Puget Sound Section

ANNUAL RESEARCH CONFERENCE NUMBER

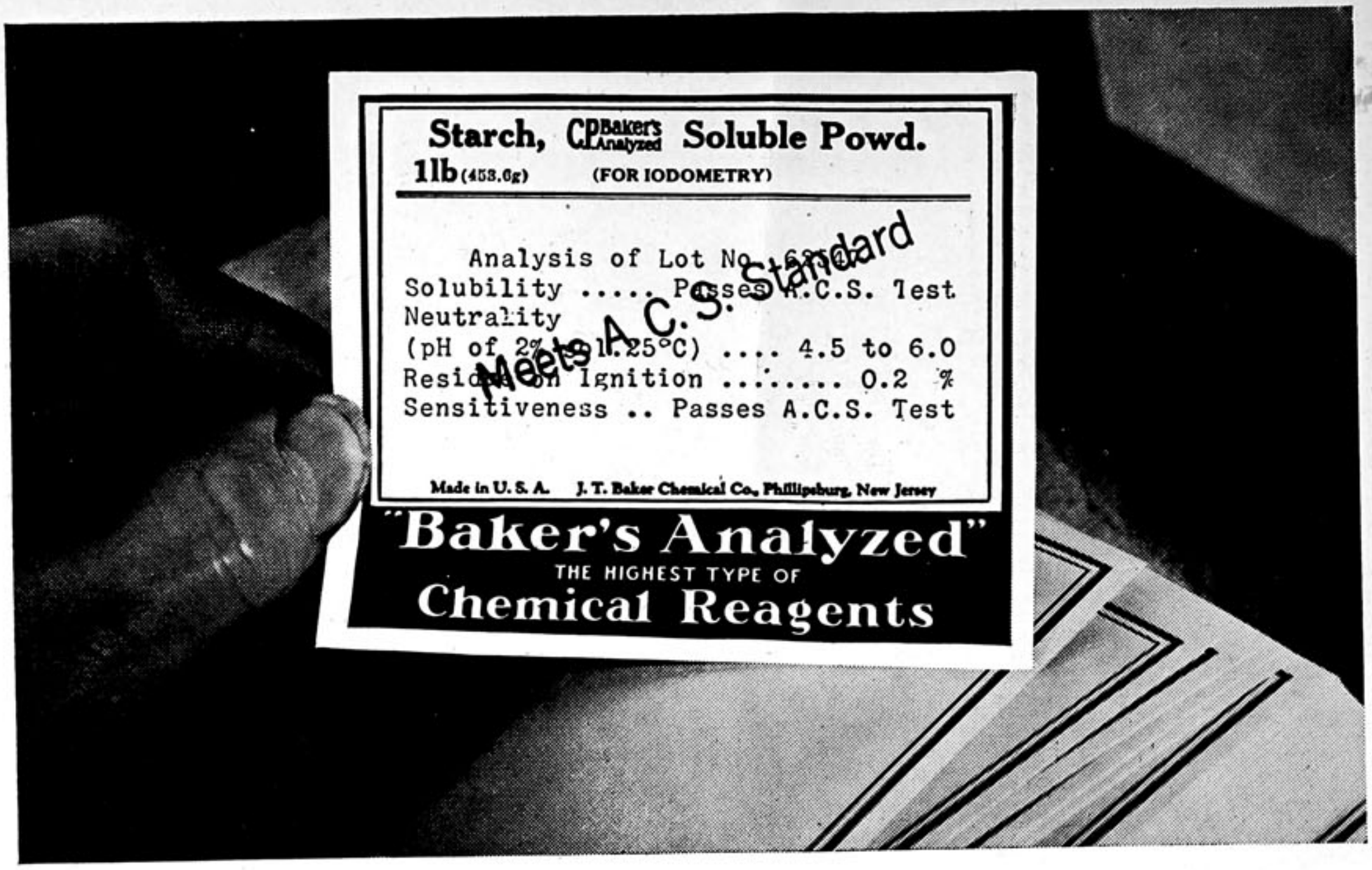
SEE PAGE 7

Bagley Hall — University of Washington

The PUGET SOUND CHEMIST

Bulletin of the Puget Sound Section of the American Chemical Society

VOLUME VIII NOVEMBER • 1947 NUMBER 9



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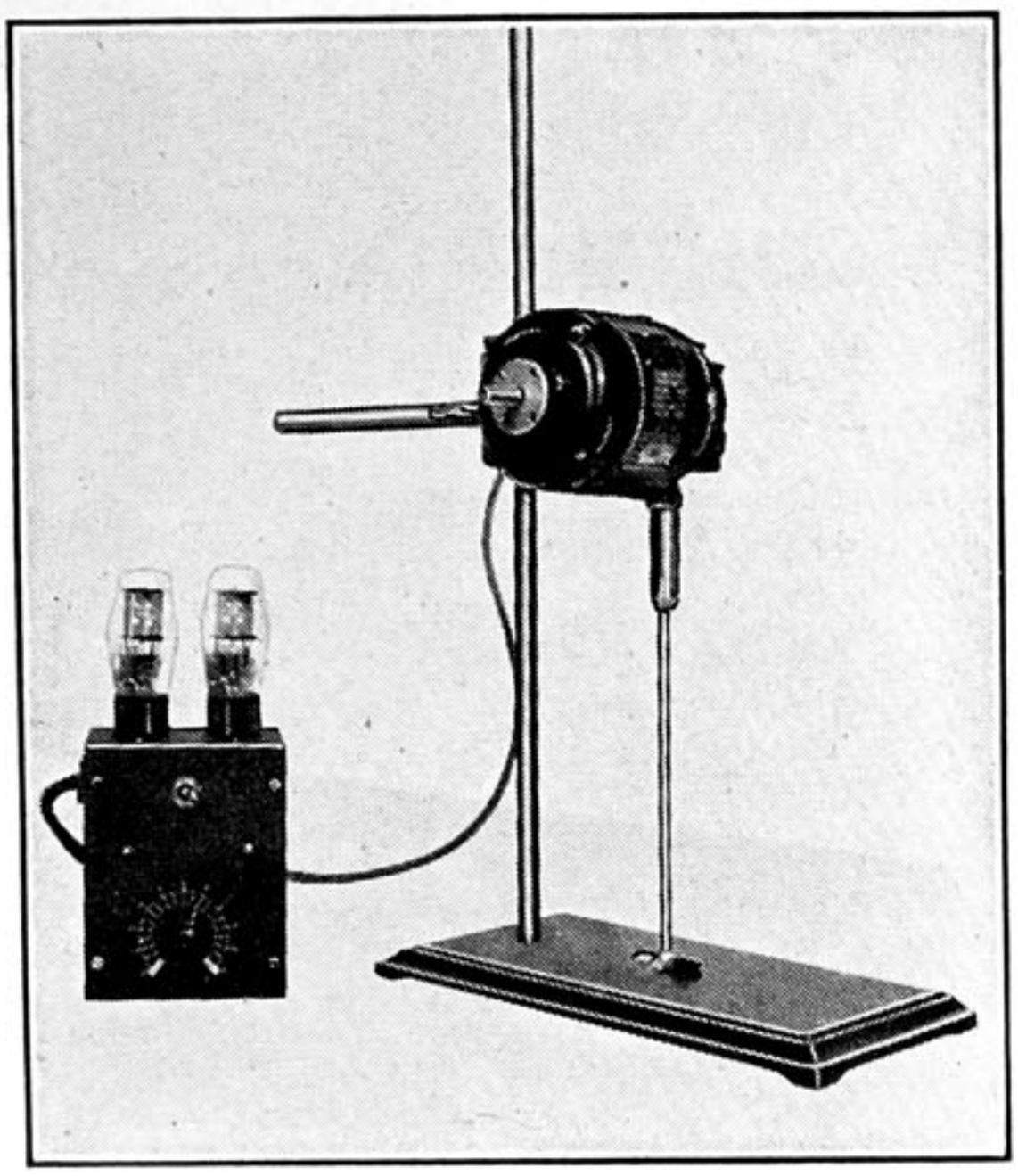

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November Meeting

PUGET SOUND SECTION OF THE AMERICAN CHEMICAL SOCIETY

Tuesday, Nov. 25, 1947

ANNUAL RESEARCH CONFERENCE

University of Washington — Bagley Hall

Registration — 9:00 A.M.

Morning Session — 10:00 A.M. — 12:00 M.

Afternoon Session — 2:00 P.M. — 4:30 P.M.

★

Informal Dinner — Edmond Meany Hotel — 6:00 P.M.

Be sure your reservation is made

★

EVENING MEETING — 8:00 P.M.

Guest Speaker — DR. JOEL H. HILDEBRAND

Dean of the College of Letters and Science — University of California

"Solvent Power of Liquid Ammonia"

The PUGET SOUND CHEMIST

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Guest Speaker . . .

DR. JOEL H. HILDEBRAND

Joel H. Hildebrand, Dean of the College of Letters and Science at the University of California since 1939, was born in Camden, New Jersey, November 16, 1881. He took his Bachelor of Science degree at the University of Pennsylvania in 1903, followed by the Ph.D. degree in 1906. During 1907 he was an instructor at the University, but left to become assistant professor