The addition of ether to the alcohol solution does not interfere with crystallization. In fact, considerable crystalline glyceric aldehyde was obtained from this mixed solvent. But even with the technique described, the results obtained in crystallization are somewhat variable, as will be seen from the results given below. Moreover, no experimental explanation has yet been found for the fact that usually only 75% of the glyceric aldehyde theoretically possible could be crystallized out of any given batch.

In some test experiments the following results were obtained: Ninety grams of the acetal gave, on the first crystallization, 28.5 g. of glyceric aldehyde crystals. On concentrating the mother liquor and washings *in vacuo* a second crop of 8.2 g. was obtained. The washings from the second crop gave 11.0 g. of gum which no longer crystallized on diluting with alcohol. Therefore, 75% of the 49.3 g. of glyceric aldehyde theoretically possible were obtained in the crystalline form.

In another experiment, 27 g. of crystalline glyceric aldehyde out of the 41.7 g. theoretically possible were obtained from the first crystallization, *i. e.*, 64.7%. A second crop of 4.7 g., and a third crop of 3. 7 g. was obtained, making a total of 84.8% recovered as crystals.

Altogether, enough material was worked up to have given 400 g. of crystalline glyceric aldehyde, assuming that 95% of it could be crystallized. As a matter of fact, only a little over 250 g. was obtained altogether.

CHICAGO, ILL.

[CONTRIBUTION FROM THE CHEMICAL LABORATORY OF WASHINGTON UNIVERSITY.]

A FURTHER STUDY OF THE PREPARATION AND PROPERTIES OF THE AMMONIUM SALTS OF ORGANIC ACIDS.

FOURTH COMMUNICATION.[1]

BY LEROY McMASTER.

Received July 20, 1914.

In continuation of the investigation of the preparation and properties of the neutral ammonium salts of organic acids, I still find that the salts were always prepared by neutralizing an aqueous solution of the organic acid with ammonia water or ammonium carbonate, and the solution allowed to evaporate. As a result, the acid salts, instead of the neutral salts, were generally obtained, due to the hydrolytic action of water upon them. The properties given are thus the properties of the acid salts. In some cases no record at all can be found of the preparation of any ammonium salt of the organic acid. Many of the salts also contained water of crystallization.

In attempting to prepare some neutral di-ammonium salts by the above

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[1] For previous papers on this subject see: *Am. Chem. J.*, **49**, 84–87 (1913); *Chem. News*, **108**, 136–137 (1913); *Am. Chem. J.*, **49**, 294–301 (1913); *Chem. News*, **108**, 182–183, 193–194 (1913); THIS JOURNAL, **36**, 742–747 (1914).

general method, Keiser and McMaster[1] always obtained the acid salts. They then dissolved the organic acids in absolute ethyl alcohol or ether and conducted a stream of dry ammonia gas into the solution. By this method they were thus able to prepare neutral di-ammonium salts of several of the organic acids. I[2] continued the preparation of neutral ammonium salts in methyl alcohol, ethyl alcohol and ether and studied their properties, many of which were found to be different from those described in the literature. There have been prepared by this method, in this laboratory, the neutral ammonium salts of propionic, butyric, isobutyric, isovalerianic, caproic, malonic, succinic, glutaric, ethyl malonic, adipic, pimelic, sebacic, fumaric, maleic, itaconic, citraconic, mesaconic, tartronic, malic, tartaric, racemic, crotonic, benzoic, cinnamic, *o*-phthalic and *m*-phthalic acids.

The work on the preparation of neutral ammonium salts of organic acids and a study of their properties has been continued. There have been prepared and studied the neutral ammonium salts of palmitic, stearic, oleic, elaidic, aconitic, salicylic, *m*-hydroxy benzoic, *p*-hydroxybenzoic, *p*-methoxybenzoic, hydrocinnamic, hippuric, *o*-toluic, phenyl acetic, mandelic and uvitic acids. They were prepared in absolute alcoalcohol and ether. Several were prepared also in acetone.

Some of the ammonium salts of the organic acids are more or less soluble in alcohol, and, when such was found to be the case, they were generally precipitated from a saturated solution. Before filtering, ether was generally added to decrease their solubility. As a rule, the salts were generally precipitated in a crystalline form from the alcoholic solution and in an amorphous condition from the ethereal solution. On passing ammonia into the solutions, there are frequently formed at first gelatinous or mucilaginous precipitates which generally change in a short time to crystalline or amorphous powders. This happens more frequently in the ethereal solution than in the alcoholic. In the acetone solutions so far studied, granular powders are formed at once on passing in the ammonia.

