

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF THE UNIVERSITY OF MICHIGAN.]

THE INFLUENCE OF GELATIN ON THE TRANSFERENCE NUMBERS OF SULFURIC ACID.

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The properties of hydrophilic colloids have been the subject of many investigations during the past few years. So far, no entirely satisfactory explanation has been offered for their action in the presence of electrolytes. The theories advanced are based largely on the measurements of osmotic pressure, conductivity, swelling and transference numbers.

There appear to be but three articles in the literature dealing with the influence of colloids on transference numbers and in each instance the analytical method was used.

Paul Richter¹ investigated the influence of gelatin, gum arabic, agar-agar, and peptone on the transference number of the chloride ion of lithium, potassium and hydrogen chlorides.

A. Mutscheller² investigated the influence of gelatin on the transference numbers of silver nitrate, cupric sulfate and zinc sulfate solutions which contained definite quantities of a 1% gelatin solution.

According to his results the transference numbers of the nitrate and sulfate ions decrease with an increase in the quantity of gelatin solution added. By the addition of sufficient quantities of gelatin solution, even negative values were obtained. He states that when the transference number of the anion is zero the conditions are most favorable for the deposition of the metal. The effect of the gelatin is accounted for on the assumption that it is positively charged and forms an "absorption compound" with the anions. This results in the partial or complete neutralization or even reversal of the original charge on the ions. The results obtained by Mutscheller for the sulfate and nitrate ions show effects of gelatin far in excess of those observed by Richter for the chloride ion.

It is well to emphasize here that the results obtained by Mutscheller, if correct, are indeed remarkable, but it is the opinion of the authors that an error has been made in the calculations or in the recorded data. This subject is under investigation at the present time.

In an earlier article³ the authors described in detail the application of the concentration cell method to the determination of the transference numbers of sulfuric acid and demonstrated its reliability. The method lends itself admirably to the determination of the influence of gelatin on the transference numbers of sulfuric acid. In that article it was also

¹ Richter, *Z. physik. Chem.*, **80**, 449 (1912).

² Mutscheller, *Met. Chem. Eng.*, **13**, 353 (1915); *THIS JOURNAL*, **42**, 442 (1920).

³ Ferguson and France, *THIS JOURNAL*, **43**, 2150 (1921).

pointed out that the boundary potential is an important factor in the determination of transference numbers by the concentration-cell method.

Mutscheller² explains the effect of gelatin on the transference numbers of silver nitrate, cupric sulfate and zinc sulfate by the assumption that gelatin is positively charged and "absorbs" the negative ions. This causes a decrease in their velocity. According to Nernst the potential at the boundary of two solutions of different concentration depends upon the difference in velocities of the ions. If the theory of Mutscheller is true the presence of gelatin in such solutions should change the boundary potential. Then measurements of the transference numbers of sulfuric acid by this method would determine whether gelatin affected the boundary potential.

Since gelatin precipitates the heavy metals, it was obvious that precipitation would result if it were added to a sulfuric acid solution saturated with mercurous sulfate. Since, however, the influence of the gelatin on transference numbers is due only to its effect on the boundary potential, it is unnecessary to introduce gelatin into the electrode containers.

The cells were prepared as described in the previous article and the siphons connecting the hydrogen and sulfate electrodes were filled with 0.1 *M* and 0.01 *M* solutions of sulfuric acid which contained a definite concentration of gelatin. They were then placed in the reservoirs, with the ends immersed in solutions of the same concentration as that which surrounded the electrodes. The measurements were made as before, but showed a gradual progressive change. It was discovered that this was due to the diffusion of the gelatin from the siphons into the reservoirs and then into the solution which surrounded the electrodes. This made it necessary to devise a method which would prevent the diffusion and at the same time introduce no new potentials. Several devices were tried in which use was made of glass wool, filter paper, glass capillaries, and cotton wicks, before the following satisfactory method was found.