at California. A professor since 1918, he served also as Dean of Men during 1923-26, Faculty Research Lecturer in 1936, becoming Dean of the College of Letters and Science in 1939. During World War 1, Dr. Hildebrand served with the Chemical Warfare Service and for a time directed the C.W.S. Laboratory near Paris, later was commandant at Hanlon Field near Chaumont. He attained the rank of Lieutenant Colonel and was awarded the Distinguished Service Medal. During 1924-26 he served as Consulting Chemist for the U.S. Bureau of Mines.

In 1943 Dr. Hildebrand served as Scientific Liaison Officer of OSRD with the American Embassy in London. He delivered the Walker Memorial Lecture in Edinburgh, and was chosen as Guthrie Lecturer for 1944.

Dr. Hildebrand has been a member of the ACS since 1908, and he has held numerous local and national offices of the Society. He has written several books, including "Principles of Chemistry" and the ACS monograph on Solubility. In 1939 he was recipient of the Nicholas Medal. During 1932-39 he was an Associate Editor of the Journal of the American Chemical Society.

Dr. Hildebrand is a Fellow of the American Association for the Advancement of Science, and has been Vice Chairman of its Pacific Division. He also belongs to the American Physical Society, The National Academy of Sciences, Phi Betta Kappa, Sigma Xi, and is an honorary member of the Chemical Society of Edinburgh.

Nominating Committee Report . . .