In the following work the neutral ammonium salts of palmitic, stearic, oleic and elaidic acids were prepared and analyzed by Mr. John D. Fleming, Jr. The ammonium salicylate and hippurate were also analyzed by Mr. Fleming, to whom I desire to express my sincere thanks.

Of the Higher Fatty Acids.

Ammonium Palmitate.—On attempting to prepare the neutral ammonium salt of palmitic acid by treating the acid with ammonia, Fremy[3] obtained the acid salt, insoluble in cold water. The neutral salt can be readily

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[1] Keiser and McMaster, *Am. Chem. J.*, **49**, 84 (1913).

[2] *Loc. cit.*

[3] Fremy, *Ann.*, **36**, 46 (1840).

prepared by passing dry ammonia gas into an ethereal solution of the acid, when it is formed as a very voluminous, white gelatinous precipitate. It does not become crystalline even after passing in the gas for three hours. This precipitate was first filtered by suction, washed with ether and dried in the air. Prepared in this manner, it lost ammonia and turned to a yellow curdy substance resembling a "soap." The freshly precipitated substance was next quickly filtered by suction on an alundum crucible, placed in a glass tube and a current of dry ammonia conducted over it to remove the ether. It was then placed for a few minutes in a vacuum desiccator and analyzed. Determination of the nitrogen by the Kjeldahl method proved it to have the composition of the neutral salt.

Calc. for $C_{16}H_{31}O_2(NH_4)$: 5.13%; found: 5.16% N.

The neutral salt when first precipitated is white, but soon becomes somewhat yellow. It is not hygroscopic, but loses ammonia, especially in moist air. It is slightly soluble in ether and petroleum ether, readily soluble in methyl alcohol, ethyl alcohol and acetone, and insoluble in carbon tetrachloride and benzene. There is considerable frothing when the salt is shaken with water.

Palmitic acid was also dissolved in ethyl alcohol and the solution treated with ammonia gas. After a short time, a crystalline precipitate was formed which went into solution upon the addition of a small amount of alcohol. The solution was poured into a crystallizing dish and the alcohol allowed to evaporate. The salt obtained was at first pure white, but before the evaporation was complete it became yellowish. After the alcohol had entirely evaporated and the salt became dry, it had the appearance of the compound prepared in ether. It had lost ammonia and analysis proved it to be the acid salt. In order to obtain neutral ammonium palmitate it was thus very evident that the salt must not be exposed to the air for any length of time. The compound prepared in either alcohol or ether is evidently an ammonium "soap."

Ammonium Stearate.—Stearic acid was dissolved in ether and dry ammonia conducted into the solution. A white gelatinous precipitate was formed which, after a short time, appeared to be somewhat crystalline. Like the palmitate, this salt loses ammonia in ordinary air, and it was necessary to filter it very quickly by suction and dry it in a current of ammonia gas. The salt thus prepared is not hygroscopic, is stable in dry air, but loses ammonia in moist air. It is practically insoluble in ether, benzene, carbon tetrachloride and petroleum ether, but very soluble in methyl alcohol, ethyl alcohol and acetone. It froths considerably when shaken with water. When an alcoholic solution of the acid is saturated with ammonia gas and the mixture allowed to evaporate in the air, there is obtained a soapy residue which analysis shows to be an acid salt instead of the neutral salt. This is due to the fact that it has lost ammonia during the evaporation of the alcohol. When a small amount of the neutral salt prepared in ether was dissolved in alcohol, and the alcohol quickly evaporated, the residue was partly amorphous and partly made up of needle-like crystals. We have with the stearate another example of an ammonium soap.

Determinations of the nitrogen by the Kjeldahl method gave results slightly higher than the calculated amount for the neutral salt. This may have been caused by a small amount of free ammonia not being removed, although the salt was placed over sulfuric acid in a vacuum desiccator.

Calc. for $C_{18}H_{35}O_2(NH_4)$: 4.65%; found: 4.80 and 4.81% N.

