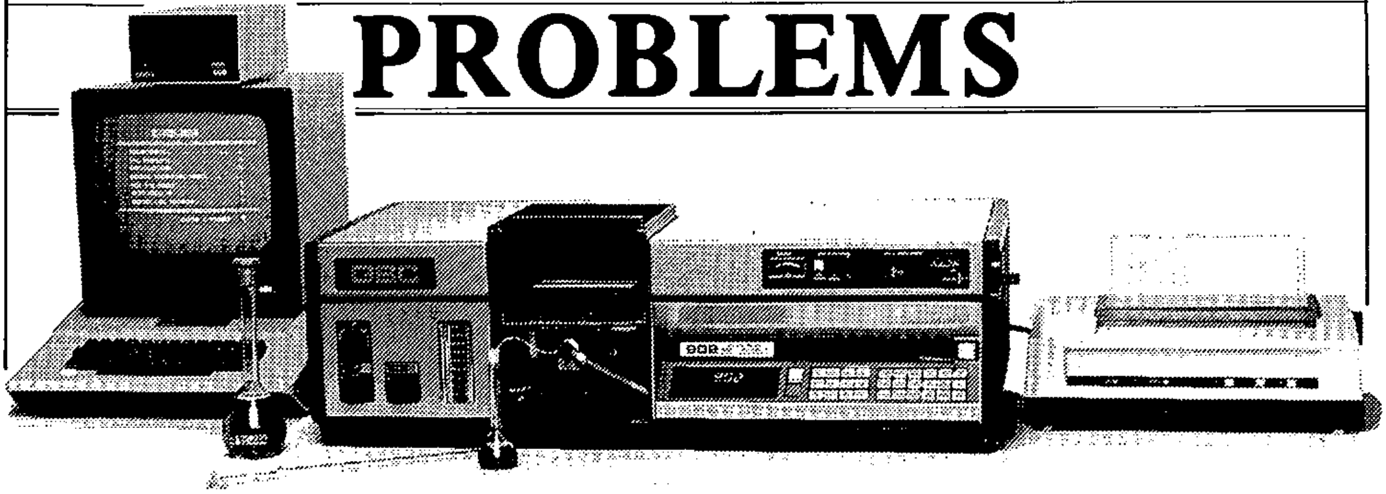

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DIRECTORY QUESTIONNAIRE

The NZIC Council and the publishers of Chemistry in New Zealand consider that the publication of a 1984 yearbook would be of benefit both to the Insititute's members and to the chemical industry. Basically, the yearbook will consist of two parts, a directory of the chemical industry and an updated NZIC membership list. The following questionnaire relates to the directory.

The directory will only have maximum usefulness if it is complete. Would all members please ensure that a copy of the questionnaire reaches the relevant person in your organisation and that it is completed and returned as soon as possible.

Completed copies should be returned to, and additional copies of the questionnaire can'be obtained from:

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BRAND NAMES ....
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IF ADDITIONAL SPACE IS REQUIRED, CHECK HERE ☐ *AND CONTINUE ON BACK PAGE.*

A. LABORATORY INSTRUMENTS AND ACCESSORIES

Categories of Instruments for which your company has an agency (Please list brand names)

BALANCES
  Analytical balances
  Top-pan balances
CENTRIFUGES
CHART RECORDERS
CHROMATOGRAPHY
  Gas Chromatographs
  Chromatography columns and packings
  Syringes
COMPUTERS
  Laboratory Computers, data stations, integrators
ELECTROCHEMISTRY
  pH/mV meters
  Electrodes (glass, Pt, reference
  Selective ion and gas sensing electrodes
  Polargraphs
SPECTROSCOPY
  Visible spectrophotometers
  UV-vis spectrophotometers
  Infrared spectrophotometers
  Fluorimeters
  NMR
  Flame photometers
  ICP
  Atomic Absorbtion Spectrophotometers
  Hollow cathode lamps
  Arc/spark spectrographs
THERMAL ANALYSIS
X-RAY AND RADIOCHEMISTRY
  Radiochemical equipment
  X-Ray diffraction and fluorescence
OTHER (please specify)

B. LABORATORY EQUIPMENT & FITTINGS

Items or categories in which your company is involved (Please list brand names).

Bench surfaces
Burners
Clamps, stands, bossheads
Crucibles
Dessiccators
Filter media
Fume cupboards
Furnaces
Gas regulators
Glassware
Heating mantles
Hot plates
Laboratory coats
Laboratory furniture
Plasticware
Safety glasses
Sieves
Spatulas
Stirrers
Thermometers
Tongs, test tube holders
Ovens
Vacuum pumps
Other (Specify)

IF ADDITIONAL SPACE IS REQUIRED, CHECK HERE ☐ AND CONTINUE ON BACK PAGE.

C CONSULTANTS

Consultants will be sublisted geographically.

TYPE OF ANALYSES OR SERVICES AVAILABLE ....

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INSTRUMENTATION ....

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D CHEMICALS

Check against the categories listed below. Although these categories are very broad they will be cross referenced to the main listing where detail can be given in the company description.

Adhesives .... ☐
Agricultural Chemicals .... ☐
Compressed Gases .... ☐
Detergents .... ☐
Disinfectants .... ☐
Dyes .... ☐
Emulsifiers .... ☐
Food Chemicals .... ☐
Laboratory Chemicals .... ☐
Metals and alloys .... ☐
Pharmaceuticals .... ☐
Pigments .... ☐
Polymers .... ☐
Solvents .... ☐
Surface Coatings .... ☐
Surfactants .... ☐
Water Treatment Chemicals .... ☐
Other (specify) .... ☐
.... ☐
.... ☐
.... ☐

E PROCESS CONTROL EQUIPMENT

Control areas in which your company is involved. Please list brand names.

Pressure ....
Flow ....
Mass ....
Volume ....
Density ....
Temperature ....
pH ....
Conductivity ....
Vacuum ....
Other (specify) ....

F PROCESS EQUIPMENT

Categories of equipment which your company manufactures or holds an agency. (Please list brand names).

Mixers ....
Filters ....
Sterilisers ....
Crushers ....
Grinders ....
Pumps ....
Fans ....
Valves ....
Heaters ....
Coolers ....
Freezers ....

(Continued overleaf)

IF ADDITIONAL SPACE IS REQUIRED, CHECK HERE ☐ *AND CONTINUE ON BACK PAGE.*

F PROCESS EQUIPMENT CONTINUED.

Crystallisers ....

Other (please specify) ....

....

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RETURN THE COMPLETION QUESTIONNAIRE AS SOON AS POSSIBLE TO:

THE EDITOR
CHEMISTRY IN NEW ZEALAND
P.O. BOX 9072
NEWMARKET, AUCKLAND.

ADDITIONAL INFORMATION

STOPPED FLOW SPECTROPHOTOMETRIC STUDIES OF ENZYME-CATALYSED REACTIONS

M J Hardman
and
L F Blackwell
Department of
Chemistry, Biochemistry
and Biophysics
Massey University
Palmerston North.

Michael Hardman (left) and Len Blackwell were educated at Canterbury University where they both gained Ph.D. degrees in physical organic chemistry. Subsequently they have developed an interest in the application of physical techniques to the study of the kinetics and mechanism of enzyme-catalysed reactions. They are currently Senior Lecturers in Biochemistry (MJH) and Chemistry (LFB) at Massey University.

Enzyme-catalysed reactions proceed through a series of steps, some bimolecular (binding steps) and some unimolecular. For example, most NAD+- dependent dehydrogenases oxidise their substrates according to the minimal mechanism of Eqn 1, where A and Q represent the oxidised and reduced cofactors NAD^+ and NADH and B

$$E \underset{k_{-1}}{\overset{k_1A}{\rightleftharpoons}} EA \underset{k_{-2}}{\overset{k_2B}{\rightleftharpoons}} EAB \underset{k_{-3}}{\overset{k_3}{\rightleftharpoons}} EPQ \underset{k_{-4}\ +P}{\overset{k_4}{\rightleftharpoons}} EQ \underset{k_{-5}}{\overset{k_5}{\rightleftharpoons}} E + Q \quad (1)$$

and P represent the substrate and product respectively.

The unimolecular steps of enzyme-catalysed reactions generally have half lives in the range 1 ms to 1 s and, at the concentrations used in kinetic studies, the bimolecular reactions are normally faster than this. Although the overall reaction can be studied in the steady state on a conventional spectrophotometer, and this usually provides some information about the slowest step, the unimolecular steps are normally too fast for direct detection using a conventional system. A rapid kinetics system, such as a stopped-flow spectrophotometer, is necessary for this purpose.

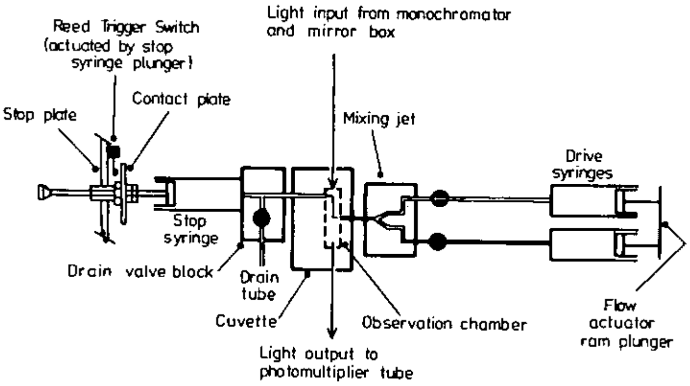

Fig. 1. Schematic diagram of the Durrum-Gibson stopped-flow apparatus.

