STANDARD ALKALI FOR MIXED ACID CONTROL

By EVELYN HEARSEY AND C. M. JOYCE

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Standard alkali for the titration of mixed acids usually consists of normal sodium hydroxide standardized through normal sulfuric acid, standardized in turn by sodium carbonate with methyl orange as an indicator. This procedure has several disadvantages, which are discussed in the "Standardization of Alkalimetric Solutions," by Francis D. Dodge,¹ who recommends potassium acid phthalate as a standard. The accuracy of this method has been established by W. S. Hendrixson in his careful experimental study of the subject.²

The advantages of direct standardization with potassium acid phthalate over titration with normal acid which must be standardized by a troublesome process, are so obvious that it seems strange that the new method has not come into more widespread use. The reason may be contained in the fact that phenolphthalein, in spite of its sensitiveness, is not as desirable an indicator as methyl orange when carbonates are present in the standard alkali. By following the procedure described in "Preparation of a Solution for Making Standard Solutions of Sodium Hydroxide,"³ the interference of carbonates with the indicator can be easily eliminated. A standard solution prepared in this manner may be titrated against potassium acid phthalate in the cold using phenolphthalein as an indicator.

A standardization along these lines, performed in

¹ THIS JOURNAL, 7 (1915), 29.

² J. Am. Chem. Soc., 37 (1915), 2352.

³ Cowles, *Ibid.*, 30 (1908), 1192.

this laboratory, differed from the result of a titration against *N*/5 acid standardized with sodium carbonate by less than 0.05 per cent.

STANDARDIZATION OF *N*/5 SODIUM HYDROXIDE WITH ACID POTASSIUM PHTHALATE

Wt. $\text{KHC}_8\text{H}_4\text{O}_4$ Grams	Vol. $\text{NaOH}(a)$ Cc.	<i>N</i> /5 NaOH Equivalent to 1 g. $\text{KHC}_8\text{H}_4\text{O}_4$ Cc.	$\times$ <i>N</i> /5 Grams
1.750	42.81	24.49	$\times 1.750 + 42.81 = 1.001$
1.754	42.95	24.49	$\times 1.754 + 42.95 = 1.000$
1.743	42.66	24.49	$\times 1.753 + 42.66 = 1.001$
1.741	42.61	24.49	$\times 1.741 + 42.61 = 1.001$

AVERAGE, 1.001

STANDARDIZATION OF *N*/5 SULFURIC ACID WITH SODIUM CARBONATE

Wt. Na_2CO_3 Gram	Vol. $\text{H}_2\text{SO}_4(a)$ Cc.	<i>N</i> /5 H_2SO_4 Equivalent to 1 g. Na_2CO_3 Cc.	$\times$ <i>N</i> /5 Gram
0.5000	47.44	94.33	$\times 0.5000 + 47.44 = 0.9942$
0.5005	47.49	94.33	$\times 0.5005 + 47.49 = 0.9942$
0.4995	47.41	94.33	$\times 0.4995 + 47.41 = 0.9939$
0.4995	47.40	94.33	$\times 0.4995 + 47.40 = 0.9941$

AVERAGE, 0.9941

<i>N</i> /5 SULFURIC ACID VS. <i>N</i> /5 SODIUM HYDROXIDE					
<i>N</i> /5 $\text{H}_2\text{SO}_4(a)$ Cc.	$\times$ <i>N</i> /5 Gram	<i>N</i> /5 NaOH Cc.	$\times$ <i>N</i> /5 Gram	$\times$ <i>N</i> /5 Gram	<i>N</i> /5 NaOH
42.33	$\times$ 0.9941	+	42.03	=	1.001
42.45	$\times$ 0.9941	+	42.15	=	1.001
42.34	$\times$ 0.9941	+	42.05	=	1.001
42.33	$\times$ 0.9941	+	42.05	=	1.001

AVERAGE... 1.001

(a) Corrected for calibration, temperature, and run back.

These data were obtained in connection with ordinary control work and without unusual precautions, except that all the burettes used for alkali were freshly calibrated as they change appreciably every few months from solvent action. The potassium acid phthalate used was prepared from Merck's phthalic anhydride by Dodge's method.¹ The sodium carbonate used was Kahlbaum's "for analysis."