The following is the slate of officers for 1948 approved by the Nominating Committee:

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PROGRAM OF PUGET SOUND SECTION

ANNUAL RESEARCH CONFERENCE

November 25th, 1947

The annual research conference will be held in two sections, a Theoretical Section with papers being given both in the morning and the afternoon, and an Applied Section with papers being presented during the afternoon session only. The following is the program for the conference, including abstracts of the papers scheduled:

THEORETICAL SECTION

10:00 A.M.: *"The Solid Phases of Hexamethylethane" by William F. Seyer, R. B. Bennett and Campbell Williams of The University of British Columbia, Vancouver, B. C.*

Abstract: The density of Hexamethylethane, obtained from the Ethyl Corporation, was measured from 20° to 107°. The same type of dilatometer tube was used as for the normal paraffin hydrocarbons. Because of the high sublimation pressure a special apparatus was required for filling the dilatometer bulb. Above 20° and below the melting point 100.63°, two transition points were observed upon cooling but not upon heating the material. The first transition point occurred at 99.65° or about 1° below the f.p. The density then decreases from 0.767 to 0.733. At 74.25° the second transition occurs to a more stable phase.

10:25 A.M.: *"A Diffusion Analysis of Refined Lignin Sulfonic Acid" by E. D. Olleman, D. E. Pennington and D. M. Ritter.*

Abstract: Two lignin sulfonic acid fractions have been obtained by the acetone precipitation of barium lignin sulfonate. These have been further refined by solvent extraction with quinoline. The success of the fractionation and refinement has been demonstrated by diffusion analysis. The average integral diffusion coefficients obtained over several successive intervals from analyses for total solids, methoxyl content and ultraviolet light absorption indicate rather uniform chemical composition of a high molecular weight fraction. Diffusion coefficients calculated on the basis of sulfur transport show the presence of some fast-diffusing sulfur-containing material. A low molecular weight fraction which accounts for a somewhat smaller proportion of the ligneous material displays diffusion coefficients suggesting slightly less uniform chemical composition but more uniformity in molecular size. The calculation of average molecular weights by the Stokes-Sutherland-Einstein equation gives an average value of 1500 for the low molecular weight fraction and of 21,000 for the high molecular weight fraction.

10:50 A.M.: *"An Ion Migration Study of Lignin Sulfonic Acid" by Quentin P. Peniston, Hilda S. Daniels and Joseph L. McCarthy.*

Abstract: It has previously been shown that 20 to 30 percent of the lignin sulfonic acids of sulfite waste liquor pass readily through cellophane membranes in dialysis and are thus presumably of relatively low molecular weight. Attempts have now been made to separate these dialyzable lignin sulfonic acids by an ionophoretic procedure in an agar gel. Ultraviolet absorption analysis of gel sections after migration shows partial separation of the lignin sulfonic acids into fractions of widely different electrical mobility. Ratios of mobilities for these fractions are in substantial agreement with those calculated for

members of a polymeric series in which the effective molecular radius increases with the cube root of the molecular weight and the charge increases linearly with degree of polymerization. It is indicated that eight members of the series are present from a monomeric lignin sulfonic acid of about 500 molecular weight (i.e. two guaiacyl propane units with one sulfonic acid group) to the corresponding octameric molecule. An estimate is made of the relative properties of these substances in the sulfite waste liquor dialyzate investigated.

11:15 A.M.: *"Studies of Sulfonates X-Sodium 1,2,4-Tri-iso-propylbenzene-5-sulfonate as a Colloidal Electrolyte" by Gordon R. Shuck and E. C. Lingafelter.*

Abstract: 1,2,4-Tri-iso-propylbenzene-5-sulfonic acid and its sodium salt have been prepared and their behavior as colloidal electroyltes has been studied by means of solubility, electrical conductance and the use of pinacyanol chloride.

The critical concentrations observed, 0.055M and 0.063M, when compared with the value for sodium n-octylbenzene-p-sulfonate (0.013M), illustrate the extreme importance of molecular shape as well as size in determining the tendency toward aggregation. Thus the tri-iso-propylbenzene sulfonate, although it contains one more carbon atom, does not aggregate until a considerably higher concentration is reached.

The sodium 1,2,4-tri-iso-propylbenzene-5-sulfonate shows no discontinuity in its conductance at the critical concentration. This indicates a smaller fraction of attached gegenions than is ordinarily the case and illustrates the danger of drawing conclusions on the basis of one property only, since the conductance data alone give no indication of colloidal electrolyte behavior.

11:40 A.M.: *"A Fractional Precipitation Study on Non-Dialyzable Barium Lignin Sulfonates" by Aaron E. Markham, Quentin P. Peniston and Joseph L. McCarthy.*

Abstract: The non-dialyzable portion of sulfite waste liquor, consisting of lignin sulfonic acids of higher molecular weight, has been fractionized by the addition of successive increments of ehtanol to the aqueous solution of the barium salt. The fractions thus obtained differ to only a small extent in the sulfur and methoxyl content. The apparent diffusivity of the different fractions increases in the order of their precipitation. This increase, indicative of a corresponding decrease in molecular weight, shows that the molecular weight is the primary basis of the fractionation, although degree of sulfonation may also exert an effect. An estimate of the distribution of the apparent molecular weight is made.

2:00 P.M.: *"Reaction Products of the Fluorination of some Pentanes with CoF_3" by E. J. Barber, L. L. Burger and G. H. Cady.*

Abstract: The fluorination of n-pentane, isopentane, neopentane and cyclopentane was carried out with CoF_3 using the conditions suggested by Fowler. The resulting products were fractionized with an 82 plate column. In addition to some products of cracking and the completely saturated perfluoropenanes, hydrogen derivatives of each were obtained. No compound having the properties predicted for perfluoroneopentane was isolated; instead the neopentane yielded perfluoroisopentane and numerous other products.

This is in harmony with the proposal that during fluorination with CoF_3, HF elimination occurs. When there is no possibility of elimination from adjacent carbon atoms, then it is possible that ring formation occurs followed by cleavage of the ring to give the isopentane structure and considerable amounts of smaller fragments.