Ordinary cotton lamp-wicks were carefully washed by boiling in acid of the same concentration as used in the cells. After washing and drying they were kept in 0.1 *M* and 0.01 *M* sulfuric acid solutions. Cells were prepared and so filled that the solution rose in the inner tube to the level *L*, indicated in Fig. 1. Gelatin solution identical with that in the siphon *S* was filled in the reservoirs to the level *L*. A wick *W* previously saturated with acid solution containing no gelatin was hung over the side of the inner tube so that one end of it was immersed in the plain solution of the inner tube and the other in the gelatin solution in the reservoir. This arrangement effectively eliminated the

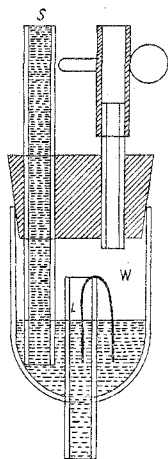


Fig. 1.—Detail of reservoir.

diffusion, provided the solutions in the inner tube and in the reservoir were maintained at the same level. No new potentials were introduced by this arrangement. All of the measurements were made with cells prepared in this manner. Measurements were made with concentrations of gelatin over a range of 0.5 to 20.0%. The results of these measurements are contained in 18 tables of which Table I is a sample.

TABLE I.—TYPICAL EXPERIMENTS.

Expt.	Date.	Time.	Bar.	E_H	E_{SO_4}	$E_{0.1}$	$E_{.01}$	E_H by $+E_{SO_4}$	$E_{.01}$ by $-E_{0.1}$
Using 0.5% gelatin.									
1	1/24	12:30 A.M.	743.8	.....	.....	0.74189	0.80260	.....	.....
2	1/24	9:30	748.4	.....	.....	0.74205	0.80264	.....	.....
3	1/24	11:50	748.4	.....	.....	0.74203	0.80260	.....	.....
Using 5% gelatin siphons introduced at 1 P.M.									
4	1/24	1:00 P.M.	747.8	0.01295	0.04750	0.74199	0.80235	.....	.....
5	1/24	5:00	749.6	0.01290	0.04743	0.74210	0.80220	0.06033	0.06010
6	1/24	11:00	751.0	0.01292	0.04740	0.74217	0.80237	0.06030	0.06020
7	1/25	10:30 A.M.	754.2	0.01290	0.04779	0.74213	0.80260	0.06069	0.06047
		Av.		0.01290	0.04754	0.74213	0.80239	0.06044	0.06026

The cell was set up on Jan. 23 at 2:30 P.M. The averages do not include the first four sets of readings.

In these tables the same arrangement of the data has been followed as in the previous article. In order that a comparison of the values recorded in the separate tables may readily be made, the average values in each table together with the transference numbers calculated therefrom have been summarized in Table II.

The headings of Cols. 2, 3, 4, and 5 have the same significance as in the previous article. Cols. 6, 7, 8, and 9 contain the transference numbers calculated from the values in Cols. 2, 3, 4, and 5, as indicated in the headings. Col. 10 contains the sum of the N_a and N_c values of Cols. 7 and 9 and should always be equal to unity. The deviation from unity is an indication of the small error of the potentials used in their calculation. The accuracy with which the potentials of E_H and S_{SO_4} can be duplicated in the presence of gelatin, is shown by the closeness with which the averages for any two tables of the same concentration agree. From a comparison with similar values in the tables of the previous article, it is plainly evident that when gelatin is present the agreement is less satisfactory than when it is not. This lack of agreement becomes greater the higher the concentration of gelatin. Table III is a summary of the averages of the potentials and transference numbers contained in Table II.

TABLE II.—SUMMARY OF POTENTIALS AND TRANSFERENCE NUMBERS WITH GELATIN.