LEOMINSTER, MASSACHUSETTS

¹ *Loc. cit.*

ADDRESSES AND CONTRIBUTED ARTICLES

OUR OPPORTUNITY

By BERNHARD C. HESSE¹

Since the early days of the war, exhortations to coöperation as a remedy—in fact the only remedy—for the then suddenly revealed, although long known, lack of self-containedness and of industrial independence in many countries and especially in what have since been grouped as "key" or "pivotal" industries have been numerous, widespread, and persistent. Our own country and our own business and profession have by no means escaped those exhortations. In fact, our profession has been made the special target for unfounded, vehement, and indiscriminate charges of inexcusable backwardness in development and of conspicuous want of courage in operation and expansion; in corresponding measure we have been urged and have ourselves repeatedly promised coöperation as a cure for those alleged conditions.

While the war was on, all our industries bent all their energies towards accomplishing the heavy tasks imposed upon them in the shortest possible time, regardless of any and all refinements as to efficiency and exquisiteness of workmanship. Consideration of measures of development or of coöperation to be followed upon the return of peace had to be put to one side until the immediate and pressing war needs were out of the way. With the signing of the armistice opportunity for such consideration

came measurably closer. The Council of the AMERICAN CHEMICAL SOCIETY then took immediate steps to formulate a coöperative policy for after-the-war conditions.

THE CHEMIST IN THE LIFE OF THE NATION

Before discussing our opportunity it will be serviceable to review what the probable general position of our business and profession is in the national economic life of our country. Those who follow chemical pursuits of whatever kind in this country made up, before the war, 1/10000 of our population; those of us then engaged in industrial activities, as distinguished from educational and like activities, were engaged in industries which employed 1/6 of the industrial wage-earners of the country, produced 1/4 of the value of all manufactures in the country, created 1/5 of the total value created by manufacture in this country, in their trade with one foreign country alone made up 1/20 of our total foreign business and produced 1/7 of our balance of trade. The forthcoming census will, no doubt, show a decided growth of our importance, both relative and actual, in our national economic life.

RECIPROCAL RESPONSIBILITIES

Bulking so large in the economic life of our country as do the industrial activities of this 1/10000 of the country's population it is clear on the one hand that the nation owes it to itself to see to it that the activities of this 1/10000 are interfered with as little as possible and are enhanced to the utmost, and on the

¹ Read before the Lehigh Valley Section, American Chemical Society, at Easton, Pa., March 14, 1919.

other hand that this 1/10000 owes it to the nation and to itself to leave nothing undone that will enable it to live up to the needs, requirements, and just expectations of the other 9999/10000. Under these circumstances, I think it requires no extended argument to show that it is primarily and solely the duty of the 1/10000 to make up its mind definitely what it should do, do as much as it can, formulate the help it may need from the other 9999/10000, and then bend its efforts to attending to it that such aid is forthcoming. Whether such aid is ultimately forthcoming or not in no way relieves the 1/10000 from its duty of setting its own house in order and keeping it so. In our own particular case this duty of setting and keeping our house in order is all the more compelling because our calling normally requires of us a degree of education and of intellectual equipment far above the average; we are in daily contact with complex and puzzling problems which we must solve as a part of our daily routine and therefore by training and by daily vocation we are peculiarly well positioned to determine conclusively, fairly, and equitably what we *should* do, *how* we should do it, and to what extent and how we are *entitled* to help from the other 9999/10000. Likewise, it requires no extended argument to show that if the 9999/10000 habitually and continuously refrain from showing any interest in or from giving any encouragement to the 1/10000, the latter's work can only become more self-centered, and as time goes on, less and less concerned with the needs and expectations of the 9999/10000, as a whole.

MORE THAN FIFTY YEARS OF PUBLIC EFFORT

It can be truthfully said that as a body American chemists have for more than 120 years and particularly in the past 50 years made not only all reasonable effort but very creditable sustained effort, and with a very good measure of success, to put and to keep their own house in order. They have recognized their duties and their opportunities and have very intelligently set about the creation of organizational machinery to perform those duties and to embrace those opportunities. The Manufacturing Chemists Association of the United States, the oldest of these organizations, the AMERICAN CHEMICAL SOCIETY, the American Electrochemical Society, the American Institute of Chemical Engineers are each and all entirely volunteer organizations for the ultimate purposes above mentioned, and the good they have accomplished, not only for the business and profession of chemistry but also for the general public welfare in national as well as international matters, can safely challenge comparison with what has been done in any other country, confident that the American chemist, all things considered, can well feel proud of his record even when so compared.