2:30 P.M.: *"The Relation of Molecular Structure to Physical Properties of Some Fluorocarbons" by L. L. Burger, E. J. Barber and G. H. Cady.*

Abstract: Information based on early studies of fluorocarbons indicated that as a result of low intermolecular forces, many of the physical properties depended largely on molecular weight alone. However, structure should be of some importance, particularly with smaller molecules.

To investigate this problem, the boiling points, freezing points, densities, viscosities and heats of vaporization of the perfluoropentanes are being studied. Data show that the structure factor is not insignificant, although less important than for the corresponding hydrocarbons. In contrast to the hydrocarbons, the normal form exhibits a lower density and boiling point.

Warming and cooling curves indicate that both perfluorocyclopentane and perfluoroisopentane rotate in the solid state.

3:00 P.M.: "*A Light Absorption Method for the Determination of Diffusion Coefficients in Gels*" by *Aaron E. Markham, Quentin P. Peniston and Joseph L. McCarthy.*

Abstract: A simple and rapid method is described for the determination of diffusion coefficients of visible and ultraviolet light absorbing substances in agar gels. The method utilizes a cell 2x11x50 mm. constructed from quartz microscope slides. An initially sharp boundary is established by means of a stainless steel gate. Diffusion is allowed to proceed in a constant temperature cabinet and at the end of the desired period (4 to 20 hours) concentrations of the diffusing substance throughout the cell are measured by scanning with a Beckmann quartz prism spectrophotometer. Calculation of an average diffusion coefficient is made by a moment method. The effects of time, agar concentration, and supporting electrolyte concentration on values obtained and the reproducibility of results possible by the method are discussed. Application of the method to studies on the molecular size of lignin sulfonic acids is indicated.

3:30 P.M.: "*Synthesis and Structure of Tetrahydropyrethrolone*" *by Hyp J. Dauben, Jr. and Ernest Wenkert.*

Abstract: Tetrahydropyrethrolone, the partially hydrolyzed moiety of the active insecticidal constituent of Pyrethrum, has been synthesized by the sequence: methyl *B*-ketopelargonate with aqueous sodium hydroxide to tetrahydropyrethrone (2-n-amyl-3-methylcyclopentene-2-one-1), bromination with N-bromosuccimide to 4-bromopyrethrone, replacement of the bromine by silver acetate followed by hydrolysis of the acetate to tetrahydropyrethrolone (2-n-amyl-3-methylcyclopentene-2-ol-4-one-1). The synthetic product and its derivatives were identical in all respects with the material prepared from natural sources. N-bromosuccinimide is known to give both allylic and *a*-methylenic bromination but allylic substitution must have occurred since tetrahydropyrethrolone prepared from it showed no reaction with periodic acid. Consequently, pyrethrolone contains a hydroxyl group in the 4-position and not in the 5-position as previously suggested.

4:00 P.M. "*Some Evidence on the Constitution of Gymnosperm Lignin*" *by D. Ritter, D. E. Pennington, E. D. Olleman, K. A. Wright and T. F. Evans.*

Abstract: Freudenberg's deduction of a benzpyrane ring constitution for gymnosperm lignin has recently been extended by Russell's proposal of a polyflavanone structure as its specific form. However, the alleged synthesis offered as evidence is open to doubt. More reliable evidence than Russell's has been accumulating to indicate that lignin sulfonic acid is an 8-methoxy-polyflavanone-3-sulfonic acid. An analogous structure is proposed for thioglycollic acid lignin. These conclusions are based upon the use of periodic acid to determine the degree of substitution in the non-benzenoid portion of the lignin sulfonic acid and its methyl and acetyl derivatives. These structures afford a basis for speculation regarding the constitution of lignin in wood.

APPLIED SECTION

2:00 P.M.: "*The Adsorption of Hydrocarbon Gases on Activated Charcoal*" *by R. W. Moulton and N. P. Anderson.*

Abstract: Recent developments have indicated the possibility of making a commercial fractionation of hydrocarbons by selective adsorption on activated charcoal. This work was essentially a study of the equilibrium between hydrogen, ethylene, ethane, and propane and activated charcoal at 80.6° F. and 138° F. and at pressures ranging from one to seven atmospheres.

Equilibrium values are reported, the

equipment for these measurements is described and a new correlatoin method for extending adsorption data is presented. The new correlation method has an accuracy of about two or three percent.

2:30 P.M.: *"The Preparation of Vitamin Oils from Salmon Cannery Offal by the Alkali Digestion Process" by Charles Butler, Seattle Fishery Technological Laboratory, U.S. Department of Interior, Fish and Wildlife Service.*

Abstract: The alkali digestion process was found to be adaptable for the preparation of vitamin A bearing oils from total salmon cannery waste.

Several variations were made in the type of raw material selected from the total cannery waste to observe the effect of the presence or absence of specific parts of the waste on the digestion process, and on the vitamin A content of the oil produced therefrom. From the standpoint of vitamin A recovery in an oil with the highest possible potency the best portion of the cannery waste to utilize is the viscera. Some increase in the facilitation of the digestion may be made by the removal of the gonads from the viscera.

The oil yield and the vitamin A content of the oils in U.S.P. units per gram of oil varies with the species of salmon and with the particular parts of the waste used for the digestions. Tables will be presented showing these data.