1. Table.	2. E_H .	3. E_{SO_4} .	4. $E_H + E_{SO_4}$.	5. $E_{0.01} - E_{0.1}$.	6. $\frac{N_a}{E_H + E_{SO_4}}$.	7. $\frac{N_a}{E_{0.01} - E_{0.1}}$.	8. $\frac{N_c}{E_{SO_4} + E_{SO_4}}$.	9. $\frac{N_c}{E_{0.01} - E_{0.1}}$.	10. $\frac{N_a + N_c}{7 + 9}$.
Average from previous article.	0.01131	0.04925	0.06056	0.06034	0.1868	1.0868	0.8133	0.8135	1.0001
				0.5%					
IX	0.01290	0.04754	0.06044	0.06026	0.213	0.214	0.786	0.789	1.003
	0.01289	0.04774	0.06063	0.06049	0.213	0.213	0.787	0.789	1.002
Av.	0.01290	0.04764	0.06054	0.06037	0.213	0.214	0.787	0.789	1.003
				1.0%					
XI	0.01480	0.04549	0.06029	0.06039	0.246	0.245	0.754	0.753	0.998
XII	0.01507	0.04577	0.06084	0.06070	0.248	0.248	0.752	0.754	1.002
Av.	0.01494	0.04563	0.06056	0.06055	0.247	0.247	0.753	0.754	1.000
				2.0%					
XIII	0.02476	0.03799	0.06275	0.06077	0.395	0.407	0.605	0.625	1.033
XIV	0.02466	0.03699	0.06165	0.06067	0.4000	0.407	0.600	0.610	1.010
Av.	0.02471	0.03749	0.06220	0.06072	0.397	0.407	0.603	0.617	1.025
				2.5%					
XV	0.02708	0.03213	0.05921	0.06081	0.457	0.445	0.543	0.528	0.974
XVI	0.02655	0.03239	0.05894	0.06064	0.450	0.438	0.550	0.534	0.972
Av.	0.02682	0.03266	0.05907	0.06072	0.453	0.442	0.547	0.531	0.973
				3.0%					
XVII	0.03062	0.02809	0.05871	0.06086	0.521	0.503	0.478	0.461	0.964
XVIII	0.03300	0.02839	0.06139	0.06065	0.537	0.544	0.462	0.467	1.011
Av.	0.03181	0.02824	0.06005	0.06075	0.529	0.524	0.470	0.464	0.987
				5.0%					
XIX	0.03838	0.02278	0.06106	0.06058	0.627	0.632	0.373	0.376	1.008
XX	0.03683	0.02539	0.06222	0.06059	0.592	0.607	0.408	0.419	1.026
Av.	0.03755	0.02408	0.06169	0.06069	0.610	0.620	0.390	0.398	1.017
				10.0%					
XXI	0.03814	0.02406	0.06220	0.06098	0.613	0.625	0.387	0.397	1.000
XXII	0.03655	0.02414	0.06069	0.06085	0.602	0.601	0.398	0.397	0.997
Av.	0.03735	0.02410	0.06145	0.06092	0.608	0.613	0.393	0.397	0.999
				15.0%					
XXIII	0.04041	0.02267	0.06308	0.06085	0.641	0.664	0.359	0.373	1.037
XXIV	0.04083	0.02219	0.06307	0.06076	0.648	0.673	0.352	0.305	1.038
Av.	0.04065	0.02243	0.06308	0.06081	0.645	0.669	0.356	0.369	1.038
				20.0%					
XXV	0.04117	0.02057	0.06174	0.06074	0.667	0.678	0.333	0.339	1.017
XXVI	0.04194	0.02078	0.06272	0.06071	0.669	0.691	0.331	0.342	1.033
Av.	0.04157	0.02068	0.06223	0.06073	0.668	0.685	0.332	0.341	1.025

TABLE III.—SUMMARY OF POTENTIALS AND TRANSFERENCE NUMBERS.

% Gel.	E_H .	E_{SO_4} .	N_a .	E_B .
0.0	0.01136	0.04918	0.187	0.02906
0.5	0.01290	0.04784	0.213	0.02746
1.0	0.01494	0.04563	0.247	0.02544
2.0	0.02741	0.03749	0.407	0.01676
2.5	0.02682	0.03266	0.442	0.01283
3.0	0.03181	0.02824	0.524	0.00822
5.0	0.03755	0.02408	0.620	0.00354
10.0	0.03735	0.02410	0.613	0.00362
15.0	0.04065	0.02243	0.668	0.00140
20.0	0.04155	0.02068	0.685	-0.00006

A consideration of the values recorded for N_a shows that they increase with increase in concentration of gelatin. The relation between the transference number of the anion and concentration of gelatin is shown by the curve in Fig. 2. In this curve the transference numbers are plotted as

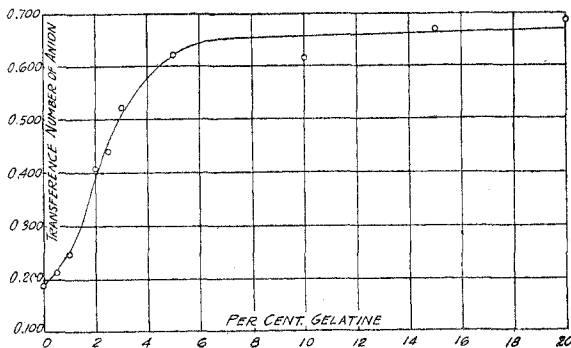


Fig. 2.— N_a -gelatin curve.

