For the sugar solutions having concentrations less than 25 per cent. the results do not differ from the results for distilled water more than is explainable by the accidental variation normal to the method when the temperature is not controlled precisely. The effects of one hundredth normal acid and alkali found by MacDougal were many times the variations here observed and one may conclude that neither sucrose nor dextrose, in concentrations under 25 per cent., has any important effect on the swelling of gelatine-agar gels in water; important, that is, in comparison with the effects of acids or alkalis. With sugar concentrations of 50 per cent. the data show a markedly lessened swelling of all the gels in sucrose and of the two low-gelatine gels in dextrose. It may be that the two high-gelatine gels also swell less in 50 per cent. dextrose but the decrease is not certainly determinable from the single test which was made. This decrease in swelling in concentrated sugar solutions is to be expected from analogy with the osmotic behavior of such solutions and does not indicate any specific effect of either sugar on the swelling or imbibition capacity of the gels themselves.

E. E. FREE

DESERT BOTANICAL LABORATORY

THE AMERICAN CHEMICAL SOCIETY

III

DIVISION OF INDUSTRIAL CHEMISTS AND CHEMICAL ENGINEERS

H. E. Howe, *Chairman*

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A new method of separating zinc from cadmium and the latter's determination iodometrically: ERIC JOHN ERICSON. The separation consists in crystallizing the zinc out as zinc sulphate or zinc ammonium sulphate. It may be applied to the determination of cadmium in ore or in spelter (after removing and determining lead). In the latter case, although a small trace of cadmium is entrained in the crystals, only one crystallization is deemed necessary in view of the large sample taken. After removal of zinc, the cadmium may be determined by any of the usual methods. An iodometric method is outlined.

The determination of cadmium in brass: E. SCHRAMM. Owing to the lack of any well-tried method for the determination of cadmium in brass, a series of analyses was carried out on brasses and on mixtures of salts with and without additions of cadmium. A procedure was developed which gives fairly reliable results for the small amounts of cadmium concerned. The method consists essentially in removal of the copper electrolytically from nitric acid solution, followed by separation of the cadmium from zinc with hydrogen sulphide, in solutions of regulated acidity and small volume. The cadmium is finally weighed as sulphate.

The electrometric titration of zinc: F. RUSSELL V. BICHOWSKY. In the potassium ferrocyanide method for determining zinc there are three principal sources of error: (1) Oxidation of the ferrocyanide by any nitric acid, chlorine, or bromine present; (2) precipitation of other metals along with zinc; (3) uncertainty of the end point. To remove the first source of error precautions such as the addition of SO_2 should be taken. To avoid the precipitation of other metals the rational procedure is to change the conditions of the ferrocyanide precipitation by carrying it out in solutions containing from 10 to 20 per cent. HCl. In these solutions zinc ferrocyanide is only slightly soluble, but lead, manganese, iron and copper ferrocyanides are very soluble. Since the ordinary indicators can not be used at this concentration of acid, an electrometric determination of the end point is adopted, which is found to be quicker and more accurate than the older methods. This consists in noting the point at which there is a sharp change in potential of the solutions against a platinum electrode. The apparatus is the same as that used in determining the end-point of oxidation and reduction reactions in the analysis of iron, vanadium, chromium, etc. Experiments on a number of salt mixtures show that the end point is not affected by the amount of acid or neutral salts present within reasonable limits, nor by the presence of iron, lead, manganese (up to 50 mg.), or by small amounts of copper and cadmium. The preliminary operations for the purification of the ore therefore lose their customary importance; comparative results show that the electrometric method is more rapid than the usual procedure.

The vapor pressure of zinc and related metals: JOHN JOHNSTON. A review of the somewhat scattered observations on the vapor pressure of high-boiling metals, and a reduction of the data yielding equations by means of which the vapor pressure at any temperature can be ascertained. Published observations on the volatility of metals, alone and from mixtures, are also summarized.