There are now sufficient signs that the world as it was before August 1914 was a decidedly easy-going affair when compared with the world that we may reasonably expect when the peace treaty becomes operative. That being reasonably certain, what is the American chemist to do then that he has not heretofore done? For this evening's purpose that question will be narrowed down to: What is the AMERICAN CHEMICAL SOCIETY and its individual membership then to do that has not heretofore been done?

WHAT NEED NOT BE CHANGED

The constitution of the AMERICAN CHEMICAL SOCIETY needs no modification to enable it to do all needful things, within its proper sphere, suitably to advance the welfare and interests of chemistry in the nation or the several states of the Union as well as in international relations.

The general plan of organization of the AMERICAN CHEMICAL SOCIETY needs no changes that require specific action by the Society; its mechanism is so elastic and so comprehensive that it can without difficulty be effectively and rapidly adapted to all new conditions. On neither of these two points is there any disagreement of consequence among our members.

PRESENT RESPONSIBILITIES DELIBERATELY ASSUMED

As to *how* the different parts of our organizational mechanism shall be joined up there has been in the past considerable difference of opinion. Two of the most divergent views were considered by our Council for more than a year and finally, in 1916, one view was adopted and the other rejected. The rejected view contemplated, in general, a concentration of the executive offices and officials in one city and in one building for the purpose of closer-knit coöperative effort in the administrative and routine activities of our Society in the expectation that thereby all our other efforts would be provided with machinery promptly to detect and to embrace new opportunities of Society endeavor. The adopted view contemplated the present relation of our organizational parts with a large measure of the responsibility for new endeavor lodged with the membership as expressed in local sections. Theoretically, at least, the President of our Society is supposed to appoint all necessary committees, except a certain specified few, to look after all relevant interests of American chemists. But in an organization of 12,000 members in 54 sections in 33 states of the Union and the District of Columbia, it is clear that theory and practice simply cannot coincide, even with the help of the recently appointed Advisory Committee to the President of our Society. The rejected plan aimed at relieving that situation. That being so, the membership and the sections of the Society cannot, even if they would, escape the responsibility that they have thus explicitly retained to themselves.

THE RESPONSIBILITIES

Now, what are these responsibilities?

To be on the lookout for new developments of all kinds that may work good or harm to American chemistry and to find ways and means effectively and promptly to aid or to check them, as the case may be. Obviously, that makes it imperative and inescapable that each local section must, in theory at least, be on guard not only as to the good or harm of chemistry in its own immediate locality or its own state but in every state of the Union as well and not forgetting our national and international interests of any and all kinds whether relating to the industrial, the educational, the commercial, the scientific, the technical, or the research aspects in their manifold ramifications and developments; thereupon, ways and means must be found and operated. In practice, the results are bound to be smaller, of course.

INDIVIDUAL MEMBERS THEMSELVES RESPONSIBLE

Local sections, in turn, are dependent upon their executive committees and their councilors, and these in turn upon the section members. Therefore, in the last and the final analysis, each and every member has thus deliberately and inescapably had placed upon him and by his own voluntary act his fair and equitable share of the burden thus laid upon his own local section. In my view, every member of our Society gave an implied promise, at the time he qualified for membership, to carry that burden, and I have the greatest confidence that each member so understands the situation; if there are any members who are unwilling to carry that burden they must be in very great minority, and that due to misapprehension entirely.

From this it is clear that each member must maintain a receptive mind and must at all times be watchful of chemistry's good so that when opportunity offers he can place his suggestions for improvement where they may become most effective. The society machinery offers him a great many avenues for giving effect to his views and these are, among others, the committee, if any, of the Society that is charged with general care of his subject; should there not be any such committee he can send his communication to the Secretary of the Society who will put it where it will receive appropriate attention; local councilors and local executive committees should be consulted where

possible as to such communications, to the end that when they reach the committee or the Secretary they may be as definite, comprehensive, well thought out, and precise as circumstances will permit or call for, otherwise much ill-considered matter may be brought forward; finally, there are the councilors-at-large who are likewise available. There are plenty of ways and means for members to become articulate in the Society's affairs, and if members do not avail themselves thereof, those in office cannot conclude otherwise than that their work is being satisfactorily performed.