Instrumentation

A system to be used for studying rapid reactions (half life <5 s) must provide both rapid mixing and a suitable rapid detection system. The Durrum stopped-flow instrument (Fig. 1) mixes two solutions through a teflon mixing jet which has four inlet holes and one outlet hole. The two solutions are held in small syringes containing plungers; when the plungers are pushed forward by a ram driven by compressed air, the solutions are forced through the mixing jet and through an observation chamber. This drives back the plunger of a stopping syringe and, when this hits a barrier, the flow is stopped and a recording device is activated. At this time the reaction mixture in the observation chamber is between 1 and 3 ms old and the reaction can be followed from this time onwards. By using the appropriate observation chamber and photomultiplier position, we can follow either absorbance or fluorescence changes.

The rapid detection system used with a stopped-flow spectrophotometer was originally just a storage oscilloscope. The traces from this were photographed (e.g. Fig.2) and data were measured from the photographs. Many laboratories, including ours, now use a digital data acquisition device (a transient recorder) interfaced to a computer. Our transient recorder stores 1024 8 bit points on a time scale in the range 0.2 ms to 10 s. The data are then transferred to the memory of a Cromemco CS-2 microcomputer for processing and storage on disk under the control of a FORTRAN program.

Some examples of stopped-flow experiments

(a) Dissociation and binding of cofactors

The absorbance of NADH at about 340 nm (the wavelength of maximum absorbance for free NADH) is reduced on binding to many dehydrogenases and the rates of association and dissociation can therefore be determined by following changes in absorbance. Fig.2 shows an experiment[1] designed to measure the rate constant (k_5 in Eqn 1) for dissociation of NADH from a carboxymethylated derivative of alcohol dehydrogenase. NADH was displaced from its binary complex with the enzyme by mixing the complex with an excess of NAD^+ and a first order in-

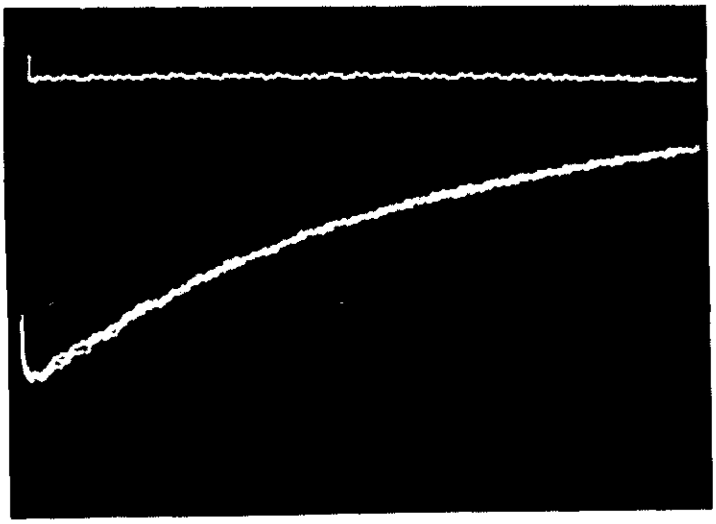

Fig. 2. Time course of the absorbance change at 355 nm during the dissociation of NADH from its complex with carboxymethylated alcohol dehydrogenase. Vertical scale: 0.01 absorbance units per div., horizontal scale: 50 ms per div. Three reactions are superimposed.

crease in absorbance was observed with a rate constant of 3.2 s^{-1}. This value is much larger than the overall rate constant for alcohol oxidation, k_{cat}, indicating that NADH dissociation is not rate-limiting for the modified enzyme, although it is rate determining for the native enzyme.

The rate constant for association of NADH with dehydrogenases can also be determined on stopped-flow equipment by measuring changes in absorbance[1] or fluorescence [2,3] on mixing enzyme with NADH.

(b) Transient kinetics

The steady state situation can be avoided by using excess enzyme over substrate (steady state conditions require excess substrate) or by monitoring a reaction, with excess substrate, before the steady state is set up. In either of these cases a stopped-flow spectrophotometer is normally required to follow the reaction.

We have followed the pre-steady state kinetics of oxidation of alcohols by alcohol dehydrogenase [4;5] and aldehydes by aldehyde dehydrogenase[6]; Fig. 3 shows a typical experiment for aldehyde dehydrogenase. For both enzymes a rapid production of NADH (a burst) was observed, followed by a slower steady state. The rate constant for the rapid exponential phase can be determined[4] by extrapolation of the steady state back to zero time, calculation of the differences between the observed data and this line, and a logarithmic plot of the differences against time.

For alcohol dehydrogenase, the burst rate constants for deuterated primary alcohols are 4-5 times less than for the corresponding undeuterated alcohols [4,7]. This indicates that hydrogen transfer is rate-limiting for the rapid burst process. We were able to correlate the burst rate constant with substrate structure for a range of alcohols[4,5]. Low negative values of the Hammett and Taft reaction constants were obtained, suggesting that the hydrogen transfer step k_3 in Eqn 1) may involve synchronous removal of a hydride ion from the $-CH_2-$ group and the proton from the hydroxyl group.

For aldehyde dehydrogenase the dissociation of NADH (step 5 in Eqn 1) is partly rate determining for the overall reaction of aldehyde oxidation. A burst is observed when the production of NADH is followed by NADH fluorescence (Fig. 3) but the rate constant does not show an isotope effect when deuterated aldehydes are used as substrates[6]. This indicates that the transfer of the hydride ion from the -CH- group, which must take place during the oxidation, is not rate-limiting for the pre-steady state phase of this reaction. This situation can be contrasted with that for alcohol dehydrogenase where the chemical transfer step is the slowest step of the pre-steady state phase of the reaction.

Protons are released into solution during the oxidation of aldehydes by aldehyde dehydrogenase (and in other dehydrogenase reactions). The rate of proton release can be monitored by using suitable pH indicators, such as phenol red at pH close to 7.6, in solutions of low buffering capacity[8]. Since protonation and deprotonation of indicators is very rapid (probably diffusion controlled), proton release can be followed by measuring changes of the absorbance of the indicator (Fig. 4). Comparison of the transient rate constants for proton release during the oxidation of a range of aldehydes with the corresponding transient rate constants for NADH production shows that the rate-limiting step for the transient phase is a conformational change in the enzyme[9]. A conformational change also occurs before hydrogen transfer in the alcohol dehydrogenase catalysed oxidation of alcohols but is too fast to be rate-limiting for the transient phase.

Single turnover conditions (excess enzyme over substrate) were used[10] for studying the hydrolysis of

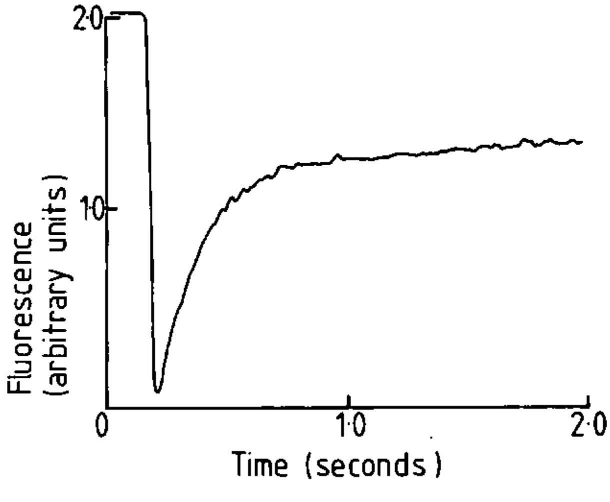

Fig. 3. Time course of the nucleotide (NADH) fluorescence change during oxidation of propanal (100 μM) catalysed by aldehyde dehydrogenase at pH 7.6. The burst rate constant is 8.9 s^{-1}.

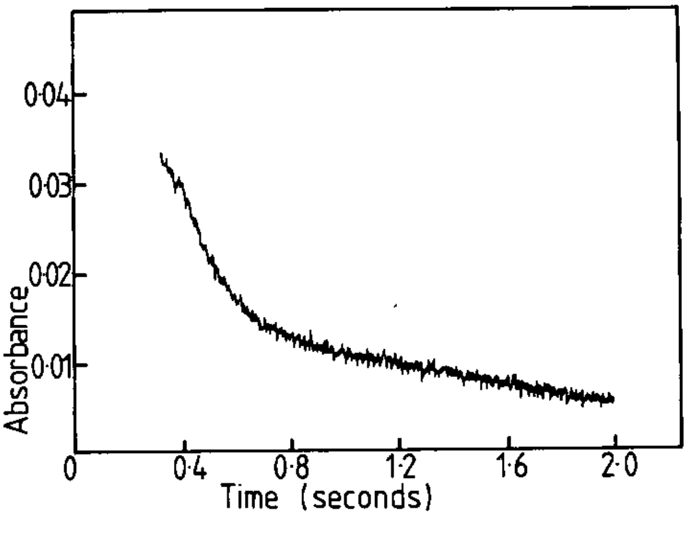

Fig. 4. Time course of proton release monitored by absorbance changes at 560 nm. The reaction mixture contained aldehyde dehydrogenase (11 μM), phenol red (15 μM), NAD^+ (1.03 mM) and propanal (60 μM) at pH 7.6. The burst rate constant is 8.3 s^{-1}.

Fig. 5. Time course of the absorbance change at 400 nm during the actinidin-catalysed hydrolysis of Z-Lys ONp at pH 7.0. Vertical scale: 0.01 absorbance units per div., horizontal scale 5 ms per div. Three reactions are superimposed.

Z-lysine p-nitrophenyl ester by actinidin, the thiol protease from kiwifruit. With excess enzyme the first product, in this case p-nitrophenol, can be produced more rapidly than the second product, Z-lysine, and the reaction does not reach a steady state. The absorbance at 400 nm (due to the p-nitrophenolate ion) was monitored in the stopped flow apparatus and the reaction was found to consist of two phases (Fig. 5). The reaction commences at the lowest point on the trace and a rapid increase in absorbance (about 80% of the total absorbance change) is followed by a slower exponential increase.