3:00 P.M.: *"A Proposed Method for the Analysis of Fatty Material" by D. Berhagen, R. Parent, J. Shackleford, M. Narod—Lyle Branchflower, Inc., Seattle, Washington.*

Abstract: Several methods were tried for the extraction and estimation of oil and vitamin A content in "low-fat" type fish livers. Most of those tried were found to give somewhat non-reproducible results due, probably, to losses in transferring and poor extraction. In the proposed method the sample of tissue is dried in a frozen state and then extracted with one portion of solvent. The extract is then made up to volume in the same flask. Thus the necessity for the use of sodium sulfate to dry the sample and for transferring the extract is eliminated. This method is applicable to other types of fatty material.

3:30 P.M.: *"The Design of a Pilot Plant Scale Packed Tower for Absorption of Sulfur Dioxide in Water" by L. A. Lundberg, D. A. Pearson, F. B. West and Joseph L. McCarthy.*

Abstract: The design of packed towers for continuous absorption of sulfur dioxide in water is being studied. A literature search has been carried out. Previously reported mass transfer coefficients for this system have been compiled, and then recalculated to permit correlation on a uniform basis. It is found that these have been determined using towers relatively small and flow rates relatively low as compared to commercial practice. The present investigation has been initiated by completing the design and construction in these laboratories of a stainless steel absorption column one foot in diameter, 24 feet high, packed with 1″ diameter rings and suited for operation at high flow rates.

4:00 P.M.: *"Problems in the Commercial Use of Formaldehyde" by K. W. Gerstmann, W. R. Moffitt and R. L. Brewster.*

Abstract: Problems encountered in the commercial handling of formaldehyde which will be dealt with in the current paper include rapid analysis by specific gravity methods for methanol, and the prevention of polymer formation in storage. A graph is presented on the basis of our analytical determinations and information previously presented in the literature, which permits ready estimation of methanol content from the knowledge of the formaldehyde content and specific gravity of commercial formaldehyde solutions. The possible effect of small amounts of methylal sometimes encountered in commercial formaldehyde solutions on the determination is shown.

Data are presented on the effect of storage temperature on the rate of polymer formation in four standard commercial grades of formaldehyde. The effect of polymer separation on the composition of the liquid phase is also treated.

Informal Scene at the Pacific Chemical Exposition. "Professor Oronite" was a Favorite Attraction.

PACIFIC CHEMICAL EXPOSITION

The Pacific Chemical Exposition, held in San Francisco's Civic Auditorium, October 21-25, was attended by a total of 14,726 visitors. The 84 papers given during the week were uniformly high in quality. Authors from this region included Clark C. Heritage, Weyerhaeuser Timber Co., who gave a paper on "The Western Wood Industry as a Consumer of Chemicals"; R. G. Mispley, Crown Zellerbach Corporation, who talked on "The Western Pulp and Paper Industry as a Consumer of Chemicals"; Lloyd H. Brown, Arthur J. Norton Laboratory, who presented a paper co-authored by F. G. Lum of Oronite Chemical Co. on "The Utilization of Dihydrophthalic Acid in Alkyd Resins"; and A. J. Norton, who gave a paper co-authored by Donald V. Redfern of of American-Marietta Company on "The Western Plastics Industry as a Consumer of Chemicals," reprinted elsewhere in this issue of the Puget Sound Chemist.

Others attending from the Northwest were L. D. Berger, Jr., Carbide and Carbon Chemicals Corporation; Albert Hooker, Hooker Electrochemical Company; David Eichelberger and Bob Williams, American-Marietta Company; Donald Walters of Inland Empire Industrial Research, Spokane, Washington; T. S. Hodgins and Wilson Compton, Jr., Reichhold Chemicals, Inc.; Carl F. Miller and R. W. Benson of Carl F. Miller & Co. Inc.; L. F. Cooper, Scientific Supplies Company; R. W. Benson of Standard Chemical Engineering Co.; Marshall Ramstad of the Tacoma Chamber of Commerce and H. B. DeWaide of Bakelite Corporation.

Registrants were present from 35 states and territories of the United States and from 20 foreign countries.

It has been announced that the next Pacific Chemicals Exposition will be held at the San Francisco Civic Auditorium November 1-5, 1949, and will be related to the celebration of the 100th anniversary of the famous Gold Rush.

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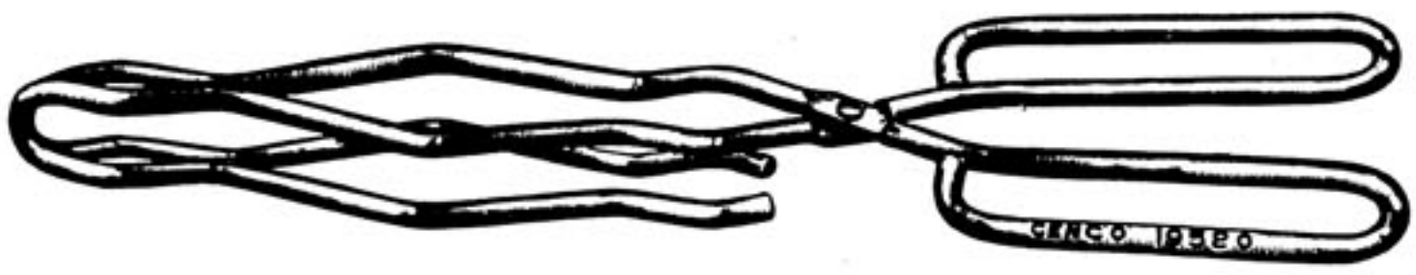