Ammonium Oleate.—For the preparation of liquid-crystalline ammonium oleate, Lehmann[1] has made the neutral anhydrous ammonium oleate by passing ammonia gas from a steel cylinder into oleic acid until it smells strongly of ammonia. If this preparation is fused under a cover-glass on a slide, and "the cooling is watched under a microscope, it is seen that the mass solidifies as a whole to small needle-shaped (rhombic?) crystals of a labile modification. These are soon converted into a rather less fusible stable modification appearing as imperfectly formed (monoclinic?) leaflets. From alcoholic solution these latter can be obtained as relatively large crystals with sharp edges." Lehmann also states that an anhydrous acid ammonium oleate does not exist and that solid neutral ammonium oleate dissolves in oleic acid from which it crystallizes out again unchanged. The neutral anhydrous ammonium oleate can also be prepared by conducting dry ammonia gas into an ethereal solution of oleic acid. At first there is formed a white gelatinous precipitate which becomes somewhat crystalline after running in the gas about one hour. It is impossible to filter the mixture even by suction. The ether was removed by a current of dry ammonia gas and the salt finally dried in a stream of dry air. It is very deliquescent and loses ammonia easily in moist air. When shaken with water it forms a milky suspension.

Calc. for $C_{18}H_{33}O_2(NH_4)$: 4.68%; found: 4.67% N.

When it was found that the ether could not be removed by filtration from the precipitated salt, the mixture was poured into a crystallizing dish. When the ether had evaporated, there remained a very viscous liquid which on stirring became semi-solid. During the evaporation of the ether, moisture was taken up by the gelatinous precipitate and there was presumably formed neutral ammonium oleate hydrate. This is practically what was observed by Lehmann[2] in the preparation of liquid-crystalline ammonium oleate—"If we continue to add water to the solid anhydrous

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[1] *Sitz. b. Heidelberger Akad. Wiss.*, 1913, A, xiii; *Chem. News*, 108, 191 (1913).

[2] *Loc. cit.*

crystals of ammonium oleate it may easily be seen under the microscope that when the amount of water has reached a certain definite limit, the whole mass is converted into the syrupy liquid-crystalline modification. Thence forward no needles or leaflets of the anhydrous modification appear; the mass has become neutral ammonium oleate hydrate." That the mass referred to above will take up moisture readily was also noted by Lehmann for—"it is sufficient to leave the preparation uncovered for some time, when it absorbs moisture from the air, or to breathe on it."

Ammonium Elaidate.—No record can be found of the preparation of this salt. Elaidic acid was dissolved in ether, and ammonia passed into the solution. A glistening, white, gelatinous precipitate was formed which was filtered, washed with ether, and dried in a current of dry air. When thus dried, it became an amorphous soap-like substance. Ammonium elaidate can also be prepared in alcohol by saturating an alcoholic solution of the acid with ammonia gas and allowing the alcohol to evaporate. Since this salt loses ammonia slowly in the air, it is better to pass the ammonia gas into a saturated alcoholic solution of the acid, when white, translucent crystals are precipitated at once. These can be filtered, washed with ether, and dried in a desiccator. White, crystalline flakes are thus formed. The salt prepared in either medium is not deliquescent. The salt is soluble in methyl alcohol, ethyl alcohol, acetic acid and acetone. Analysis of the salt prepared in ether showed it to be the neutral ammonium elaidate.

Calc. for $C_{18}H_{33}O_2(NH_4)$: 4.68%; found: 4.61% N.

Of a Tribasic Acid.

All the previous preparations have been the neutral salts of monobasic and dibasic acids. The method having proved so very applicable in these cases, it was tried on the preparation of a neutral ammonium salt of a tribasic acid. Neutral ammonium aconitate was prepared, but only with difficulty, on account of it being so very deliquescent and losing part of its ammonia so readily. It suffices to show that the method is of very general application.

Ammonium Aconitate.—Several attempts were made to prepare the neutral ammonium salt of aconitic acid. When ammonia is passed into a solution of the acid in ether or in methyl alcohol, a mucilaginous precipitate is formed. This will not crystallize, even if the ammonia is conducted into the ethereal or alcoholic solution for a long time. A white colloidal precipitate is formed if the ammonia is passed into a solution of the acid in ethyl alcohol. After standing four days, this precipitate settled out mostly as an amorphous powder, but a small part of it was gummy. It was not analyzed. Baup[1] has also found that the neutral ammonium

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[1] Baup, *Ann.*, 77, 302 (1851).

salt of aconitic acid will not crystallize. The salt was prepared by Baup in aqueous solution and allowing the solution to evaporate to crystallization.