The biphasic nature of the reaction is not consistent with the simple mechanism which was generally accepted for hydrolysis catalysed by thiol proteases (Eqn 2, where

$$E + S \rightleftharpoons ES \longrightarrow \underset{+\,P_1}{EP_2} \longrightarrow E + P_2 \quad (2)$$

P_1 is p-nitrophenol/p-nitrophenolate and EP_2 is an acyl-enzyme intermediate). This mechanism predicts that the production of p-nitrophenolate should be a single phase, first order, process under single turnover conditions. The biphasic reaction and the dependence of the amplitude of the rapid phase on enzyme concentration were found to be consistent with a mechanism involving an additional step (Eqn 3).

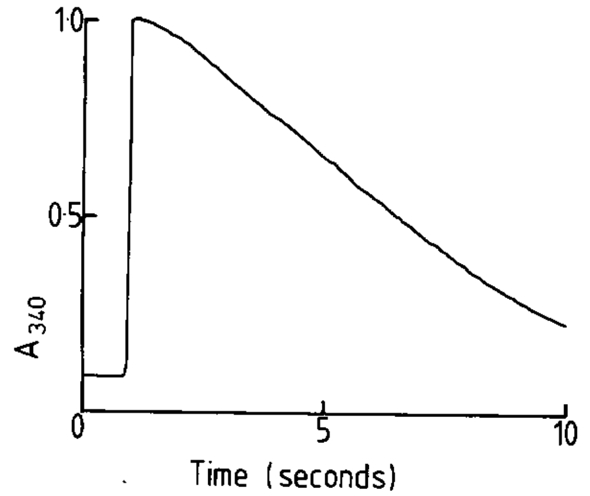

Fig. 6. Time course of the absorbance change at 340 nm during reduction of pyruvate catalysed by lactate dehydrogenase from S. lactis. Enzyme in one syringe was mixed with pyruvate, NADH and FBP in the other syringe.

$$E + S \rightleftharpoons ES \rightleftharpoons EP_1\,P_2 \longrightarrow \underset{+\,P_1}{EP_2} \longrightarrow E + P_2 \quad (3)$$

This additional step is likely to be an isomerisation of the enzyme which controls the rate of product release and may represent a conformational change of the enzyme.

(c) Hysteretic transitions

These are interconversions of enzyme forms which are slow relative to the times required for the conversion of significant amounts of substrate into product. The transitions are not part of the catalytic cycle (the enzyme remains in the same form during the cycle) and therefore appear as lags, or sometimes bursts, at the start of a reaction. Such a lag was observed[11] for the lactate dehydrogenase (LDH) from *Streptococcus lactis* when the enzyme was mixed with its substrates (NADH and pyruvate) at the same time as the activator fructose 1,6-bisphosphate (Fig. 6). The lag was abolished when the enzyme was premixed with activator before adding substrates. This behaviour is consistent with a mechanism (Eqn 4) involving a slow conversion

$$M + E' \xrightarrow{\text{slow}} ME \rightleftharpoons MEA \rightleftharpoons MEAB \longrightarrow ME + \text{products} \quad (4)$$

of the enzyme from a form E' with essentially no activity to an active form by the modifier M (FBP); A represents NADH and B pyruvate. Premixing enzyme with FBP allows time for the activation to occur before substrates are added but otherwise the reaction cannot proceed until the enzyme is converted into the active form.

The rate constant for the lag phase can be determined by nonlinear fitting of the progress curve. This rate constant was found to show a hyperbolic dependence on FBP concentration, indicating that FBP binding is not a simple bimolecular step. Instead the bimolecular step is probably followed by a slow conformational change of the enzyme (Eqn 5).

$$M + E' \overset{\text{fast}}{\rightleftharpoons} ME' \overset{\text{slow}}{\rightleftharpoons} ME \quad (5)$$

This interpretation is supported by the observation[11] that binding of FBP quenches the protein fluorescence of LDH in the absence of substrates and that the rate constant for this process is similar to that for the lag phase. FBP cannot quench protein fluorescence directly, because of the lack of spectral overlap with the fluorescing tryptophan residues, and therefore must do so indirectly by a conformational change which alters the environment of one or more tryptophans.

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11. V.L. Crow, D.S. Cruickshank, M.J. Hardman and G.G. Pritchard, unpublished results.

COUNCIL NEWS

1984 NZIC-RACI Visiting Speaker

Professor R.D. Batt has been selected for the 1984 NZIC-RACI Visiting Speaker Award by the Council of the Royal Australian Chemical Institute.

Honorary Fellowship

At the Standing Committee meeting on 23rd November Mr J.R. Warby, President of the Royal Australian Chemical Institute was elected an Honorary Fellow of the New Zealand Institute of Chemistry during his term of office.

John Warby is Manager — Quality Assurance Laboratories of Wellcome Australia Ltd in Sydney. He was New South Wales Branch President. 1979-82.

Prizes

Council advises members that entries for the Easterfield, ICI, Shell and Chemical Essay Prize close with the Administrative Secretary, Box 29-183, Christchurch on April 30th, 1984. The rules for these awards are set out in the 1982 List of Members.

Overseas Visitors

Mr L. Bretherick (Dr. W. Temple), Dr P. Sykes (Dr B. Halton) and Dr C.W. Jones (Dr R. Daniel) from the UK are visitors (and their sponsors) expected to speak to Branches March-May 1984.

PAC CHEM '84

This Congress will be held in Honolulu 16/21 December 1984. It is supported by most of the Pacific Basin Chemical Societies. More than 2500 chemists and biochemists are expected to take part in about 50 Symposia.

Futher information is available from Dr D.E. Wright, MAF, Private Bag, Wellington.

YEAR BOOK — LIST OF MEMBERS

Council plans to issue a List of Members about March in an additional Yearbook Volume of "Chemistry in New Zealand". It also will contain lists of current Branch officers. Members are invited to suggest other material which they consider could be included in this publication through their Branch Committees.

Prince and Princess of Wales Science Awards

Members are advised that closing dates for these awards are 28th February and 31st August in each year. The Royal Society of New Zealand, Private Bag, Wellington, is now accepting applications for the second series of awards to be made in May 1984. 38 application were received for the first series of five awards made late in 1983. Council of the New Zealand Institute of Chemistry donated $2,000 last August towards the $23,000 awarded.

CONFERENCES

1984 NZIC/Biochemical Society Conference,

(See Page 4.).

OVERTASMAN

Education, Training and Employment

Organised by the Higher Education Research and Development Society of Australasia (HERDSA) Development Society

Organised by the Higher Education Research and Development Society of Australasia (HERDSA) 11—14 May 1984, Sydney. Contanct Dr A Prosser, School of Metallurgy, University of N.S.W., P.O. Box 1, Kensington N.S.W. 2033 Australia

OVERSEAS

High Temperature and Energy-Related Materials

2—6 April 1984, Santa Fe. IUPAC sponsored. Contact Mary Bowen, Los Alamos National Laboratroy CHM-DO, MSJ563, Los Alamos, NM 87545, USA.

Polymers in Medicine and Biology

9—12 July, Prague, IUPAC sponsored. Contact P.M.M. Secretariat, c/o Institute of Macromolecular Chemistry, Czechoslovak Academy of Sciences, 16206 Prague 616 Czechoslovakia.

Physical Optics of Dynamic Phenomena and Processes in Macromolecular Systems.

16—19 July 1984, Prague, IUPAC sponsored. Contact P.M.M. Secretariat (address above).

Hazardous Waste Management

11—14 September 1984, Odense. Contact Chemcontrol A/S, Dagmarhus, DK-1553 Copenhagen V, Denmark.

MEMBERSHIP

The following members and graduate members were elected by the standing Committee on 14th December 1983.

Members:

DOBBIE, Robert Shedden, NZCS, Assoc NZIC, Wellcome NZ Ltd. Auckland (Packaging Officer).

GROUNDS, Peter Reginald BSc (Hons Cantuar) Chemistry Division, DSIR, Christchurch (Scientist).

HOWE, Russel Francis BSc (Hons) Ph.D. Cantuar) Chemistry Department, University of Auckland (Lecturer).

MOORS, Patrick William MSc PhD (Auckland) Chemistry Department, University of Tasmania, (Post Doc Snr Research Officer).

HARRISON, Richard Stephen BSc (Hons) PhD (Massey) Winchmore Irrigation Research Station, Ashburton (Scientist).

SINGH, Miss Ragina Manisha Devi MSc (Waikato) Chemistry Department, University of Auckland (PhD Student).

WHITE, Geoffrey Vaughan, NZCS Pottery and Ceramics Research Association Lower Hutt (Head, Ceramics Testing Section).

Graduate Members to Members

BLOOR, Stephen John BSc (Hons Massey) Chemistry Division, DSIR, Gracefield (Scientist).

DICKSON, Roderick John BSc Stevens Chemicals Ltd, Christchurch (Chemist).

HARRIS, Alistair Cedric BSc (Hons Cantuar) Wheat Research Institute, Christchurch (Scientist).

ONG, Chin Choon BSc (Hons Cantuar) Chemistry Department, University of Canterbury (PhD Student)

VANNOORT, Richard William BSc (Hons) PhD (Cantuar) Chemistry Division, DSIR, Christchurch (Scientist).

Graduate Members

BAKER, Mrs Debra June BSc NZ Pharmaceuticals Ltd Palmerston North (Technical Officer).

BOWMAN, Nigel MSc (Cantuar) Chemistry Department, University of Canterbury (PhD Student).

CRESSEY, Peter John BSc (Hons Cantuar) Wheat Research Institute, Christchurch (Scientist).