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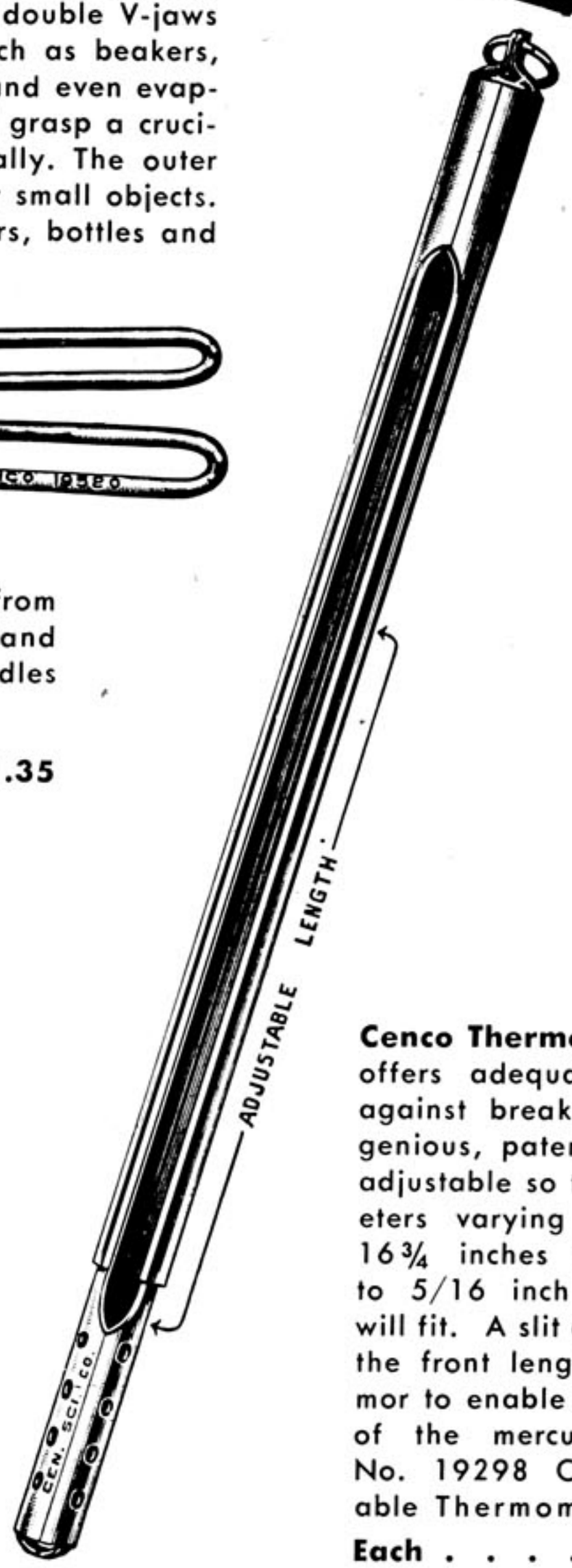

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SETTING THE PACE IN CHEMICAL PURITY SINCE 1882

THE WESTERN PLASTICS INDUSTRY AS A CONSUMER OF CHEMICALS

by ARTHUR J. NORTON and DONALD V. REDFERN

Presented before the Western Chemical Market Research Group, October 21, 1947.

In 1947 the West Coast plastics industry used directly in their own processing plants 39,814,000 pounds of chemicals for plastic materials production. (See Table I, Page 15.)

Before analyzing these figures in relation to the total consumption of plastic products on the West Coast and also in relation to those chemicals and materials produced in the West for processing into plastic materials in other sections of the country, it would probably be best to define and explain the term "plastics industry."

The term has changed in meaning almost as rapidly as the industry has grown. According to the dictionary, plastics are products that can be formed into shapes by the application of pressure or heat and pressure. According to this definition, most glasses, metals and clays are true plastics. With the advent of the synthetic resins, popular usage limited the meaning of the term plastics to those products that owe their formability to the presence of high molecular weight organic materials or synthetic resins. This was fairly simple until the high polymeric materials began to branch out from the molding field and find uses in many industries as coatings, binders, adhesives, etc. These so-called specialty uses of plastics accounted for just about half of the 1946 production of 728,000,000 pounds. So today the term plastics industry really covers the chemistry, production and uses of high polymers. For the purposes of this paper, and conforming to the general practice of today, the scope will cover all the uses of high polymers except those that are drawn into fibers and the elastomers or rubber-like polymers. Resins for the plywood adhesive industry and for the coating resins are included here in the grand totals for the West Coast plastics industry unless otherwise indicated.

Now market research can be divided into two parts—the statistical analysis of past and present markets and trend analysis of future markets based on the first figures and correlated data of the many other variables that affect trends, such as new industries, new developments, competitive industries and new types of markets. Market research for the last six years has emphasized one point in particular—i.e. the close integration and inter-dependence of one industry on another and the effects of government control particularly in regard to world trade. In attempting to analyze the plastics industry these effects are especially noticeable. For example, a bureau's directive to produce and ship as much nitrogenous fertilizer as possible abroad, boosted the ammonia production rate to full capacity. This in turn curtailed some of the possible methanol production, which in turn limited the amount of formaldehyde. This affected the production of synthetic resins for plywood adhesives, limited the amount of exterior plywood production and finally had its effect in the housing programs. So that any analysis of business, particularly trend analysis must always consider the growing effects of centralized bureaus where a directive regarding some seemingly remote industry may come back to roost in your own sphere.

The total plastics production for the United States in 1946 was 728,109,492 pounds, except for the alkyds and other coating resins. The coating resin field, added to this quantity, would run the grand total over 800,000,000 pounds.