The new zinc fields of Kansas and Oklahoma: W. P. Haynes. A visit to the new zinc fields south of Baxter Springs, Kansas, and to Picher and Admiralty, Oklahoma, shows the great strides in production which this district is making. Small drilling rigs dotting the prairie mark the advance guard, prospecting to determine the value and extent of the ore bodies. Concentrating mills follow closely and give the appearance of a large city. The ore minerals in this new district are chiefly sphalerite with some galena and variable amounts of pyrite and marcosite. This ore is much richer than in the older Galena-Joplin district and frequently contains over 20 per cent. of sphalerite. The origin of the ores of this district is still somewhat in doubt, but the most recent researches by Siebenthal have led him to conclude that they have been produced from the disseminated sulphide minerals scattered through the Cambro-Ordovician limestones, by artesian waters transporting them in solution and ascending and depositing them in the open spaces of the cherty members (Grand Falls chert) of the Boone formation (Burlington or Mississipian limestone), which is the productive horizon in this region.

Recent investigations on the smelter smoke problem: A. E. Wells. At most smelters where large quantities of sulphide ores are being handled, serious efforts are being made to utilize through the manufacture of sulphuric acid, liquid dioxide or elemental sulphur, the sulphur dioxide which results from the roasting and smelting of these ores. However, at plants situated at a considerable distance from markets for these products, only a comparatively small amount of the sulphur can be so utilized. It is recognized that although the amount of the smelter waste sulphur gases that will be utilized in commercial products will be increased steadily, yet, for many years to come, these smelters will be obliged to waste large volumes of sulphur dioxide daily into the atmosphere. Therefore, efforts are being made to determine how, under different climatic and topographic conditions, these large volumes of sulphur dioxide can be discharged into the atmosphere without doing injury to vegetation in the surrounding country. In this paper the development of the methods for conducting these investigations were discussed briefly.

Notes upon the hydro-metallurgical and electrolytic treatment of zinc ore: E. E. Watts. After briefly discussing the treatment of zinc ore, the paper related the writer's experimental work upon the ore of the Sullivan Mine of Kimberly, B. C. This work served to develop a process that involved a sulphurous acid leaching of the ore, and further experimental work developed the Watts Process. By this process, zinc oxide obtained by any suitable means is treated in specially constructed electrolytic tanks for the recovery of zinc. The work done in the experimental plant of the Electro Zinc Company at Welland, Ont., was discussed.

Chemical examination of industrial brines: O. R. Sweeney and James R. Withrow. The value of chemical examination, from the manufacturer's standpoint, was discussed. The errors resulting from improper sampling were shown, and a suggestion for a standard method given. The constituents which it was thought should be determined were given; together with the form in which they should be reported. A standard procedure for determining the density was given and the best temperature to use was discussed. Suggestions for determining total solids from the author's experiences were given. Procedures for silica, iron and aluminum were given and shorter methods for calcium and magnesium in mineral waters. Barium, strontium, sodium, potassium and sulfuric acid procedures were given, also modifications of the methods for bromine determination.

Contribution to the industrial chemistry of chicle and chewing gum: Frederic Dannerth. The author presents methods for the valuation of commercial block chicle by determining moisture, viscosity, resins, proteins and carbohydrates and mineral matter. Twenty problems relating to the chewing gum industry are presented. The total exports of finished chewing gum, amounted in 1916 to $574,400, equivalent to approximately 718,000 pounds. This represents crude chicle equal to at least 179,000 pounds. The amount of chicle imported, manufactured and consumed in the United States in 1916 was approximately 7,031,000 pounds equivalent to 28,124,000 pounds of chewing gum. Researches are at present being carried out on the constituent elements of chicle—alpha chicl-alban; beta chicl-alban; gamma chicl-alban; chicl-fluavil, and chicl-gutta. These substances have been investigated by Tschirsch and later by Bosz and Cohen. The latter investigators have not entirely agreed with the results published by Tschirsch.