McCOMBS, John Douglas MSc (Cantuar) Chemistry Department, University of Canterbury (PhD Student).

MULLIGAN, Paul Elliot BSc Chemistry Department University of Canterbury (MSc Student).

WINTER, David BSc (Hons Cantuar) Chemistry Department, University of Canterbury, (PhD Student).

BOOK REVIEW

HYDROGENATION OF FATS AND OILS by H.B.W. Patterson. 310p 1983. Applied Science Publishers, Barking, England. £38 (UK) + £1.75 postage = $100NZ.

The discovery of hydrogenation of fats by Normann in 1902 came at the right time as the supply of solid animal fats from America was becoming insufficient for European manufacturers, and Normann's discovery made available solid fats by the hardening of marine and vegetable oils. In the eighty years since there has been only one book on the subject, the exhaustive treatise by Ellis (3rd Ed. 1930), so this book will be welcome especially as the author has had considerable practical experience in the field.

The strength of the book is the major section on the hydrogenation of the various fats and oils, and the results obtained. Advice is given on the amounts and kind of catalyst to be used (new or part used, etc.) conditions of temperature and pressure and other factors. The especial characteristics before and after hydrogenation are dealt with in some detail, including such things as solid fat index (SFI). For people wanting information on the hydrogenation of a large variety of fats, this book will be invaluable.

In other respects the book is disappointing. The chapter on catalysts has very little on new developments, such as homogenous and promoted catalysts. There is very little on continuous hydrogenation, and there could be far more illustrations and diagrams.

S.G. Brooker

GOVERNMENT DEPTS AND RESEARCH INSTITUTIONS

RUAKURA AGRICULTURAL RESEARCH CENTRE

Dr. Rex Gallagher recently returned from a visit to West Germany, where he investigated FTIR technology and the use of high-resolution high-field NMR for structure elucidation of complex organic molecules. This involved a week at the Bruker Analytische Messtechnik factories and laboratories at Karlsruhe. Following this, he spent a month at the CSIR National Chemical Research Laboratory in Pretoria, South Africa, with *Drs Peter Steyn and Robert Vleggaar,* where a collaborative study using a Bruker 500 MHz NMR instrument was successful in elucidating the structure of lolitrem B. This complex toxin, formula $C_{42}H_{55}NO_7$, is the major neurotoxin implicated in ryegrass staggers disorder of farm livestock.

DSIR CHEMISTRY DIVISION — GRACEFIELD

Dr D.S. Sheppard has returned to Chemistry Division six months working the U.S. Geological Survey in Menlo Park California. Dr Sheppard was involved in surveys of the Lassen and Yellowstone National Parks and the Cascade Volcanoes. He also assisted in rebuilding systems for Geothermal and Volcanic gas Analysis.

N.J. Tapp, who recently completed BSc (Hons) at Otago University, has joined the Inorganic Materials Section at Chemistry Division.

Dr L.J. Wright has left Chemistry Division to join Auckland University as a lecturer in Inorganic Chemistry.

J.S. Buckleton has transferred from the Forensic Section at Chemistry Division Gracefield to Chemistry Division Auckland.

The Physical Chemistry Section headed by *Dr K.J. McKenzie,* has recently installed a new Mossbauer spectrometer for carrying out studies on minerals and fertilizers. This instrument will also be used to examine the causes of corrosion.

D.S.I.R. APPLIED BIOCHEMISTRY DIVISION:

Dr R.T.J. (Dick) Clark, Director of the Division since April 1983, has been promoted to the DSIR Head Office in Wellington as Chief Director of the Biological Industries Group (BIG). This group of divisions include Applied Biochemistry, Crop Research, Grasslands, Horticulture/Processing, Entomology, Plant Diseases and Plant Physiology. Dr Clarke joined the Plant Chemistry Division (now known as ABD) of the DSIR in 1958. He is well known for his work in the field of microbiology.

The new Director (from 19 December, 1983) for ABD is *Dr C.S.W. (Cam) Reid.* Dr Reid is well known for his work on the physiology of the digestive tract of ruminants, in particular the physiopathogenesis of diet-related disorders such as bloat. He has also organised research into aspects of overfatness of lamb carcases and the detection of multiple pregnancy in ewes. Results of these studies have been published in 37 papers to scientific journals as well as 10 review articles, 7 chapters in various books and papers presented to local and international meetings. He is a member of learned NZ societies concerned with animal health, nutrition and production, as well as being a Fellow of the Royal Society of NZ and of the NZ Institute of Agricultural Scientists.

Dr C.S.W. Reid

Dr Michael Boland has been appointed to the position of Officer-in-Charge of the Bichemical Processing Centre. This unit, although a part of ABD, is controlled in matters of policy by a committee consisting of members from the DSIR, Massey University and the Dairy Research Institute. The Centre has been developed as a national facility for scaling-up laboratory procedures to the stage of pilot or commercial production scale. It now has a staff of three including Dr Boland, a chemical engineer *Michael Frude* and a technician *Wynton Bell.* Some recent investigations undertaken include the manufacture of wood-based ion exchange resins and contract work for various industries. Future work may include the processing of industrial effluents for the isolation of valuable chemicals that can be either exported or used in products that are currently being imported.

Keith I. Williamson retires this month from the Division after 40 years service in the DSIR. Mr Williamson is best known for his researches utilising electron microscopes. He installed NZ's first electron microscope in the then Dominion Physical Laboratory (now Physics and Engineering Laboratory) in 1948 and also those in the then Plant Chemistry Division to which he had been transferred in 1961. His interest in alternative energy sources led him to undertake the first attempt in NZ to use tallow as a diesel substitute. Mr Williamson has helped to introduce advanced data handling techniques to the Division and has for many years overseen building design and construction for much of the Palmerston North Centre. In 1948 he was elected Associate Member of the Institute of Physics, London and Member of the Royal Society of NZ. He was Honorary Secretary of the NZ Branch of the Institute of Physics and the Physical Society for a period after its formation n 1962. His outside interests include the welfare of intellectually handicapped children, in which he has been actively involved for over 20 years.

Mrs Pam Lyttleton retired at the end of 1983. Although she was employed by the Department of Chemistry, Biochemistry and Biophysics at Massey Universtiy, she spent most of her time in ABD undertaking research involving the electron microscopes there. Mrs Lyttleton has been associated with various research projects on bacteria, in particular studies of the structure and function of plant components in nitrogen fixation by rhizobia-containing nodules on legumes. Her husband, the late *Dr John Lyttleton,* was a well known biochemist in the Division.

John Allen has joined the Organic Chimistry Group of the Division. He has a BSc in biochemistry from Canterbury University and has recently been working in the Plant Science Department of Lincoln College. Mr Allen is now analysing fruit aromas using gas chromatrographic — mass spectrometric techniques, with *Dr John Shaw.* They are currently studying the aroma of babaco fruit with *Dr Frank Visser.*

Within its various groups, the Division has some students from Massey University undertaking experimental work. With Dr John Shaw is *John White* BHort (Hons student) and *Bruce Dick* (MSc student) analysing boysenberry aroma and wine yeast esterase activity respectively. Russel Wilson (MSc student) has been characterising opines in selected legumes. With *Dr Daryl Rowan* is *Kevin Walmsley* (BSc student) working on the extration and bioassay of Argentine stem weevil feeding deterrents from fungal-infected rye grass.

DAIRY RESEARCH INSTITUTE

Dr Dave Ward has joined the Milk Powder and Drying Section as a Research Officer. He graduated from Otago Chemistry Department in 1978 and spent five years doing post-doctoral research into the pyrolysis of cellulose at the University of Montana, synthesis of mono-functional electron-dense markers for use in biological systems at the University of Oregon and cellulose modification at Massey University.

H. Tuan Truong, a chemical engineer, has left to take a Technical Officer position in the Moa-Nui Co-operative Dairy Company at Inglewood after five years in the Milkfat and Butter Section.

David Illingworth has been appointed as a Research Officer in the Milkfat and Butter Section. Previously he had been employed in the Fats and Oils Section of Unilever (UK) for 15 years. After a period in Perth, Western Australia, he took a Visiting Research Fellowship at the New Zealand Dairy Research Institute.

Dr John Smart has been appointed as a Research Office in the Biochemistry Section. He graduated from Massey University and obtained post-doctoral fellowships at Auckland University and Murdoch University in Perth, Western Australia. He is currently working on aspects of microbial fermentation of lactose in whey and permeate.

Dr Wayne Sanderson, an Assistant Director, has been elected President of Commission B (Technology and Engineering) of the International Dairy Federation.

Dr Bob Lawrence, an Assistant Director, was awarded the 1983 Miles Marschall International Dairy Science Award, which involved delivering a paper on cheese flavour and testure to the American Dairy Science Association.

Dr Lawrence also represented the New Zealand Dairy Research Institute at the Centenary celebrations of the Polish Co-operative dairy industry.

UNIVERSITY NEWS

Waikato

Prof. Neil Bartlett visited the Chemistry Department and lectured on rare gas compounds. Despite a delayed start due to bad weather in Wellington, there was a remarkably high attendance of undergraduates at this talk although it was scheduled in the middle of the examination period!

Dr Derek Smith and *Prof. Ken Mackay* attended the joint RACI/NZIC COMO-12 meeting at the University of Tasmania from the 23rd to 26th January.

Dr Malcolm Carr returned from the first term of his study leave which was spend in the Science Education Unit at Chelsea. He is taking up the Chemistry subject convenorship for the University Entrance Board and intends using the second term of his study leave contacting local groups.

Dr Peter Molan is on study leave at the New Zealand Dairy Board Artificial Breeding Centre at Newstead, near Hamilton. He is working on antibacterial peptides in semen.