WHEN PEACE RETURNS

There is every reason to believe that upon the actual return of peace our Society will have to act promptly in a large number of new matters, will have to speed up action on old matters, and will make a large number of new connections both at home and abroad, governmental and non-governmental. Speed and comprehensiveness will more than ever be the essence of our problems. Action without opportunity for consultation with local sections in many matters and especially in such as are new or radical, may easily be abortive or unsatisfactory. Certainty that in any and all such matters any action taken is reasonably representative of our Society as a whole calls for response from all the local sections.

RECENT POLLS EXPERIENCE

During the past four years I have had several occasions to take a poll of our local sections on Society matters which had been assigned to me. In the very nature of things these polls had to be taken by circular letter and it is probably that which accounts for the slowness of returns and failure to notify me that certain sections would not file returns. In all of these polls a time limit had to be set for receipt of replies; nevertheless, it does seem autocratic to go ahead, even on the expiration of the time limit when, say, two-thirds and more of the sections have not in any way responded. Any one of a number of things may have happened to prevent reply and anyone's spirit or sense of fairness revolts at doing anything that has even the appearance of being high-handed. We are all in the same boat and it is hard to believe that any one is "holding-out" on the work, and for that reason I have felt called upon to delay procedure until I absolutely had to go ahead. Our sections must acquire the habit of taking circular letter polls quite as seriously as personal letter matters, if the best interests of our Society are to be safeguarded and developed. However, there has been encouraging improvement in the returns from the polls and I am confident that before long replies will be received to future polls with great promptness and celerity. There is no reason whatever to believe that my experience with slow returns from polls is due to any lack of willingness on the part of any appreciable proportion of our members. I am inclined to charge non-returns to an assumption that if not heard from the program will go forward as scheduled; if all could agree to that, well and good. Ought not the poll taker, however, be advised that a return will not be filed, if such is to be the case, in order that injustice be not done? How about a case where the circular letter for a section went astray or was never delivered?

Slow or incomplete returns I am inclined to charge to unfamiliarity with the subject matter or inability to assemble the reply promptly. As to these, it is my view that not all sections can be interested in or acquainted with every topic that may be of importance to the Society as a whole, yet each section should be given an opportunity to be heard on all such occasions and each section, in turn, should let itself be heard from, one way or another, but with promptness and completeness. No doubt, each section knows pretty well what subjects are of direct interest to it and as to these promptness of reply should be the rule; on these topics the local councilors and the executive committee should keep in close touch with each other and per-

haps twice a year each section could devote at least a half-hour to the general discussion of those subjects for the guidance of its local councilor or councilors, as the case may be. For such meetings, it might be a feasible program to discuss the problems assigned to the various and then active special committees and the divisions of our Society, and their published reports, if any, and thereafter to call for proposals outside such committees and divisions. Such comprehensive treatment of the Society's activities by each section once or twice a year, I believe, cannot help but react favorably all around; when the local councilors report at home what was or was not done at the General Meeting of that spring or that fall the membership will then be able to follow the Society's activities in closer touch and hence with greater interest and to greater mutual benefit.

THE DECEMBER 1918 POLLS

Going back now to the Council Meeting of December 1918. Two polls were taken in preparation for that meeting, one by the Philadelphia Section and one by the secretary of our Society. The results of both were placed in my hands for coördination, in the expectation that a program for that Council Meeting could therewith be worked out. A number of sections communicated their inability to participate in that poll within the time limit set, for one good reason or another; some sent their recommendations in duplicate as requested and most of these were in numbered paragraphs. A few put their recommendations in narrative form. This heterogeneity of form of reply probably more than quadrupled the labor thrown upon me and under the circumstances on account of the stress of time the assembly work had to be done under high pressure and hence not as well as it could or would have been done had there been uniformity of reply form as requested by the Philadelphia Section. The additional work thrown upon me because some one forgot to have a carbon copy sent along was out of all proportion to the slight additional cost of providing me with that carbon copy. I did not have time nor opportunity to have copies of them made and therefore I was compelled to do a large amount of longhand note-making that should have been spared me.