ordinates and the concentrations of gelatin as abscissas. The change in transference number with increase in gelatin is rapid at low gelatin concentrations, is gradual between 3 and 5%, and above this is not appreciable. If this represents an actual increase in the migration velocity of the anion, then there must be a corresponding decrease in the boundary potential (E_B). The values in the columns headed E_B and N_a indicate such changes. Since the boundary potential is opposed to the electrode potentials in the case of the hydrogen concentration cell (E_H) and is added to the electrode potentials in the case of the sulfate concentration cell (E_{SO_4}) a decrease in E_B would result in an increase in the value of E_H and a decrease in E_{SO_4} . That such changes do take place is indicated by the values in the columns headed E_H and E_{SO_4} .

It has been shown that the boundary potential depends on the transference numbers of the ions and the ratio of their concentrations in the two solutions. Therefore a change in E_B would result from a change in concentration or a change in transference number.

The value of E_B would be reduced by making the concentration of the solutions more nearly equal. When exactly equal E_B would be zero, and when the concentration of the 0.1 M solution became less than that of the 0.01 M , the direction would be reversed.

To determine whether or not concentration changes are produced by the gelatin, concentration cells of the type $\text{Pt}_H | 0.1 M \text{H}_2\text{SO}_4 | \text{KCl} | 0.1 M \text{H}_2\text{SO}_4 + \text{gel.} | \text{Pt}_H$ and $\text{Pt}_H | 0.01 M \text{H}_2\text{SO}_4 | \text{KCl} | 0.01 M \text{H}_2\text{SO}_4 + \text{gel.} | \text{Pt}_H$ were used. The data from these measurements are summarized in Table IV.

TABLE IV.

% Gel.	0.1 M .		0.01 M .	
	C_1 .	E_x .	C_2 .	E_z .
0	0.05946	.....	0.012340	.....
1	0.05694	0.00070	0.007684	0.01216
2	0.05670	0.00122	0.002172	0.04458
3	0.05542	0.00181	0.000430	0.08609
4	0.05356	0.00268	0.000144	0.11418

It was impossible to work with concentrations of gelatin above 4% because of the excessive foaming of the solutions.

The first column contains the percentage of gelatin in the acid in one-half of the cell. The columns E_x and E_z contain the measured potentials of the cells E_x and E_z when 0.1 M and 0.01 M solutions are used. In columns C_1 and C_2 are the hydrogen-ion concentrations in 0.1 M and 0.01 M solutions with gelatin, calculated by the use of the formula for concentration cells in which boundary potential has been eliminated. The results in columns C_1 and C_2 show that gelatin produces a relatively small decrease in the hydrogen-ion concentration of the 0.1 M solution, and a much greater relative decrease in the 0.01 M solution. The hydrogen-ion concentration of the 0.1 M solution is always greater than that of the 0.01 M ; therefore the reversal of the boundary potential (E_B) as shown in Table II cannot result from the concentration changes produced by the gelatin. Since E_B can be decreased or reversed only by a change in concentration or transference number, the observed change must be due to a change in the transference number.

Since it has been shown above that the gelatin produces changes in the hydrogen-ion concentration, new potentials are developed at the boundaries between the solutions in the wicks and the gelatin solution in the reservoirs. The locations and directions of the boundary potentials, E_B , E_x , and E_z together with E_H and E_{SO_4} are represented diagrammatically in Fig. 3. The location of the boundary potentials is shown also by the same letters in Fig. 1 of the previous article. E_B represents the potential within the siphon, that is, the potential which has been considered thus far. E_x and E_z represent the potentials at the contact of the solutions in the reservoirs. E_H and E_{SO_4} are the measured potentials and are the

algebraic sums of the potentials at the electrodes and the boundary potentials E_x , E_B , and E_z .