(Continued on page 16)

TABLE I

Product	Grade	Made in West	Used in West
Phenol	40°	None	8,064,000 lbs.
Urea	Technical	None	500,000 lbs.
Formaldehyde	37%	10% of amt. used (1)	13,900,000 lbs.
Cresylic Acids	Various	Petroleum grades	1,120,000 lbs.
Caustic Soda (3)	50%	100%	3,780,000 lbs.
Phthalic Anhydride	C.P.	Almost all	6,800,000 lbs.
Glycerine	C.P.	None	1,900,000 lbs.
Maleic Anhydride	C.P.	None	1,000,000 lbs.
Pentaerythritol	C.P.	None	1,500,000 lbs.
Solvents (2)	Various	None	500,000 lbs.
Miscellaneous	.....	.....	750,000 lbs.
TOTAL			**39,814,000 lbs.**

(1) Capacity on West Coast for 8,400,000 lbs.
(2) Includes only direct usage—not lacquer or coating solvents.
(3) Figures do not include chemicals for protein adhesives.

TABLE II
End Use of Plastics on West Coast

	End Use	Production
Cellulose Esters and Ethers	18,600,000	0
Phenolic Resins—Molding Compounds	18,600,000	250,000 lbs.
Other Uses	16,000,000	12,000,000 lbs.
Ureas and Melamines—Molding Powder	5,400,000	None
Other Uses	12,000,000	1,000,000
Polystyrene	7,500,000	None
Other Vinyls	9,000,000	None
Alkyds	20,000,000	10,000,000
TOTALS	**106,500,000**	**23,250,000**

TABLE III
Chemicals for Plastic Materials in 1953 — A West Coast Guesstimate

	Present	1953
Phenol	8,064,000	24,000,000
Formaldehyde	13,900,000	38,000,000
Other Aldehydes	.....	4,000,000
Urea	500,000	1,000,000
Cresylic Acids	1,120,000	6,000,000
Acetylene	.....	15,000,000
Cellulose	.....	10,000,000
Phthalic Anhydride	6,800,000	12,000,000
Maleic Anhydride	1,000,000	4,000,000
Solvents	500,000	5,000,000
Pentaerythritol	1,500,000	3,000,000
Caustic Soda 50%	3,780,000	11,340,000
Glycerine	1,900,000	3,000,000
Furanes	.....	5,000,000
Misc.	750,000	1,500,000
TOTALS	**39,814,000**	**142,840,000**

PLASTICS INDUSTRY . . .

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The exact totals for the coating resin field are hard to get for the products are often made and used in the same plant, and are often modified so that the amount of chemicals used is hard to guess.

The phthalic esters included in this total are also used as plasticizers, demonstrating that chemical consumption of the plastics industry must also consider the use of modifying agents, solvents, thickeners and plasticizers.

Almost all plastic materials reach the ultimate consumer, but few reach him directly. They are part of assembled articles such as automobiles, radios, electrical equipment, raincoats, safety glass, plywood, etc. It is true that some are consumed in producing industries, such as grinding wheel bonds, core binders, oil well sealers, etc., but for a quick glance, if we assume that the bulk reach an ultimate consumer, then 14% of the total United States production, which for 1946 was about 728 million pounds, or 102 million pounds of plastics material were consumed in the West Coast trading area in 1946. If it takes about 1¼ pounds of chemicals, not counting the solvents that may be used in processing, to make a pound of plastics, then in 1946 there was a grand potential of 127 million pounds of chemicals used directly in plastic materials that went into the West Coast trading area as consumer goods.

This, of course, is a very crude figure and can be affected by many local variables. Before attempting a break-down into local statistics it might be well to review the nature and integration of the plastics industry as a whole.

Plastics material manufacture is quite a distinct phase of industry, and is fundamentally a branch of the chemical industry. There are very few plastic material manufacturers that are not producers of at least some of their chemical raw materials and many are branches of large chemical manufacturing companies. Some laminators, it is true, make their own plastic materials, process them into laminates and even fabricate the laminates into finished parts. Some of the rubber companies are building up complete units from chemicals and molded articles but as a rule the plastics material manufacturer integrates back to the raw material producer and sells his product to the processor of plastics.

The processor, who may be a molder, a brake lining company or a plywood manufacturer makes a product which, in turn, has to be marketed to still another manufacturer. This last man fabricates or assembles finished articles for the consumer. There are quite a few departmental molders and processors of plastic materials—people like the automotive companies who mold parts for their own end products. In other words, the processor integrates to the consumer, rather than back to the materials manufacturer.

On the West Coast we have six large plastic material manufacturers, all making resins for the wood working industry. In addition, we have five or six smaller companies making specialty products, molding compounds, casting resins, etc. We have 47 molders, 11 laminators, and 47 fabricators, and a large paint and varnish industry who not only buy resins but make many of their own.

Breaking down our production of plastic materials by classes, we have only the thermosetting phenolic types—ureas and alkyd resins for coating work—made on the coast.

There is no production of cellulose derivatives, vinyl plastics or other thermoplastics.

Our molding industry processes about 6 million pounds of phenolic molding powder; 2,500,000 pounds of ureas and 7½ million pounds of thermoplastics a year—much less than our 14% of the national total. This is because we do not yet have the assembly type of industry that consumes the large volume of molded parts, and our molding industry is young without well developed merchandising practice. Our molders have a cacacity of about twice their present production. We have one large high pressure laminating plant, but at present most

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THE EDITOR'S RETORT . . .

The present shortage of fats and oils has brought to the Editor's mind that perhaps a solvent recovery system for our Northwest household waste (commonly known as garbage) might assist in relieving some of the shortage. It might be said that the lowly word "garbage" is listed under "G" in our "Chemical Abstracts."