Apparatus for determining the specific gravity of natural gas: Chas. K. Francis. The apparatus is to be used according to the method proposed by

Bunsen, which is based on the fact that the specific gravity of two gases bear approximately the same ratios to each other as do the squares of their rate of flow when passing through a very small opening. The apparatus consists of a pipette or burette to which is sealed at right angles, just below the tip, a glass stopcock. To the tip of the burette another stopcock is sealed which is provided with a very small, practically invisible opening. The gas to be examined is admitted through the larger side opening and the time of escape is measured through the small opening. A sample of air is measured in the same manner. The following example will serve as an illustration: The time required for the sample of gas to escape was 13.4 seconds and for the same quantity of air, 11.8 seconds; these squared are equal to 190.4 and 129.9. As the specific gravity of natural gas is referred to air as unity, the specific gravity is obtained by dividing 129.9 by $179.5 = 0.723$ the specific gravity of the gas.

Comparative results from experiments in the distillery with open and closed fermenters: Niels C. Ortved. A closed iron fermenter of the latest type with a capacity of 4,000 liters was brought from Germany in 1914 and a wooden open tub of the same capacity was constructed. Eleven experiments were made, fermenting simultaneously mash from the same batch in both vessels. The results obtained were in favor of the closed fermenter, viz., lower acidity in the finished beer, and increased yield, amounting to one per cent. of spirit. The yields from the open fermenter corresponded to the average yields obtained in the ordinary normal runs of the distillery.

The effects of exposure of some fluid bitumens: Charles S. Reeve and Richard H. Lewis. The work described was a continuation of that begun by Hubbard and Reeve (*Jour. of Indus. and Eng. Chem.*, 1913), and of later results published by Reeve and Anderton in the *Journal of the Franklin Institute,* October, 1916. Experiments were carried out along similar lines to those previously followed, using fluid types of products which had not been previously investigated. Exposure tests conducted for a period of one year show that certain types of petroleum harden materially while others are relatively little changed in their physical character, although all are materially changed in their composition as shown by the change in percentage of bitumen insoluble in naphtha and free and fixed carbon values. The relation between amounts volatilized upon heating for various periods in a laboratory oven at 163° C. and the amounts lost upon atmospheric exposure were shown by tables, and relations between the characters of the residues obtained by the two methods of volatilization were given. As in the previous work referred to, the changes which occur in bitumens upon exposure are notably greater than can be accounted for by mere loss of volatile constituents, and are due to chemical changes in the constitution of the bitumen itself.

The thermal and pressure decomposition of an absorbent oil: Gustav Egloft. An absorbent oil derived from a Pennsylvania crude petroleum, specific gravity 0.828/15.5° C. and 95.3 per cent. boiling between 250° C. and 350° C. was subjected to temperature conditions of 550° C., 600° C. and 650° C. in the gas phase at one and eleven atmospheres pressure. The above conditions of temperature and pressure gave the following percentages of gasoline, benzene, toluene and zylenes on basis of oil used.

Basis of Oil Used	Temperature Pressure in Atmospheres					
	550° C.		600° C.		650° C	
	I	II	I	II	I	II
Per cent. gasoline...	11.6	19.5	16.4	18.8	16.8	14.2
" benzene...	0.0	0.0	0.8	3.4	2.5	5.5
" toluene...	0.6	1.7	1.5	4.4	2.9	4.4
" xylenes...	0.3	1.7	0.6	2.8	1.6	2.2

The formation of benzene and toluene by the action of aluminum chloride on solvent naphtha: Gustav Egloft. Solvent naphtha derived from the thermal decomposition of coal, having a specific gravity of 0.867/15.5° C. and 93 per cent. distilling between 135° and 160° C. with the dry point at 181° C. was treated with anhydrous aluminum chloride. Five per cent. by weight of $AlCl_3$, was added to one liter of solvent naphtha and distilled over in two hours from a Hempel flask until 78 per cent. came over. The distillate was neutralized with caustic, washed and dried over calcium chloride. The distillate upon analysis gave on the basis of solvent naphtha used 1.2 per cent. of benzene and 13.9 per cent. of toluene.