A start has been made on construction of the new laboratory for the thermophile research group. The laboratory is approximately 500 square metres and completion is expected by September 1984. The laboratory is designed to accomodate up to 24 people, 8 scientists, 8 technicians/research assistants, and 8 research students. The proximity of the building to existing laboratories is important to allow regular contact with other personnel in the School of Science. The laboratory is a combined microbiology/biochemistry facility and will be equipped for growth and cultivation of bacteria, and the isolation and purification of enzymes from these organisms.

Dr Roy Daniel and others have received UGC grant equipment for HPLC amino acid analysis and protein purification. *Dr Kathleen Smolenski* has been appointed to take charg of this equipment. She is returning to New Zealand from Bristol where she carried out Ph.D work on collagen.

NZERDC have made a grant to the thermophile research group to support continued research into enzymic cellulose degradation and high temperature fermentation of the end products. The project commences 1st January 1984 and will run for two years.

Prof. Ken Mackay and *Dr Brian Nicholson* have been awarded a grant by the Petroleum Research Fund through the American Chemical Society to support their work on the synthesis and properties of germanium cobalt polymetallic clusters.

Dr Alan Hogg, who runs the Carbon-14 Dating Unit, is spending a year's leave of absence at the University of Georgia. He will be working with *Dr John Noaks* who developed the benzen synthesis used in Waikato's carbon dating process.

Massey

Prof. Geoff Malcolm, Dean of Science and Professor of Physical Chemistry in the Department of Chemistry, Biochemistry and Biophysics, has been appointed as one of the three university representatives on the University Grants Committee. This appointment, recently announced by the Minister of Education Mr Wellington, is for a five year period.

Dr David Parry, of the same Department, has been invited to present an address on "The Structure of Intermediate Filaments" to the 9th Lorne Conference on Protein Structure and Function, held during 6-10 February. Lorne is on the south coast of Victoria, Australia. After the Conference, Dr Parry will spend two weeks in the CSIRO Division of Protein Chemistry in Melbourne.

Building of the 4th Science Tower has been completed and staff members have almost finished (when this report was written) setting up the laboratories and offices. Courses taught in this Tower will include microbiology and genetics as well as advanced physics.

Graduate employment statistics for 1982/83 have been released by the University. In the year ending 31 May 1983, 1,541 students received qualification from the University, of which 94 were overseas students. On completion of their course, 69% of the NZ graduates went directly into full-time employment, about 4% of which were in work not suited to their qualifications and thus they regarded this as temporary employment. About 9% were still looking for suitable employment at the end of May, 1983 and 10% were enrolled for further study. The male mean salary of those employed was $1,571 higher than the female mean salary. Only 9% of overseas graduates obtained employment in NZ, with 76% returning to their home countries and 13% enrolling for further study. For science graduates, 47% obtained full-time employment (mean salary $16,335) while 14% were looking for employment and 28% returned to full-time study.

The Massey University Council has approved in principle the establishment of a science park at the University. Negotiations with interested parties will now proceed. The Council also approved in principle the establishment of the Massey Research and Development Foundation to handle contracts, patents and licences.

Victoria

Dr S.I. Smedley's term as the first Chairman of the Chemistry Department has ended and *Prof. N.F. Curtis* has taken over for a three-year period.

Recent visitors to the Department have included *Dr K.H.R. Woolridge,* Pharmaceuticals Research Manager, May and Baker (U.K.) who presented a seminar on "QSAR and Drug Desgin," and *Rr J.B. Metson* (University of Western Ontario) who outlined the work of the Surface Science Facility at the University.

Dr K.R. Morgan, a former graduate student of the Department, has completed post-doctoral studies at McMaster University (Hamilton, Ontario) and is currently spending a short period working with *Prof. Curtis.*

Dr R.J. Speedy has spent the N.Z summer on research leave working with *Prof. H.E. Stanley* at the Polymer Physics Centre of Boston University.

Dr D.C. Weatherburn has left for research and refresher leave to be spent, in the main, at the University of Texas at Austin. He will be working with *Prof. W. Woodruff* and returns to Wellington in early September.

Dr P.C. Tyler, a Junior Lecturer in the Department, is moving to a permanent post with the Ministry of Agriculture and Fisheries research station at Invermay.

Otago

Dr Rob McKeown (Pharmacy Department) attended the 2nd Australian Conference on Molecular Design and Structure-activity Relationships, sponsored by the Medical and Agricultural Chemistry Division of the Royal Australian Chemical Institute at Sydney University in December. *Dr Peter Barber,* of the School of Home Science's Textiles Department, will attend the 14th Australasian Polymer Symposium, also organised by the R.A.C.I., at Ballarat in February. He will

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COVER STORY

Solomat are specialists in portable instrumentation and with the announcement of the MPM 2000, they offer a new concept in versitility and portability.

The MPM 2000 is a two part instrument which includes the main unit and plug-in Modumeters which determine the function of the MPM 2000. The main unit includes the measuring and display circuitry, the Solomat processor, power supply, and digital and analog outputs. Solomat have used the latest microprocessor technology and is very easy to use despite its sophisticated performance. It has special minimum, maximum, hold and average functions as well as continuous readings on a 4½ digit Liquid Crystal Display. Choice of resolution, selection of units of measurement and testing of the display and instrument are performed automatically by the microprocessor.

The plug-in modumeters fill many measurement needs with one instrument. Select a probe, turn a switch and measurement of any of the following parameters can be made simply and accurately:—

Temprature, Humidity, Air Speed, R.P.M. pH, Dissolved Oxygen, Conductivity, Ion Concentration, Amps, Volts, Ohms, Pressure, Thickness.

Each Modumeter communicates to the MPM 2000 through a digital interface and transfers the analogue measuring signals to the MPM 2000 for analysis.

The MPM 2000 is the result of several years research into advanced portable instruments. The development of unique technology has made possible a new patented linearisation system which allows interfacing with many types of sensors and guarantees accurate and reliable measurements.

A versatile "user-friendly" portable data logger

For further information circle 5 on Reader Reply Card.

UNIVERSITIES

(Continued)

present a paper in the Polymer Education Symposium.

From the Pharmacology Department, *Assoc. Prof. I. Ralph Edwards* attended the World Clinical Pharmacological meeting in Washington, U.S.A.. He later visited institutions in Columbus, Richmond, San Francisco and Albuquerque to look at current research on toxicity of formaldehyde on behalf of the Liquid Fuels Trust Board. In October, he delivered a paper on the N.Z. Adverse Drug Monitoring System at the W.H.O. Conference on the International Drug-monitoring Scheme in Brussels. More recently, *Prof. Edwards, Dr David Clark, Dr Alistaire Miller* and *Larry Schaff* attended a conference of the Australasian Society of Clinical and Experimental Pharmacology in Newcastle, N.S.W.. *Prof. Edwards* chaired a session there. Also the Adverse Drug Reaction Centre has installed a computer terminal to link the Centre directly to the Health Department's main-frame computer in Christchurch. The National Poisons Centre has also installed a new I.B.M. terminal which will be used to computerise the Centre's files.

The Chemistry Department had a record number of 23 students in it's graduating class of 1983, 8 of them graduating with 1st class honours. Also from the Chemistry Department, the N.Z. Energy R. and D. Committee have extended their contract with *Assoc. Prof. Ross Grimmett* for he and *Dr Murray Vickers* to solvent extract and identify the products from lignites and tars obtained by pyrolysis of lignites. *Prof. David A. Buckingham, Dr Jim Simpson and Dr Lyall Hanton* are attending the COMO 12 Conference in Hobart in January. *Wayne Webley* on completing his Ph.D. with *Prof. Buckingham,* will take up electro-chemical work as a postdoctoral fellow under *Prof. Fred Anson* at Caltech. *Greg Hormann* has completed his M.Sc. with *Dr Barrie Peake* during which he interfaced several chemical measuring devices to the Apple computer.

In the Biochemistry Department, *Dr John Cutfield* attended the Annual Protein Structure and Function Workshop at Lorne, Victoria, where he presented a paper on the importance of insulin dimerisation. *Assoc. Prof. Pat Sullivan* has left for study leave to work with *Prof. Randy Scheeleman* at Berkeley, California for 9 months, then for a further 3 months with *Prof. Vincent Massey* at Ann Arbor. Michigan. *Dr Murray Grigor* is spending 3 months on a Claude McCarthy Fellowship at the University of Western Australia where he will continue his studies with *Dr Peter Hartmann* on the biochemical and developmental aspects of lactation.

Dr Clive Trotman will attend the International Meeting of the Australia and New Zealand Society for Cell Biology in Melbourne. He will present two papers, co-authored by *Dr Warren Tate,* on the control of protein synthesis. Dr Tate is spending February and March at the Max Planck Institute for Molecular Genetics, Berlin, and the Baylor College of Medicine in Houston, U.S.A., to further collaborations on the mechanism of protein synthesis and the cloning of factors involved in this event.

BRANCH NEWS

Auckland

During the Branch A.G.M. on November 15, members were treated to a very informative and interesting talk by *Doug Calhoun,* a Patent Attorney from A.J. Park, Wellington.

Mr Calhoun's address was titled: "The Chemist and the Patent System : how can one better use the other?" Topics covered in the talk and subsequent question-time included the history, mechanisms and procedures of the patent system, searching the patent literature, costs involved, recognising and commercialising a chemical invention, and examples of current chemical patents in New Zealand.