Ammonia was then passed into a saturated alcoholic solution of the acid to which a small amount of ether was added. A granular precipitate was now formed. This was quickly filtered by suction, washed with ether, and placed over sulfuric acid in a vacuum desiccator for a short time. Analysis of two samples of the salt thus prepared gave, respectively, 16.08% and 16.09% of nitrogen. The neutral salt of aconitic acid contains 18.67% nitrogen. Since this salt is very deliquescent and readily loses ammonia, it was again prepared as just described and placed in a desiccator containing sodium hydroxide instead of sulfuric acid. Two analyses of this salt gave, respectively, 18.63% and 18.65% nitrogen, showing that it was the neutral compound. This salt gave a neutral solution when dissolved in water, in which it is very soluble, but soon hydrolyzes. It is soluble in acetic acid, slightly soluble in methyl and ethyl alcohols and insoluble in ether.

Of the Hydroxy-Benzoic Acids.

Ammonium Salicylate.—Cahours[1] prepared the normal salt of salicylic acid by evaporating a hot, concentrated solution of salicylic acid and ammonia water. Upon cooling, the ammonium salt crystallized out in scales. A dilute solution produced, by slow evaporation, glittering, silky crystals, which, dried in the air, had the composition $NH_4C_7H_5O_3$. The salt was found to be very soluble in water; by dry distillation, it decomposed into water and the amide of salicylic acid. Marignac[2] obtained this salt as monoclinic crystals containing 0.5 molecule of water of crystallization.

When ammonia gas was passed into an ethereal solution of salicylic acid, white, pearly scales were formed. An aqueous solution of the salt was neutral and produced, with ferric chloride, a wine-red color. It is not deliquescent, and loses ammonia only in moist air. It is very soluble in water, methyl alcohol, ethyl alcohol and acetic acid.

Calc. for $C_7H_5O_3(NH_4)$: 9.03%; found: 9.04% N.

Ammonium-m-Hydroxybenzoate.—The ammonium salt of *m*-hydroxybenzoic acid was first prepared by Barth[3] by dissolving the acid in dilute ammonia water and allowing the solution to evaporate. The salt crystallized in needles in fascicular aggregates and was found to be very soluble in water. It contained no water of crystallization, and lost ammonia if dried on the water-bath. Analysis of the air-dried salt showed it to have the formula $C_7H_5O_3NH_4$.

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[1] Cahours, *Ann.*, **52**, 336 (1844).

[2] Marignac, *Jahresb. Fortschritte Chem.*, **1855**, p. 485.

[3] Barth, *Ann.*, **148**, 36 (1868).

When ammonia gas is passed into an ethereal solution of *m*-hydroxybenzoic acid until a portion of the salt, on being dissolved in water, shows a neutral solution, there is formed a white, granular precipitate of neutral ammonium *m*-hydroxybenzoate. When the ammonia is first passed in, the precipitate formed is very mucilaginous. The salt was washed with ether and dried in the vacuum desiccator. It is not deliquescent. In dry air the salt is stable, but loses ammonia in moist air. It is soluble in methyl alcohol, ethyl alcohol and acetic acid. It gives no color with ferric chloride. The salt crystallizes from ethyl alcohol in needles.

This salt can also be precipitated in acetone, in which it is but slightly soluble. When the ammonia is passed into the solution of the acid in acetone, no mucilaginous precipitate is formed at first, as in the case of the ethereal solution, but a granular powder is formed at once. The salt prepared in either acetone or ether slowly hydrolyzes when dissolved in water.

Prepared in ether: Calc. for $C_7H_5O_3(NH_4)$: 9.03%; found: 9.05% N. Prepared in acetone: Found: 9.02% N.

Ammonium p-Hydroxybenzoate.—This salt has been prepared by neutralizing the aqueous solution of *p*-hydroxybenzoic acid with ammonia water and the solution allowed to evaporate. It crystallized out from solution in long prisms and contained one molecule of water of crystallization.

This salt can also be prepared by passing dry ammonia gas into a saturated alcoholic, an ethereal, or an acetone solution of the anhydrous acid. In the alcoholic solution fine needle-like crystals are formed, in the ethereal solution a gelatinous precipitate is first formed which turns to an amorphous powder, while an amorphous powder is formed at once in the acetone solution. The salt was filtered by suction and washed with ether in each case. It is not deliquescent and imparts a neutral reaction to water, in which it is very soluble. It slowly hydrolyzes when dissolved in water. The aqueous solution gives no color with ferric chloride. It loses ammonia in moist air. The salt is readily soluble in methyl alcohol and acetic acid, very slightly soluble in acetone and appreciably so in ethyl alcohol. It is insoluble in ether. Analysis was made of the salt prepared in ether.