Then there were the communications in narrative form which caused me a great deal of added labor and, what is worse, much uncertainty on my part in the result as to whether or not I had correctly grasped and paraphrased the meat of the various proposals so narrated. Of course, a recommendation in narrative form is better than no recommendation at all. One or more sections overcame the difficulty encountered by those resorting to narrative, by writing out as a numbered paragraph in the general form of the body of a resolution or motion what they considered the meat of their situation and then elaborating upon that text by suitable narrative; much the same as presenting a motion orally in meeting and then speaking to the motion. That was a big help to me in my work. In short, the thoughtful ones made me no more work than I had bargained for; the less thoughtful made me many times more work than I had bargained for. If those who answer polls would follow the plan of reply suggested in the original circular calling the poll they will save the poll taker a very large amount of labor; generally the poll taker has a very definite plan of assembly of answers in mind when he sends out his poll and if any considerable proportion of answers deviates from the reply form suggested, his whole plan may be knocked to smithereens. It is easier for fifty men to do one thing in just one way, even if a new one, than it is for one man to unravel fifty different ways of doing one and the same thing.

The only object in my mind in referring to these details is to call attention to the need of coöperation that really coöperates to the utmost. These matters appear insignificant by themselves, but they are important, since they delay accomplishment

and everything that delays or tends to delay must be eradicated from our operations, if speed, accuracy, and comprehensiveness are to be attained. What, under other circumstances, is mere innocent thoughtlessness or harmless oversight may through cumulative action really have, in our case, the ultimate effect of "throwing a monkey wrench into the machinery" and that, I know, is wholly absent from the minds of our members.

In laying out the work to be undertaken by our Society we should endeavor to restrict it, at first, to those items which our Society can by itself do better than any other and then we can expand into those fields wherein we can coöperate effectively with other agencies, being throughout the whole mindful of such things as are specifically chemical and not of general nature, in and of themselves; that is, if we feel that we must have our heads in the clouds, our feet, nevertheless, should always be on the solid ground of chemistry.

There are a number of classes of our Society activities that must, in the very nature of things, proceed simultaneously such as setting and keeping our own house in order on the one hand and on the other hand the appropriate education of the general public and of government officials to the importance of our business in the life of the nation to the ultimate end that thereby the reciprocal obligations of the nation to its chemists and to those activities in which chemistry, in any of its varied phases is an essential or vital factor, will be fully recognized and properly discharged.

OUR OPPORTUNITY

For more than 120 years the chemists of this country have been telling our people and our Government over and over again to what extent and how chemistry is essential to national welfare and growth, and why the nation should foster chemistry. They have backed their faith by their own efforts. But somehow or other the country, as a whole, paid, or seems to have paid, little heed to them. It took this colossal nightmare of a war effectively to impress the cogency of those truths upon the public mind. The present is, therefore, particularly "Our Opportunity" so to coöperate in every direction as to clinch the advantages thus gained and to bring one step nearer to realization the vision our chemist forefathers had of the beneficent influence of chemistry upon our national life and greatness. Some of this clinching will be done by our Society and while it had organizational machinery fully capable of carrying such a load it cannot properly carry it unless we, either as individual members or as committee members or other Society officials, attend to it that that carefully planned and thoughtfully built organization shall function without delay, without friction, and at top speed at all needful times. We have reserved to ourselves, as members, in large measure the initiative in new matters and the execution of routine matters. Ours is, therefore, not only the sole responsibility but the golden opportunity, as well.

CONCLUSION

It must be clear to you that the main point of what I have said this evening is aimed solely at increasing the interest and the direct participation of our individual members and all our sections in all our Society's activities. I am convinced that such an increase is vital to the continued success of our Society. Nor do I pretend to have indicated, much less enumerated, all the ways in which our membership can display its interest and give wholesome effect to its participation. I am wholly confident that once the membership is satisfied that increases in those directions are necessary, these will be forthcoming, enthusiastically and promptly, any and all pessimists and doubting Thomases to the contrary, notwithstanding.