The potentials E_x , E_B , and E_z which result from the presence of the gelatin can be calculated from the data in Table IV by the use of the usual formula for boundary potential. These calculations were made and the results are included in Table V. The potentials at E_x and E_z are oppositely directed and the resultant potential is therefore their difference. These differences are recorded in the column headed $E_z - E_x$. The total potential at E_B is opposed to the resultant potentials $E_z - E_x$ and may be considered as the sum of the original boundary potential E_B (0.02906) and the potential resulting from the changes in concentration produced by the gelatin. Therefore the differences between the total potentials E'_B and the original potential E_B (0.02906) is that due to the changes in concentration produced by the gelatin. The values of these differences are recorded in the column headed $E'_B - 0.02906$. As the values in the column headed $E'_B - 0.02906$ are practically identical with those in $E_z - E_x$ and oppositely directed, their combined effect must be zero. This shows that the potentials E_x and E_z at the contacts between the solutions in the wicks and the gelatin solutions in the reservoirs are entirely compensated by the potential ($E'_B - 0.02906$) simultaneously developed at the boundary E_B . Therefore any boundary potential produced by the introduction of gelatin cannot result from changes in concentration. The experimental data, however, show that the boundary potential E_B is changed by the addition of gelatin. Since this cannot be due to concentration changes it must result from a change in the transference numbers of the hydrogen and sulfate ions or from an actual change in the kind of ions present. This may be effected in several ways; (1) by the removal of either ion as the result of its being selectively adsorbed by the gelatin; (2) by a change in the velocity of either ion; (3) by chemical reaction with the gelatin resulting in the formation of new ions.

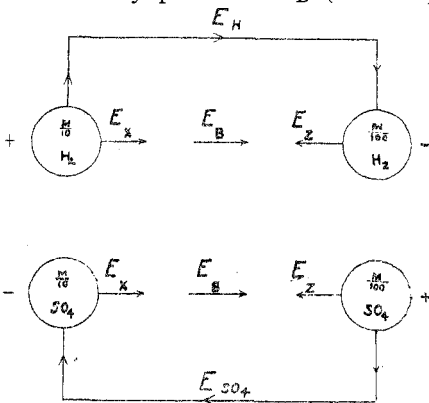


Fig. 3.—Diagram of potentials.

TABLE V.—BOUNDARY POTENTIAL CALCULATIONS.

% Gel.	E_H .	E_{SO_4} .	E_B .	E_x .	E_z .	$E_z - E_x$.	$E_B - 0.02906$.	E'_B .
1	0.01494	0.04563	0.02544	0.00077	0.00878	0.00801	0.00804	0.0371
2	0.02941	0.03749	0.01676	0.00085	0.03215	0.03107	0.03124	0.0603
3	0.03181	0.02824	0.00822	0.00132	0.06210	0.06078	0.06094	0.0900
4	.....	.....	.....	0.00196	0.0825	0.08054	0.08054	0.1095

Since the conductivity of a solution is affected by any change in the number and the mobility of its ions, it was thought that conductivity measurements would furnish information as to the nature of the influence of the gelatin. Measurements were made of the conductivity of 0.1 *M* and 0.01 *M* sulfuric acid solutions which contained different concentrations of gelatin. The concentration of gelatin was varied from 0 to 20%. As it was necessary to apply a correction for the conductivity of the gelatin in conductivity water, a series of measurements was made with gelatin solutions over this same range of concentration. The corrected conductivity values are recorded in Table VI.

TABLE VI.—CONDUCTIVITY OF SULFURIC ACID SOLUTIONS IN PRESENCE OF GELATIN.

% Gel.	0.1 <i>M</i> .	0.01 <i>M</i> .
0	0.037704	0.005011
1	0.033695	0.002413
2	0.030608	0.000948
3	0.027516	0.000755
4	0.02423	0.000686
10	0.009907	0.000462
15	0.003987	0.000349
20	0.002800	0.000233

The effect of the gelatin on the conductivity of the 0.1 *M* and 0.01 *M* sulfuric acid solutions is also shown by the curves in Figs. 4 and 5. The conductivities are plotted as ordinates and the concentrations of gelatin as abscissas. These curves show that the gelatin produces a greater relative change in the conductivity of the 0.01 *M* sulfuric acid solution than in the conductivity of the 0.1 *M* solution. It should be recalled that in the concentration-cell measurements, recorded in Table IV, the gelatin produced a much greater relative change in the hydrogen-ion concentration of the 0.01 *M* solution than in the 0.1 *M*. In fact, by the addition of about 3 to 4% of gelatin, the concentration of the 0.01 *M* solution was reduced practically to zero. From Fig. 5 it is readily seen that by the addition of about 3% of gelatin the conductivity has been reduced almost to zero. This indicates that not only is the hydrogen-ion concentration reduced by the addition of gelatin but that sulfuric acid is removed as a whole.