The determination of available oxygen in oxidized manganese ores: O. L. Barnebey. The oxalic acid method is in common use in America for the determination of available oxygen in oxidized manganese ores and hence is the basis for the evaluation of such ores for certain industrial purposes. This method gives inconsistent results causing much difficulty in control work involving the use of pyrolusite and similar products. The method is shown to be highly empirical, the errors being produced by decomposition of the oxalic acid by the action of the light in the presence of manganese salts. A modified ferrous sulfate method is accurate and is recommended for factory control work. The latter method gives results in close agreement with results obtained by Bunsen's distillation method and a new direct iodimetric method worked out by the author.

Some relations of the effect of over-heating to certain physical and chemical properties of asphalts: A. W. Hixson and Harold E. Hands. An oil asphaltic cement, a brick filler fluxed with an asphaltic oil residuum and a crude Trinidad asphalt were heated to various temperatures between 163° C. and 350° C. under uniform conditions. Physical and chemical analyses were made on the products of the various heatings. The results show that heating asphalts above certain temperatures change both the physical and chemical properties. The carbene content was not changed materially until the temperature of heating was above 200° C. Above that temperature there was a decided increase in carbenes. The results seem to indicate that carbenes are the result of cracking paraffine and asphaltic hydrocarbons into napthenes and unsaturated hydrocarbons. Moderate heating may so change the nature of the asphalts as to render them more soluble in carbon tetrachloride than in carbon disulphide. Overheating causes marked changes in natural and oil asphalts which render them unfit for many structural purposes. Two hundred and thirty-five degrees Centigrade is probably the maximum temperature to which an asphalt may be heated without permanent injuries to its useful properties and for certain structural purposes they should not be heated above 200° C. It is believed that the fixed carbon content when corrected to the original weight before heating offers a means of tracing the changes in the molecular structure of the hydrocarbons when they are subjected to the influence of heat. There is a close relation between the carbene value and the physical and chemical properties of asphaltic materials. The carbene specification is important for asphaltic materials for construction purposes.

Chemical Industry in Canada: H. E. Howe. The paper outlined something of the chemical industry in Canada, with special reference to recent important developments and new processes which have been perfected under the stimulating influence of war conditions, but which will become important factors in the chemical business after the war. It also recounted something of the natural resources of Canada as indicating the raw materials upon which chemical processes and industries may eventually be based, concluding with the statement of the steps that are being taken by private corporations, educational institutions and the government to apply scientific and industrial research looking toward the more economic utilization of natural resources and the establishment of chemical industries to serve a population which will undoubtedly increase at an abnormal rate following the declaration of peace.

The availability of nitrogen in fertilizers. A new method based on the nitrogen rendered water-soluble by incubation with a fertile soil: J. P. Schroeder. Theoretical and practical considerations governing the availability of substances for plant nutrition in recent researches dealing with the assimilation of various forms of nitrogen and the merits of various methods for determining availability were discussed. A proposed method consists of incubating a small sample of fertilizer with a 100 gm. portion of fertile soil at 30° C., maintained just below its critical moisture content and determining the total nitrogen that has been converted into the water-soluble form. It differs from the nitrification method and the ammonification method in that it takes into consideration both of those forms of nitrogen; also that in the form of nitrites and soluble protein compounds, all of which are assumed to be available or readily convertible into available form. It makes possible a shorter incubation period than in the nitrification method and the use of the exact ammonia determination instead of the difficult nitrate estimation.

The fertilizer value of city wastes—II., garbage tankage: J. P. Schroeder. The origin and composition and principal methods of rendering garbage were briefly outlined. Complete analyses of twenty samples of garbage tankage, representing all the larger garbage reduction plants in operation in this country, show on the average 3.3 per cent. ammonia, 7.84 per cent. bone phosphate and 0.80 per cent. potash, after removal of the oil, which usually amounts to about 12 per cent. Calculations based on these analyses and on figures showing production in cities of 50,000 and over, call attention to the large source of ammonia available. The availability of this ammonia for plant use is shown by experiments with different methods, and the general applicability of the material for fertilizer purposes based on its physical and chemical properties was discussed.