Waikato

Dr Lyndsay Main was elected Branch Chairman for the next year at the AGM held on 16 November. Other members elected to the new Committee were *Ron Newth* (Secretary), *Owen Clinton* (Treasurer), *Dr Roy Daniel* (Council Delegate), *Dr Max Sutton* (Branch Editor) and *Mark Cosgrove* (Past Chairman), together with *Prof. Ken Mackay, Michael Lowe and Drs Don Cowan, Carrick Devine, Bob Franich, Brian Nicholson, Peter Robinson.*

Mark Cosgrove, the retiring Chairman, initiated a round-table discussion on the future direction of branch activities, instead of the traditional Chairman's Address. A lively exchange of ideas followed, which was aimed at expanding the role of the Institute in the region. In particular, possible ways of stimulating interest in chemistry in schools were discussed. A variety of refreshments available throughout the well attended meeting, contributed to the convivial atmosphere.

Wellington

The December meeting of the branch was a joint meeting with the New Zealand Institute of Food Science and Technology. *Dr Alan Clark* from Victoria University of Wellington discussed the toxic risks encountered by living organisms and the metabolic defences the organisms can use to protect themselves from these risks. Following this address members of the NZIC and the NZIFST shared a very enjoyable social hour.

Otago

Chemistry teachers from most Otago secondary schools attended an in-service training day in the University Chemistry Department on 30th November. It was an opportunity to become acquainted with some recent developments in research at the University and also to examine new kit sets

BRANCH NEWS

(Continued)

that have been developed for use in 6th and 7th form tuition.

Chemist, *Bill Thomson,* with McLeod Bros. of Dunedin, reports that a marked increase in soap production has been necessary to satisfy demands on the Japanese market. In Southland, *Stan Winter,* recently promoted to Technical Manager with the Southland Co-operative Phosphate Co., presented a paper at the 19th Technical Conference of the N.Z. Fertiliser Manufacturers Research Association. The paper described the use of a Phillips PW 1400 XRF spectrometer to monitor uptake of major and trace elements applied to pastures. 25 farms were monitored in the study which revealed a marked interdependence of plant mineral content and soil temperature.

In the N.Z. Aluminium Smelter's laboratories, environmental control section facilities have been enlarged as part of the smelter's expansions. This was necessary because of changed requirements of the environmental control and environmental hygiene programmes. Spectrographic, metallurgical and chemical laboratory facilities were also expanded coupled with an increase in staffing levels. *Noel Patterson,* Technical Officer in the environmental laboratory has resigned to follow career interests in horticulture.

GENERAL NEWS

NEW AUCKLAND PREMISES FOR SCI-MED

The Auckland branch of Sci-Med (NZ) Ltd have moved into new premises at Unit C, 14 Haultain St, Eden Terrace — just off the top end of New North Rd. The phone, telex and postal address remain unchanged. The new premises are large enough to allow the running of an applications facility with GLC and HPLC systems permanently set up and also to run demonstrations of new equipment.

An invitation is extended to customers to visit the premises and have coffee — although those wanting biscuits as well are advised to ring first.

Ian Maskery has joined Sci-Med's technical staff. Well known in the Auckland region, Sci-Med are very pleased to have him as part of their team.

KWIC INDEX OF INTERNATIONAL STANDARDS

The International Organisation for Standardisation (ISO) has issued a comprehensive index of international standards. This KWIC (Key Word in Context) index, lists the titles, in English, of nearly 7500 international standards and standards-type documents published by 24 international organisations. The index is available from ISO Central Secretariat, Case Postale 56 CH-1211, Geneve 20, Switzerland, price CHF 285. It may also be available from national standardisation bodies.

IUPAC NEWS

The 32nd General Assembly of IUPAC was held at Lyngby, Denmark in August 1983. A new feature of the Assembly was the presence of many National Chemical Society Presidents as observers.

Presidential Report

In his report Professor S. Nagakura of Japan stated that the main problems confronting the Union, excluding financial difficulties, can be summarized under four points:

1. To open ways for as many chemists as possible to participate in IUPAC affairs.
2. To make the traditional activities of various IUPAC bodies more substantial and more efficient.
3. To introduce new roles which IUPAC should play in relation to human society.
4. To dissiminate information of IUPAC activities accurately and effectively to as many chemists as possible and to deepen their interests in the Union.

Election of Officers 1983 — 85

President:	Dr W.G. Schneider, Canada
Vice President:	Professor C.N.R. Rao, India
Secretary General:	Professor T.S. West, U.K.
Treasurer:	Professor A. Bjorkman, Denmark

IUPAC Publications

A comprehensive revision of the "Manual of Symbols and Terminology for Physiochemical Quantities and Units" (the Green Book) is at present underway. An "Abbreviated List of Symbols, Terminology and Units" will also be produced. The Commission on the Nomenclature of Inorganic Chemistry is carrying out a complete revision of the Red Book which will appear in two parts, Part 1 will deal with the most common compounds and the basic aspects of nomenclature while Part 2 will be concerned with more specialised topics. Revisions of the Blue Book rules of nomenclature of organic compounds and the Orange Book "Compendium on Analytical Nomenclature are on schedule.

Work on the "Solubility Data Series" is progressing favourably. Twelve volumes have been published but it is anticipated that there will be over 90 volumes in the series.

IUPAC Recommendations

A new procedure has been adopted for the production of recommendations on Nomenclature and Symbols.

New Zealand scientists may obtain copies of the provisional document for comment from Mr Robert Schoenfeld, Australian Journal of Chemistry, P.O. Box 89, East Melbourne, Victoria 3002, Australia.

FIBRE IN HUMAN AND ANIMAL NUTRITION

The Proceedings of the Dietry Fibre symposium held at Massey University in May 1982 are now available. They include all the plenary papers presented at the symposium, abstracts of all free papers and summaries of the workshops. Edited by G. Wallace and L. Bell, the proceedings are available for $35 from the Executive Officer, Royal Society of NZ, Private Bag, Wellington.

GENERAL NEWS

(Continued)

HEALING INDUSTRIES GET TELARC REGISTRATION

Healing Industries' paint and coatings laboratory has been given Telarc registration from the Testing Laboratory Registration Council.

Such registration means Healing is one of only three paint laboratories in this country registered to conduct performance and quality tests on marine, industrial and domestic paints and coatings.

According to Healing's chief chemist, Mr Keith Boyer, registration means the company's laboratory testing procedures conform to an established world standard, and in turn that means the company's products conform to those standards.

It also means the laboratory can carry out, on behalf of other concerns, any tests involving paints and coatings.

Mr Boyer said Telarc registration is a prestige commendation within industry and requires not only a highly competent staff, but also a sophisticated laboratory facility.

To keep the Telarc registration the laboratory is periodically asked to complete proficiency tests to ensure consistency and accuracy. The same samples are sent to testing laboratories throughout Australasia.

PROCEEDINGS OF THE ROYAL SOCIETY OF NZ

Proceedings III, the 1983 Proceedings of the Royal Society of NZ are available at the special member bodies' rate of $7.50 on direct application to the Royal Society of New Zealand, Private Bag, Wellington.

THE CORDAY — MORGAN MEMORIAL FUND AND VISITS TO DEVELOPING COUNTRIES

The Royal Society of Chemistry's Corday-Morgan Memorial Fund exists to assist members of any established Chemical Society/Institute in the Commonwealth to visit chemical establishments in another Commonwealth country. There is no restriction on age but the visits must be clearly of benefit to the country concerned. It is hoped that lectures will be given during a visit.

The maximum award to any individual is normally £500 and persons eligible must be citizens of, and domiciled in, any Commonwealth country. Applicants must be travelling to another country (not necessarily in the Commonwealth) and would stop en route to visit a third country which must be in the Commonwealth.

Funding would cover the additional costs of the stopover, together with appropriate subsistence.

The closing dates for receipt of applications are normally 1 April and 1 October, and these are strictly observed.

An application form for support from the fund is available or request from The Corday-Morgan Memorial Fund, c/o The Secretary General, Royal Society of Chemistry, Burlington House, Piccadilly, London W1V OBN.

A complementary fund for visits to developing countries is also available, details from the International Committee Awards, same address.

NEW PRODUCTS

FLUID BED DRYER

Fluidised bed drying is approximately 20 times faster than drying in a conventional cabinet and since the temperature can be kept low it is eminently suitable for temperature sensitive products. The Buchi-710 is a laboratory dryer which would have many applications in the R and D laboratories of companies involved with pharmaceuticals, foodstuffs, fertilisers, plastic materials etc. Local Agents: Watson Victor Ltd. For further information, circle **8** on the Reader Reply Card.

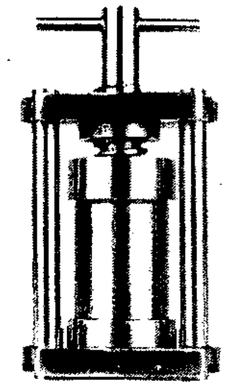
SAMPLE DISSOLUTION BOMB

Safety and efficiency are the key features of a new Sample Dissolution Bomb from Scientific Glass Engineering. Prolonged high temperatures and pressures can be safely tolerated.

A simple but rugged quick-action mechanism provides positive closure. The design ensures the locking mechanism is not exposed to corrosive solutions eliminating potentially hazardous handling problems. The PTFE reaction capsule (25ml) is totally encased in a stainless steel cylinder ensuring no loss of sample or contamination from metal surfaces.

The device, which may be used with a wide range of digesting media, is suitable for organic and inorganic compounds including volatile and radioactive materials.

A product data sheet is available from the local agents Wilton Instruments. For further information circle **9** on the Reader Reply Card.

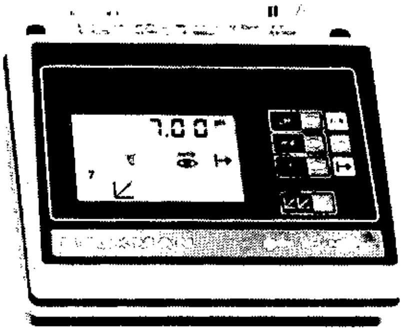


BECKMAN INTRODUCES pH METER FOR AUTOMATED MEASUREMENTS

Designed especially for the quality control laboratory, Beckman Instruments, Inc.'s pHI ™ 61 Meter simplifies accurate pH measurement and makes data available automatically.