It occurred to us that possibly a good research project on this lowly substance might be worth while. First, garbage greases bring 10c per pound on the present industrial market. Second, considerable feeding experiments have been conducted on the residues. Third, fermentation experiments could yield a multitude of various products and leave room for research programs.

Seattle, for one, is at present burning its waste in fills within the city limits and has presented "garbagetosis" to residential sections. Such a situation with a city of 600,000 population eventually will have to be corrected, and it would appear that now is a good time due to the fat and oil shortage, as well as food shortage.

Let's look at this thing called garbage grease. What would it contain? Guessing, it would contain glycerol esters of fatty acids and fatty acids from vegetable and animal origin, as well as decomposition products. (Your wife or mine is not infallible—I know mine.) By the general processes of fractionation, the usual products of fatty acid distillation could be obtained, along with some unsaturated acids and, of course, acrolein. These acids from frationation would be usable for industrial consumption in the same manner that oils from more sanitary sources would be used. Regarding sanitation, solvent extraction would undoubtedly kill off all bacteria, both pathogenic and non-pathogenic.

The use of dried garbage as dairy supplement has been studied and no

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THE EDITOR'S RETORT

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change in milk taste was noted, nor any reduction in milk. (C. A., vol. 40, pg. 4817[8].) An analysis of the air dried garbage gave about 11.46% moisture, 26% protein, 4.72% fat, 1.96% fibre, 11.2% ash and 43.78% N—free extract. Various experiments have been conducted throughout the world on feeding, and may be found in the Chemical Abstracts under Wastes, Garbage, Refuse, etc.

We are questioning ourselves on the justification of an article on garbage in the Puget Sound Chemist, but the more we think about it the more reasonable it becomes. From a patriotic standpoint, the subject is valid. From the standpoint of increasing the chemical industry in the Northwest and promoting more chemical engineering and chemical research, as well as solving some municipal problems, the idea becomes more sound. The editor would like to have some comment—clean, nice, non-smelly research does not appear to promote letters to the editor—maybe this one will.

U. of W. A.I.Ch.E. CHAPTER

The University of Washington student chapter of the A.I.Ch.E. enjoyed a talk by S. D. Kirkpatrick on October 29 as a feature second meeting of the school year. The editor of "Chemical Engineering" spoke informally on the many opportunities in such branches of chemical engineering as Atomic, Biochemical, Chemurgical, Inorganic and Petro-chemical engineering, using a wide back-

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DECEMBER MEETING

December 16, 1947

Speaker — DR. W. W. MOYER

Director of Research, Crown Zellerbach Corporation

"Recent Advances in Starch Chemistry"

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PLASTICS INDUSTRY . . .

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resins for this work are shipped in. Low pressure laminators are increasing rapidly and are reaching a rate of 1½ million pounds per year.

The laminates and composite laminates of wood and paper bid fair to grow rapidly. Various estimates indicate that impregnated paper for the plywood overlay market alone should reach 30 million pounds of phenolic resin per year on the West Coast within five years. These figures sound fantastic until one realizes that in 1935 there was no resin production of any kind on the West Coast and molders used only 300,000 pounds per year.

At present our plywood industry obtains about 20% of the phenolic resins and 50% or more of the ureas from eastern sources.

Our consumption of vinyl resins per se is negligible and even in the finished articles we fall below our 14% consumer goods average. In vinyls we use only 5-8% of the United States production—probably due to our climate where raincoats are not as big a factor.

In other words, except for vinyls, we consume in end use products at least our 14% average and in special fields use much higher. We produce only about 3 or 4% or one-fourth of our consumption. Table 11 (Page 15) shows these figures and emphasizes the fact that we now make plastics for two fields only—plywood and coating.

The trends that are not yet apparent in figures indicate large increases in phenolics for paper impregnation, a rapid increase in polyester usage for low pressure laminating with probable manufacture on the coast; a large increase in paper and textile treating resins which will be made on the coast; a large volume for hardboard bonding and most probably the production of cellulose esters and vinyls. It is a fair estimate that in five years we will be producing all our end use requirements in plastics materials and two or three times that vol-

ume in phenolics which will be processed into products for eastern consumption. Table III (Page 15) gives an idea of our opinion of 1953's consumption of chemicals by the West Coast plastics industry.

Today we ship east many products for plastics work—over 60% of the dissolving pulp used for cellulose esters. We also make petroleum cresylics, phthalic anhydride, ortho xylene, solvents of all types, and are anticipating a large phenol plant. In addition, we are being looked to as a source of benzol to supplement the coal tar supply. We produce 20,000,000 pounds of wood bark fillers for plastics—and are increasing our rate of production rapidly.

So the West Coast plastics industry resolves into two phases from the standpoint of the chemical industry.

1. As a direct consumer of chemicals—and at present we are very small except in two fields, plywood and coating.

We have the raw materials for the other types and we have now substantial end use markets. It seems reasonable to predict that in 1953 we will be consuming chemicals in the West Coast plastics industry at a rate at least equal to our population requirements.

2. Chemicals from wood, petroleum and our other material sources such as proteins coupled with our cheap power will make us a large factor in the supplying of base chemicals for processing into plastics in other areas.

U. of W. A.I.Ch.E. CHAPTER

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ground of travel and experience as a basis for his shrewd observations.

The chapter is making preliminary arrangements for another speaker in a few weeks, but as yet no date has been announced.

Newly elected officers for the coming year are:

Art Every, *President*
Billings Brown, *Vice-President*
F. Norman Grimsby, *Treasurer*
Edwin Boelter, *Secretary*.