Calc. for $C_7H_5O_3(NH_4)$: 9.03%; found: 9.05% N.

Ammonium p-Methoxybenzoate.—The ammonium salt of *p*-methoxybenzoic acid (anisic acid) is described by Laurent[1] to be rhombic plates of the composition $NH_4C_8H_7O_3$. When ammonia was passed into a solution of the acid in alcohol, pearly white crystalline leaflets were formed, which were filtered, washed with ether and dried in a vacuum desiccator. The salt is stable in the air, and an aqueous solution of it is neutral to sensitive litmus paper. It is not deliquescent and its aqueous solution

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[1] Laurent, *Berz. Jahrb.*, 23, 415.

does not hydrolyze. It is readily soluble in methyl alcohol and acetic acid, and appreciably so in ethyl alcohol and acetone. A white, curdy precipitate, soluble in ammonia water, is formed when silver nitrate is added to an aqueous solution of the salt.

Calc. for $C_8H_7O_3(NH_4)$: 8.29%; found: 8.31% N.

When ammonia gas was conducted into an ethereal solution of *p*-methoxybenzoic acid, there was first formed a gelatinous precipitate which changed to a fine, crystalline powder. It can be crystallized from acetone in the form of fine feather-like needles.

Of Some Other Aromatic Acids.

Ammonium Hydrocinnamate.—Beilstein[1] describes this salt as small leaflets, easily soluble in water and readily losing ammonia. When ammonia is run into an ethereal solution of hydrocinnamic acid there is formed a white, gelatinous precipitate, which on drying changes to white, lustrous leaflets. The salt thus formed is the neutral ammonium hydrocinnamate, soluble in water, methyl alcohol, ethyl alcohol and acetic acid. It is insoluble in ether. The salt is slightly hygroscopic and loses ammonia in the air. Ferric chloride forms a yellowish precipitate with an aquesous solution of it.

Calc. for $C_9H_9O_2(NH_4)$: 8.38%; found: 8.37% N.

On account of the great solubility of this salt in ethyl alcohol, it cannot be precipitated in this medium. Ammonia was run into a solution of 2 g. of the acid in ethyl alcohol for one hour, the alcoholic solution poured into a crystallizing dish and allowed to evaporate in the air over night. A heavy oily substance remained instead of the pure salt. This oil was acid to litmus paper. On distilling it, ammonia was first evolved, then fumes which condensed to a white solid. The mercury of the thermometer then rose to 260° and a heavy, refractive oil passed over which redistilled at 245° (uncor.). Hydrocinnamic acid[2] is easily changed partly into its ethyl ester of boiling point 247° (cor.) by merely dissolving it in ethyl alcohol. On the other hand, the ester just as readily changes back to the acid by the moisture of the air. Ethyl hydrocinnamate is also very refractive. The oily residue which was obtained above by allowing the alcoholic ammonia solution of hydrocinnamic acid to evaporate in the air was thus a mixture of hydrocinnamic acid, its ammonium salt, and its ethyl ester.

Ammonium Hippurate.—A salt of the formula $NH_4C_9H_8NO_3.C_9H_9NO_3 + H_2O$ was obtained by Schwarz[3] by treating hippuric acid with an excess of ammonia. He was unable to prepare the neutral salt, and no record of its preparation can be found. When ammonia gas was run into a satura-

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[1] Gjacosa, Hoppe-Seyler's, *Z. physiol. Chem.*, **8**, 109 (1883).

[2] Erlenmeyer, *Ann.*, **137**, 330 (1866).

[3] Schwarz, *Ann.*, **54**, 37 (1845).

ted alcoholic solution of hippuric acid to which was added a small amount of ether, glistening, pearly, white laminae were formed. These were filtered on an alundum crucible and washed with ether. The salt is stable in dry air but loses ammonia slowly in moist air. It is not deliquescent, and an aqueous solution of it is neutral. It is soluble in methyl alcohol and ethyl alcohol. It is somewhat soluble in acetone, from which it crystallizes in beautiful needles. It is insoluble in ether.

Determination of the total nitrogen by the Kjeldahl method proved it to have the composition of the neutral salt.

Calc. for $C_9H_8NO_3(NH_4)$: 14.29%; found: 14.30% N.