The microprocessor-controlled pH meter offers a variety of standard features for easy pH measurement and titrations. Increased memory provides fast operation and expanded print formats. Automatic computation and printout of electrode slope verify electrode performance, and the instrument flags questionable slope readings. Automatic stability detection enables the user to choose between the coarse setting for speed and the fine setting for greater precision. Standard Rs-232-C compatible output provides instant access to a printer, computer or CRT. Automatic buffer recognition of seven buffers covers the complete pH range.

The pHI 61 pH Meter computes all essential parameters: automatically standardizes, calibrates, computes the electrode slope, recognizes buffers and compensates readings for temperature. The user can select from two print formats: one format prints all essential standardization data, including slope, to verify standardization for each sample; the second format simply prints the pH and temperature of each sample.



The pHI 61 Meter communicates with the use. A large-area LCD display communicates essential data, system status, procedural errors or defective electrode messages. The instrument has simple universal language symbols on the display and back panel.

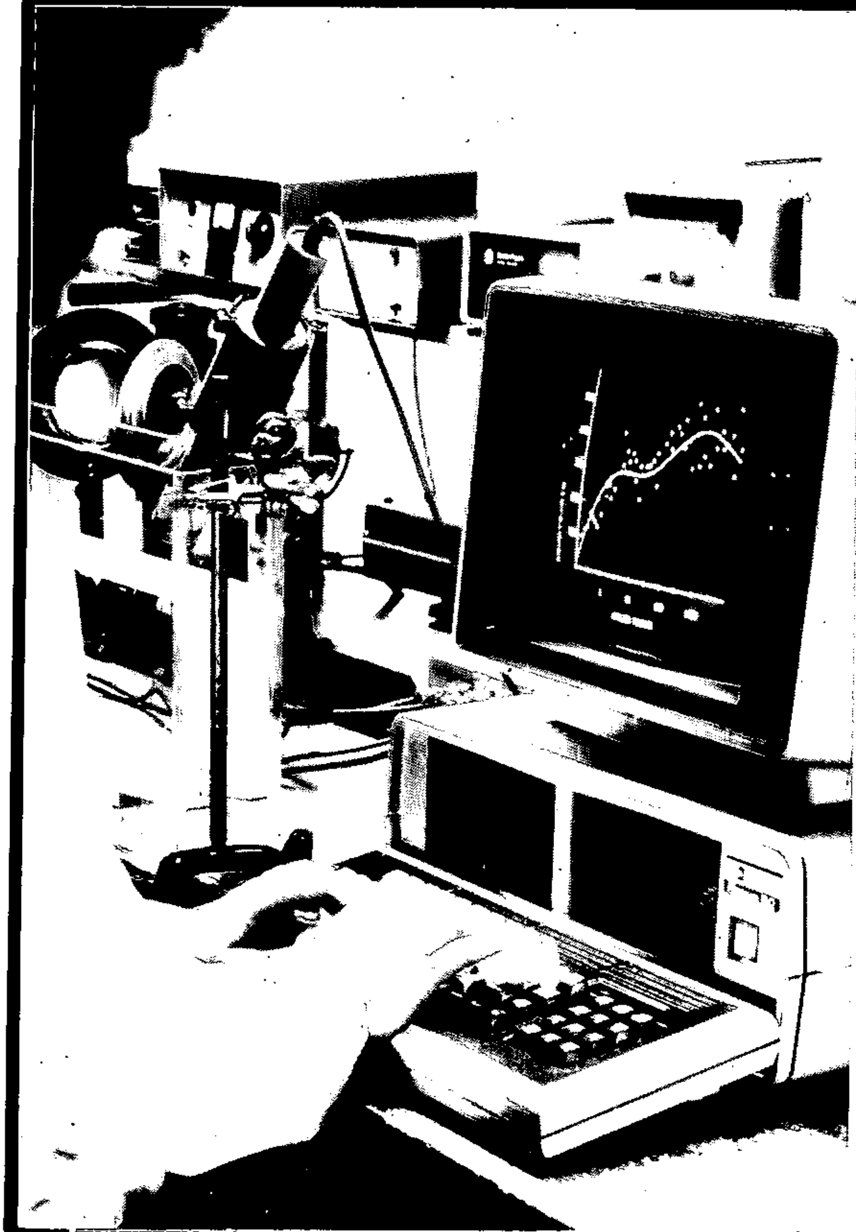
The pHI 61 diagnoses and monitors its own performance by automatically checking critical circuits. A test switch emulates the electrode to provide customer serviceability. NZ Agents: Alphatech Systems Ltd, for further information circle **10** on the Reader Reply Card.

CHROMOSORB AGENTS

Alltech Associates N.Z. are pleased to announce that they have been appointed sole New Zealand distributors for the Manville 'CHROMOSORB' range of chromatography supports.

The Australian sister Company, Alltech Associates (Aust) Pty Ltd, enjoys a similar position in that country, and the parent company, Alltech Associates Inc, of Deerfield, Illinois, is the largest U.S. domestic purchaser of 'CHROMOSORB' products.

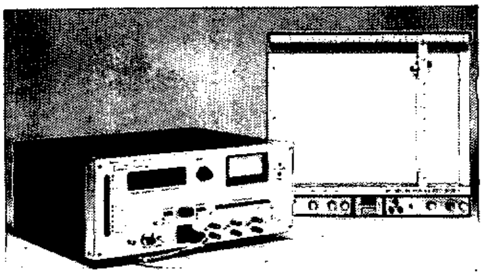
The full range of 'CHROMOSORB' products is available now from Alltech Associates N.Z., and comprehensive stocks are carried in Auckland. For further information, circle **11** on the Reader Reply Card.



NEW PRODUCTS

MODEL 362-1 CORROSION MEASUREMENT SYSTEM

E.G. & G. Princeton Applied Research has introduced a low cost instrumentation package for electrochemical corrosion measurements. The system consists of the Model 362 Scanning Potentiostat and the Model RE0092 X-Y Recorder.



The Model 362-1 System can be used to determine corrosion rates, passivation behaviour, inhibitor effectiveness, pitting tendencies, sensitization effects, and galvanic corrosion tendencies in a straight — forward and time — efficient manner. Because the Model 362 can perform both linear and cyclic scans in either controlled potential or controlled current modes, a large repertoire of electrochemical corrosion techniques are available.

The Model 362-1, which contains a ± 1A, ± 30V potentiostat/galvanostat and IR compensation, is applicable to the study of a large variety of metal/solution systems.

For further information, contact:—
Alphatech Systems Limited or circle **13** on the Reader Reply Card.

NEW HPLC COLUMN PACKING — WATERS NOVAPAK

Waters new NOVA-PAK chemistry provides the highest efficiency and reproducibility to perform even the most difficult separations. It is the only 4 — 5u spherical C18 packing that successfully separates acids, neutrals and even amines — without tailing or requiring complex, expensive mobile phase modifiers.

This high selectivity results from a sequential bonding process, exclusive to NOVA-PAK packing, designed to not only provide the most stable, durable stationary phase, but also to create a unique surface chemistry ideal for analyzing even the most difficult mixtures. This versatile surface chemistry (low hydrophobicity) gives you the performance you need to easily establish new methods or improve current ones — even where other packings fail. Plus, it provides column-to-column reproducibility unmatched by any other packing.

NOVA-PAK is available in both 15 cm columns and Radial-Pak cartridges for both the RCM — 100 and Z - Module Radial Compression Separation Systems.

For more information contact:—
Alphatech Systems Limited or circle **14** on the Reader Reply Card.

EPPENDORF VARIPETTE R4740

The safety pipette designed for the milliliter range. Exact and fast without sucking by mouth and without inconvenient working aids.

With the Eppendorf Varipette 4720, pipetting in the ml-range is now just as precise and simple as in the µl-range with the well-established Varipette 4710. Instead of a number of glass pipettes, only one Varipette 4720 is needed to cover the *entire* range from 1 ml to 10 ml. Each required volume is simple to set and easily reproducible with correct decimal point at the four-digit digital display. Since there are neither losses through glass breakage, nor time-consuming rinsing procedures, the acquisition of the Varipette pays off already after a short time.

The pitpetted liquid does not get into contact with the Varipette, but only with "varitip", a consumable product, made from plastic material which is reliably connected — but easily replaceable — with the Varipette through a clamping device.

Varitips are available in two different versions: varitips L with especially long and slender lower parts for aspirating liquids from narrow-necked vessels or from measuring flasks with up to 170mm immersion depth, as well as varitips P in accordance with the principle of positive displacement for all remaining applications. Varitips are easily replaced with new ones after use. This avoids carry-over errors and unnecessary time-consuming rinsing procedures.

Pipetting with the Varipette 4720 is especially simple: all that needs to be done is pressing down the pepetting lever to fill and empty the caritip. The Eppendorf Sample Handling Program is thus enlarged by a further single-hand operating pipetting instrument.

Local Agents: Kempthorne Medical Supplies Ltd, or circle **15** on the Reader reply card.

BIOLOGICAL SEPARATIONS BY HPLC

Waters Associates have recently introduced a range of HPLC columns designed to isolate and analyse proteins, peptides and amino acids faster with higher resolution and recovery:

ION EXCHANGE: The new Water's polymeric ion exchange resins resolve protein mixtures with the same elution buffers used for classical open column separations. The large pore size of Waters ion exchange packings (100nm) gives you recoveries of enzymatic activity approaching 100% even for high molecular weight enzymes. Resolution and speed are also enhanced.