Several calculations were made involving the conductivity data and potential data in an effort to determine whether the gelatin produced an actual change in the mobility of the ions, but it was impossible to conclude from these calculations whether the effects obtained were due to concentration changes alone or to concentration changes together with changes in mobility or the presence of new ions.

Two explanations have been offered to account for the action of gelatin, one of which assumes that the ions of the acid are "absorbed" by the gelatin, and the other that a highly dissociable chemical compound is formed.

Supporters of the first theory are H. G. Bennett⁴ and A. Mutscheller;⁵ and favoring the second theory are H. R. Procter,⁶ H. R. Procter and J. A. Wilson,⁶ J. Loeb,⁷ and W. O. Fenn.⁸

It has been shown in this investigation that some of the properties of sulfuric acid are altered by the presence of gelatin. A summary of the data obtained in the work on its influence on the transference number of the anion of sulfuric acid is contained in Table III. It may be observed that the boundary potential (E_H) is reduced from $+0.02906$ to -0.00006 . Corresponding to this decrease in boundary potential, there is an increase in the

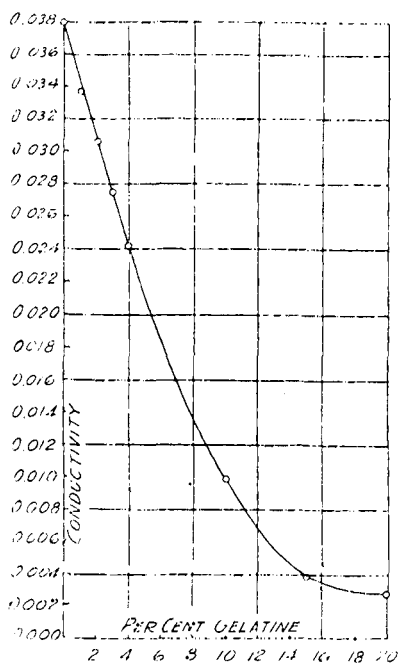


Fig. 4.—Conductivity-gelatin curve for 0.1 M H₂SO₄.

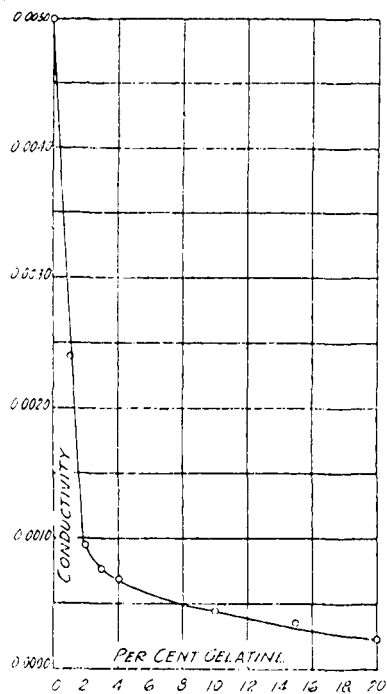


Fig. 5.—Conductivity-gelatin curve for 0.01 M H₂SO₄.

potential of the hydrogen concentration cell (E_H) from 0.01136 to 0.04155 and a decrease in the potential of the sulfate concentration cell (E_{SO_4}) from 0.04918 to 0.02068. There is an apparent increase in the transference number of the anion from 0.187 to 0.685. Any factor which would increase the numerical value of E_H and decrease E_{SO_4} would give the observed effect of a decrease in the boundary potential and an in-

⁴ Bennett, *J. Am. Leather Chem. Assoc.*, **13**, 270 (1918).

⁵ Procter, *J. Chem. Soc.*, **100**, 342-3 (1911); **105**, 313 (1914).

⁶ Procter and Wilson, *ibid.*, **109**, 307 (1916).