Ammonium o-Toluate.—This salt cannot be precipitated by passing ammonia into an alcoholic solution of the acid on account of its great solubility in the alcohol. When the solution is evaporated, crystalline meedles are formed. A fine, white, crystalline precipitate is formed if the gas is passed into an ethereal solution of the acid. The salt is not deliquescent but is readily soluble in water, giving a neutral solution. The salt is stable in dry air, but loses ammonia slowly in moist air. It is soluble in methyl alcohol, ethyl alcohol, acetic acid and acetone.

Calc. for $C_8H_7O_2(NH_4)$: 9.15%; found: 9.15% N.

Although some of the salts of *o*-toluic acid have been prepared and studied, no mention of the neutral ammonium salt can be found.

Ammonium Phenylacetate.—This salt was prepared by Moller and Strecker[1] by dissolving the acid in ammonia water and allowing the solution to evaporate to crystallization. The salt was obtained only with difficulty on account of its great solubility. Fine, white needles are formed if ammonia gas is conducted into a saturated alcoholic solution of phenyl acetic acid, while a fine, white, semi-crystalline precipitate is formed, if the ammonia is run into an ethereal solution of the acid. Before filtering off the crystals formed in the alcoholic solution, it is necessary to add ether, for they are quite soluble in the alcohol. The salt is fairly stable in the air, losing its ammonia but slowly in moist air. The salt does not deliquesce, and imparts a neutral reaction to a water solution of it. It is very soluble in water, methyl alcohol and acetic acid, but only slightly so in acetone.

Prepared in alcohol: Calc. for $C_8H_7O_2(NH_4)$: 9.15%; found: 9.12% N. Prepared in ether: Found: 9.15% N.

Ammonium Mandelate.—This salt was first prepared by Winckler[2] by treating an aqueous solution of mandelic acid with ammonia water and allowing the solution to evaporate slowly. The ammonium salt crystallized out only with difficulty as a yellowish white, soft mass, ex-

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[1] Moller and Strecker, *Ann.*, **113**, 66 (1860).

[2] Winckler, *Ann.*, **18**, 317 (1836).

tremely soluble in water and in alcohol. Duparc and Pearce[1] prepared the salt in the form of rhombic prisms.

The neutral ammonium salt of mandelic acid was prepared by the usual method in ether. When the ammonia was added there was first formed a white mucilaginous precipitate which soon changed to a fine crystalline powder, very soluble in water, methyl alcohol, ethyl alcohol and acetic acid, but insoluble in ether and acetone. The salt, being very deliquescent in the air, was quickly filtered, washed with ether, and dried for a short time over sulfuric acid in a vacuum desiccator. It gave a neutral solution when dissolved in water. It loses ammonia in moist air. The salt can be crystallized from ethyl alcohol in aggregates of fine needles.

Calc. for $C_8H_7O_3(NH_4)$: 8.28%; found: 8.29% N.

Ammonium Uvitate.—No record can be found of the preparation and properties of this salt other than being mentioned by Finck[2] that it is impossible to precipitate it out of its aqueous solution by alcohol. When dry ammonia gas was run into an alcoholic solution of uvitic acid, no precipitate was formed. Upon the addition of ether to this solution a white, flocculent precipitate was formed. This was filtered by suction, keeping the alundum crucible filled with ether to prevent the salt going into solution on account of the alcohol present. The salt dried in a vacuum desiccator to an amorphous powder. It is readily soluble in water to which it imparts a neutral reaction. It is soluble in methyl alcohol, ethyl alcohol, and acetic acid, slightly soluble in acetone and insoluble in ether. The salt is not deliquescent. The salt prepared in ether had these same properties, and analysis showed it to be the neutral ammonium salt of uvitic acid.

Calc. for $C_9H_6O_4(NH_4)_2$: 13.08%; found: 13.10% N.

This investigation is being continued with other organic acids, especially the substituted acids.

ST. LOUIS, MO.

SOME NATURAL INDICATORS.

BY H. W. BRUBAKER.

Received June 25, 1914.

Cohn, in his "Indicators and Test Papers," states that the coloring matter from roses (*Rosa Gallica*) gives a deep red with green fluorescence in alkalies and light red in acids. I found that the coloring matter from *Rosa rugosa* gives a green color in alkalies, red in acids and coloress between these two. The coloring matter was extracted by triturating the petals in a mortar with some sea sand and 95% alcohol. This was then filtered and the filtrate evaporated to dryness somewhat above room tem-

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[1] Duparc and Pearce, *Z. Kryst. Min.*, **27**, 611.

[2] Finck, *Ann.*, **122**, 186 (1862).