GEL FILTRATION: Waters new high speed gel filtration methods allow rapid fractionation of protein samples. The same gel filtration method lets you profile sample compositions, isolate all components, and verify the purity of collected fractions.

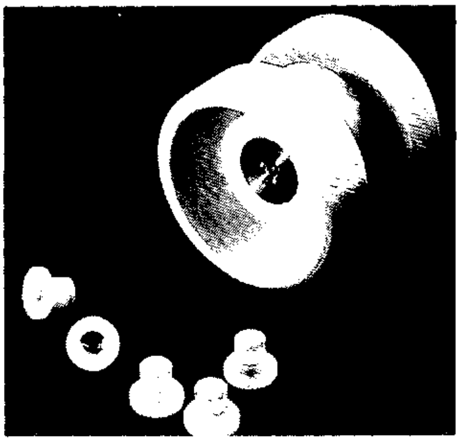
HYDROPHOBIC: Waters HPLC hydrophobic methods allow separation of proteins that are difficult to solubilize from a crude sample. Sufficient purity is achieved to allow sequence determination after one chromatographic step. The same hydrophobic HPLC method can then be used for high resolution peptide mapping of a tryptic digest.

For further information on Waters HPLC Systems for biological separations contact:—
Alphatech Systems Limited or circle **16** on the Reader Reply Card.

WATERS GUARD — PAK PRECOLUMN MODULE FOR HPLC

Eliminate the difficult and costly process of repacking or replacing steel columns.

Installed on-line immediately before the analytical column on any HPLC system, Waters Guard-PAK Precolumn Module Kit removes chemical contaminants and particulates originating from samples before they reach your column. The kit includes disposable inserts packed with C18, silica or CN chemistries which act as "mini-columns" to absorb column contaminants. What's more, replacing inserts is fast, economical and can be done completely by hand — simply open the housing, drop in a new insert, and then retighten the housing.



For further details on Guard-PAK Precolumn Modules please contact:—
Alphatech Systems Limited or circle **17** on the Reader Reply Card.

POLAROGRAPHIC ANALYZER SYSTEMS

E.G. & G. Princeton Applied Research has released a product brochure describing their new line of Polarographic Analyzer Systems. This instrumentation can quickly and economically determine the concentrations of metals, anions and organics at levels as low as 1 microgram/liter. The catalogue features the model 384B Microprocessor — Based Polarographic Analyzer, the first commercial instrument capable of performing the extremely rapid technique of square wave voltametry.

Polarographic analysis has been applied to such diverse samples as foods, plating baths, waste-waters, pharmaceuticals, alloys, and biological fluids.

The brochure describes those situations where polarography is the analytical technique of choice. A general discussion of applications is also included.

For further information, contact:—
Alphatech Systems Limited or circle **18** on the Reader Reply Card.

NEW CATALOGUES

Watson Victor Ltd announce the availability of two new catalogues. To obtain a copy of the 1983/84 Nalgene plastic — labware catalog cirlce **19** on the Reader Reply Card. Users and prospective users of the Laser Doppler Anemometry can obtain information about available equipment and applications in the DISA LDA catalogue by circling **24** on the Reader Reply Card.

NEW PRODUCTS *(Continued)*

LABORATORY DEIONISER FROM ELGA

Elgastat MicroMeg is the new laboratory deioniser manufactured by the water purification specialists, Elga.

Compact and wall mounted, MicroMeg will meet the demands of the low volume user of pure water for routine laboratory applications.

Able to operate at flow rates up to 90 litres per hour, this new unit will provide a treated water quality of 1-10 Megohm-cm.

The design of this deioniser incorporates a colour-coded conductivity meter. The meter, which is battery operated, allows the user to instantly monitor water purity at the press of a switch. When exhaustion of the ion exchange resins is indicated, the disposable cartridge is discarded and a fresh resin cartridge is fitted in seconds.
Local Agents: Wilton Instruments. For further information, circle **20** on the Reader Reply Card.

NEW LEITZ INVERTED MICROSCOPE FOR TRANSMITTED LIGHT

The LABOVERT is the first inverted microscope for transmitted light, that unifies the construction principle of an upright instrument with the advantages of the construction of an inverted model (Reinheimer principle).

The prominent features of this new model are:

Ergonomical Construction

The objective stage, the revolving nosepiece and the coarse and fine adjustments are placed in an extremely low position in front of the user. Their positions allow the operator to perform the essential manipulations with speed and accuracy.

The attachable handrests additionally improve the working conditions, especially when observing for a long time.

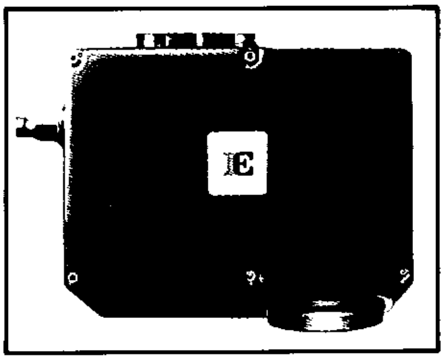
High Flexibility

The LABOVERT is provided for the most frequently used illumination systems of inverted microscopes: brightfield, phase contrast, darkground, oblique illumination or polarization light. Incident light fluorescence and interference-contrast T will be possible with a similar stand, available by the middle of 1984.

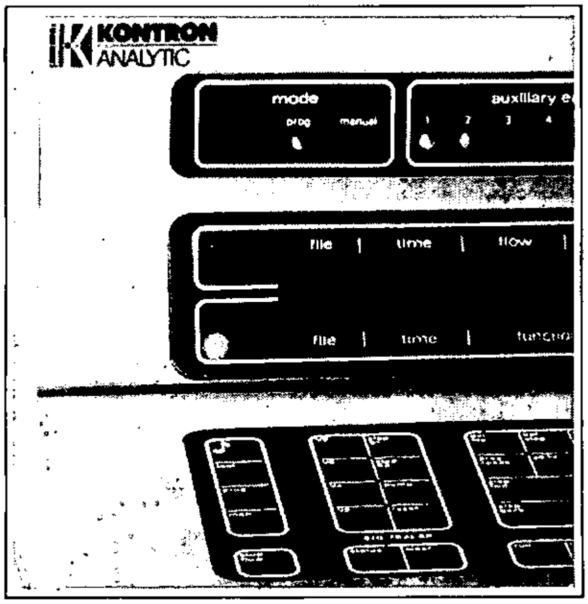
N.Z. distributors: Northrop Instruments and Systems Ltd. For further information circle **21** on the Reader Reply Card.

INFRA RED MEASUREMENTS

Infrared Engineering has introduced the MM4 Infragauge, an infrared absorption gauge for measuring water contents, coating and film thicknesses. It can be used for single measurements or for on line measurements in applications such as tobacco, building materials, chemicals, plastics, papers and foods. Local Agents: Watson Victor Ltd. For further information circle **22** on the Reader Reply Card.



The MM4 Infragauge.



Mettler LabPac is the key to faster and easier weighing in the laboratory.

The new Mettler PE LabPac makes life in the lab easier.

The Mettler LabPac programs Mettler PE balances to do the types of weighing you do in your lab each day. Turns the balances into lab specialists.

For example, if you need to do net total weighings, you simply plug in the LabPac's net total key, and away you go. The same is true for other laboratory weighing procedures. Want to do percentage weighing? Plug in the percentage weighing key. Percentage determination? Plug in the appropriate key.

It's the same for statistical weighing (mean value/standard deviation) and animal weighing. It couldn't be easier. The PE LabPac also incorporates a data output, which allows you to interface with computers and other peripheral equipment.

LabPac interfaces with the new PE balances.

There are eleven new balances in Mettler's PE series. Readability ranges from 0.001 g to 1 g and capacities go up to 24 kg.

Each of the new PE balances features automatic calibration, a microprocessor controlled integration cycle and DeltaDisplay, which allows you to hit target weights quickly and accurately.

Another aspect of the PE LabPac package you'll like very much is the price. You'll find the pricing of the PE balance you need and the companion LabPac most attractive.

Mettler

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Shimadzu. Three approaches to wide-ranging LC

All are modular designs

1 SPD-M1A Photodiode Array UV-VIS Spectrophotometric Detector for HPLC

An advance in HPLC that achieves simultaneous detection through the full UV-VIS wavelength range. Shimadzu's SPD-M1A Photodiode Array Spectrophotometric Detector for liquid chromatography is designed for simultaneous quantitative and qualitative analyses. It offers the advantage of three-dimensional spectro-chromatograms, easily identifiable peaks, spectrum memory on-flow and single and double wavelength range chromatograms. The photodiode array sensor covers the full UV and VIS spectrum range and all detector signals in the UV/VIS wavelength range are processed by dedicated microprocessor combined with a dialog system on the CRT for easy operation.

2 RF-530 Fluorescence HPLC Monitor

Shimadzu's RF-530 Fluorescence HPLC Monitor with xenon lamp and concave holographic gratings offers a wide range of excitation and emission wavelengths.

The corrected excitation energy and sensitivity to give a detection limit for quinine sulphate is 0.45pg/12μl. An off-plane optical system and aberration-corrected concave holographic gratings decrease noise. All connections are made with standard 1/16″ O.D. tubing for connection to all HPLC systems.

3 SPD-2A UV Spectrophotometric Detector for HPLC

Shimadzu's SPD-2A is equipped with a high-performance grating monochromator having a wavelength range from 195 to 350nm. To ensure high stability, the SPD-2A has a double beam optical system which cancels drifts caused by fluctuation in the intensity of the light source. Available with 8μl flow cell and 0.5μl micro flow cell.

Shimadzu delivers modular design, versatile components and full automation. Write today for more information on these and other Shimadzu instruments.

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