⁷ Loeb, *J. Gen. Physiol.*, **1**, 39-60, 237-54 (1918); **2**, 363-85, 483-504, 559-80 (1919).

⁸ Fenn, *J. Biol. Chem.*, **33**, 279-94, 439-51 (1918); **34**, 141-60, 415-28 (1918).

crease in the transference number of the anion. This factor was at first believed to be the result of changes in concentration which are recorded in Table IV, due to the presence of the gelatin. A careful consideration of the boundary potentials E_x , E_B , and E_z which result from these changes in concentration leads to the conclusion that they should neutralize each other. The data in Table VI show this to be the fact. Therefore this effect was not due to the concentration changes brought about by the introduction of the gelatin. This led to the conclusion that the observed changes in the potentials of the concentration cells resulted from a change in the boundary potentials. This decrease in the boundary potential could be produced by any one of three factors. An actual change in the transference numbers; a decrease in the concentration of the 0.1 M solution such that it was less than the 0.01 M solution; or by a change in the kind of ions present. Since the second of these factors is eliminated by the data recorded in Table IV, which shows that such concentration changes are impossible, it appears that the decrease in boundary potential must be due only to the other factors.

As there is a possibility that a chemical compound which ionizes is formed, the facts are considered also from this point of view. If such is the case there should be a fairly close relation between the amount of gelatin added and the amount of acid removed. This would explain the decrease in hydrogen-ion concentration and decrease in conductivity observed. If such a reaction occurs new compounds are formed and some of the hydrogen ions are replaced by complex gelatin ions which results in the increase in the transference number of the anion as observed. No data were obtained from which the exact amount of sulfuric acid removed by a definite weight of gelatin could be determined.

From the curve for the conductivity of the 0.1 M sulfuric acid solution, Fig. 4, it appears that the conductivity of the solution is reduced a definite amount for each additional per cent. of gelatin. The addition of the first per cent. of gelatin in the 0.01 M solution also produces about the same reduction in conductivity. This indicates that a definite quantity of gelatin removes a definite amount of sulfuric acid from the solutions. If the compound formed dissociates, and some evidence has been obtained from other sources that it does, then the conductivity curves will tend to flatten at the higher concentrations of gelatin. Loeb⁷ has been led to believe that in acid solutions gelatin reacts to form gelatin salts of the acid and in the case of sulfuric acid he states that the gelatin sulfate formed has the composition represented by the formula $gel_4(SO_4)_2$. The dissociation of such a salt would result in the formation of a slowly moving complex colloidal gelatin cation and a sulfate anion. The transference number of the anion of such a compound would be greater than that of the cation. This conforms to the observed facts. Furthermore, such a compound

would show some conductivity, so that for the higher concentrations of gelatin the decrease in conductivity would no longer be proportional to the gelatin added. This is borne out by the flattening of the conductivity curves at the higher concentrations of gelatin. It should be pointed out that the sharp bend in the conductivity curve of the 0.01 *M* solution, Fig. 5, occurs at about the same concentration as a similar bend in the gelatin transference-number curve, Fig. 2; furthermore it is shown from the gelatin concentration cells, Table IV, that the sulfuric acid in 0.01 *M* solution is practically all removed at this same concentration of gelatin.

These facts indicate that sulfuric acid as such is removed by the addition of gelatin to the solution. Accordingly the apparent change in transference numbers is due not to an actual change in the velocity of the H^+ and SO_4^{--} ions, but to the presence of new ions in the solution resulting from the dissociation of the gelatin—sulfate compound.

It is the opinion of the authors that the action of gelatin and sulfuric acid results in the formation of a single dissociable product in which the H^+ ion of the acid loses its identity. It is further believed that in the presence of a base a similar product would result in which the identity of the OH^- ion would be lost and that in the presence of a neutral salt solution no similar action would result. At the present time investigations are being conducted by the authors to confirm this hypothesis.

Summary.

1. The effective concentration of 0.1 *M* and 0.01 *M* sulfuric acid solutions has been found to be reduced by the addition of gelatin.
2. The transference numbers of 0.1 *M* and 0.01 *M* sulfuric acid solutions have been found to be altered by the presence of gelatin.
3. The conductivities of sulfuric acid solutions have been found to be reduced by the presence of gelatin.
4. An hypothesis has been offered to account for the action of gelatin in the presence of electrolytes.

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