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THE DISTRIBUTION AND CHARACTERS OF SOME OF THE ODOROUS PRINCIPLES OF PLANTS¹

By FREDERICK B. POWER

The substances which impart to many plants a particular and often characteristic odor are almost infinite in their variety, and comprise some of the most interesting compounds in the domain of organic chemistry. Many of them possess a cyclic structure, while others belong to the class of so-called aliphatic or open-chain compounds, which may be either saturated or unsaturated, and they include representatives of such various groups as the hydrocarbons, alcohols, aldehydes, ketones, phenols and phenol ethers, acids, esters, and lactones. Hydrocyanic acid, which may be regarded as the nitrile of formic acid, occurs among the products of distillation of many plants, and other nitriles represent the principal constituent of some essential oils, such, for example, as that of the nasturtium, *Nasturtium officinale*, Linné, which consists chiefly of phenylpropionitrile, $C_6H_5.CH_2.CH_2.CN$. It is well known that by the distillation of bitter almonds benzaldehyde and hydrocyanic acid are obtained, and that these substances, by prolonged contact, unite to form phenylxyacetoneitrile, $C_6H_5.CH(OH).CN$, which is therefore contained in varying amounts in the essential oil of bitter almonds. Other nitrogen compounds which are represented among the odorous constituents of plants are, for example, indole, C_8H_7N , which is a constituent of the essential oil of jasmine and of orange flowers, and its methyl derivative, skatole, C_9H_9N , which has been found in the wood of an East Indian tree, *Celtis reticulosa*, Miq. or *C. cinnamomea*, Lindl. Notwithstanding the fact that skatole possesses a strong fecal odor, it is employed, as is also indole, in the preparation of synthetic perfumes. Another interesting nitrogen compound, which appears to be somewhat widely distributed in nature and imparts to many floral products a quite distinctive odor, is the methyl ester of anthranilic acid, $C_6H_4(NH_2).CO_2CH_3$. This has been found in the essential oils of orange flowers (neroli), tuberose, jasmine, gardenia, and ylang-ylang, and also in the oils of sweet orange peel and bergamot leaves. A methyl derivative of methyl anthranilate, $C_6H_4(NH.CH_3).CO_2CH_3$, has been found in the essential oils obtained from the fruit and the leaves of the mandarin orange. Compounds containing sulfur as a characteristic constituent, the so-called mustard oils, are yielded by many plants belonging to the family of *Cruciferae*. Numerous sulfur compounds are likewise contained in liliaceous plants, such as the onion and garlic, as also in the gum resin, asafetida, a product obtained from various species of *Ferula*, belonging to the family of *Umbelliferae*.

Although the odorous principles of plants are frequently developed in some particular part or organ of them, such as the petals of the flower, of which examples are afforded by the rose and other fragrant blossoms, they are sometimes found in both the flowers and fruit, as in the orange tree, while in other instances they are contained chiefly in the foliage. It is also of interest to note that when totally distinct parts of a plant, such as the leaves and root, possess odorous or aromatic properties, the substances to which these properties are due may be quite different in character and have little or no direct chemical relationship. A particularly striking instance of this peculiarity is afforded by the essential oils obtained from the root and leaves, respectively, of the sassafras tree, *Sassafras varifolium* (Salisbury), O. Kuntze. The oil distilled from the root, especially the bark of the latter, contains among other substances safrol, camphor, and eugenol, which are not found in the leaves, while on the other hand the leaves contain the olefinic terpene, myrcene, together with citral, linalool, and geraniol, no one of which is contained in the root. Another instance of similar variations is that of the products from the Ceylon cinnamon tree, *Cinnamomum zeylanicum*, Breyne, the oils distilled from the root, leaves, and bark, respectively, being quite different in composition. In the oil from the root camphor is a characteristic constituent, whereas the oil from the leaves contains chiefly eugenol, and in that from the bark cinnamic aldehyde predominates.

It can naturally not be expected that such volatile products of plants as are comprehended under the designation of essential oils should be constant in composition, but, nevertheless, some remarkable differences, other than those already described, have been observed in oils distilled from the same species. Thus the phenol contained in the oil from the common garden thyme, *Thymus vulgaris*, Linné, is as a rule thymol, or isopropyl-metacresol, $C_6H_3.CH_3(1).OH(3).C_2H_5(4)$, but this is sometimes re-

¹ Address of the retiring president of the Chemical Society of Washington. Delivered before a joint meeting of the Chemical Society and the Washington Academy of Sciences, January 9, 1919.