Dec. 18, 1848.

John Thomas Cooper, Vice-President, in the Chair.

Messrs. John Blyth, M.D., F. Muspratt, J. H. Gladstone, Ph. D., James Napier, James Mason, and William Reylin, were elected Members of the Society.

The following paper was read :

IV.—*Researches on the volatile Organic Bases.*

By DR. A. W. HOFMANN,

Professor at the Royal College of Chemistry.

IV. ANILIDES.

In a short note,* communicated several years ago to the Society, I pointed out the existence of several new aniline compounds, without entering, however, into details respecting their properties, and without giving the analytical data on which my statements were founded.

A variety of other researches prevented me from completing the study of these substances, and it was but of late, that a new reaction I met with in another investigation, compelled me to return to the subject.

In my paper on melaniline,† I mentioned that the result of the action of chloride of cyanogen on aniline is very materially influenced by the presence of even small quantities of water, either in the aniline or in the chloride of cyanogen. Perfectly anhydrous aniline, when exposed to the action of chloride of cyanogen, previously dried by chloride of calcium, is entirely converted into hydrochlorate of melaniline, in accordance with the formulæ :

On separating the base, by means of potash, from the solution

* Memoirs of the Chemical Society, vol. III. p. 26.

† Quarterly Journal of the Chemical Society, vol. I. p. 286.

of this hydrochlorate, a mother-liquor is obtained, which, on evaporation, yields scarcely a trace of organic matter.

Action of chloride of cyanogen on aniline in the presence of water.—If the action of chloride of cyanogen on aniline takes place in the presence of water, a different deportment is observed. The mother-liquor, from which the melaniline has been separated by an alkali, when concentrated by evaporation, deposits on cooling slightly coloured acicular crystals, the quantity of which is in direct proportion with the amount of water that has been present. By treating aniline with the aqueous solution of chloride of cyanogen, obtained by passing chlorine gas into a solution of hydrocyanic acid in water, the chief product of the reaction, besides hydrochlorate of aniline, consists in the above-mentioned acicular crystals, whilst only traces of melaniline are separated on the addition of potash. The acicular crystals, as will be seen from the subjoined analysis, are the anomalous cyanate of aniline or anilo-urea, as the compound formerly was briefly termed.

ANILO-UREA.—CARBAMIDE-CARBANILIDE.

There is no difficulty in purifying the crystals of this substance. Treatment with animal charcoal, and one or two crystallizations, from boiling water, are sufficient to render them perfectly colourless.

The same compound is produced by mixing a solution of sulphate of aniline and cyanate of potash. After the lapse of some time the liquid becomes turbid, and gradually solidifies into a crystalline mass, consisting of the new substance and sulphate of potash, which have separated by crystallization, the former being very soluble in boiling, and but slightly soluble in cold water.

A third method of preparing it, consists in passing the vapour of hydrated cyanic acid (as obtained in the distillation of cyanuric acid) into anhydrous aniline. This experiment, however, requires particular care; the liquid has to be kept as cool as possible. On passing a rapid current of cyanic acid gas into the base, a very powerful evolution of heat takes place, under the influence of which, the newly-formed compound undergoes a further decomposition, a substance perfectly insoluble in water being formed, to which I shall return in the course of this paper. If the liquid has been exposed to a slow stream of gas, it gradually solidifies into a crystalline mass, which, when dissolved in boiling water, deposits crystals of perfect purity on cooling. In most cases, however, a small quantity of the substance insoluble in water is likewise formed.

The identity of these products was proved by the following analyses.

For the analyses I. II. and IV., the compound had been prepared by the action of moist chloride of cyanogen on aniline; analysis III. refers to a product obtained by treating aniline with a current of cyanic acid gas.

I.	0.3667	grm. of substance gave :
	0.8247	„ „ carbonic acid, and
	0.1995	„ „ water.
II.	0.2905	„ „ substance gave :
	0.6590	„ „ carbonic acid, and
	0.1610	„ „ water.
III.	0.2878	„ „ substance gave :
	0.6456	„ „ carbonic acid, and
	0.1595	„ „ water.
IV.	0.2947	„ „ substance gave :
	0.4262	„ „ platinum.

From these numbers the following per-centage composition is deduced :

	I.	II.	III.	IV.
Carbon . .	61.33	61.86	61.17	—
Hydrogen . .	6.04	6.15	6.15	—
Nitrogen . .	—	—	—	20.51

which leads to the formula :

as may be seen from the following table :

	Theory.	Mean of experiments.
14 equiv. of Carbon . .	84	61.76
8 „ „ Hydrogen . .	8	5.88
2 „ „ Nitrogen . .	28	20.58
2 „ „ Oxygen . .	16	11.78
1 „ „ Anilo-urea . .	136	100.00

The formation of anilo-urea in the preceding reactions is easily intelligible ; whilst in the two latter cases it is produced either by the direct union of the constituents :

or by a process of double decomposition :

we have in the former, a transposition of the chloride of cyanogen with the elements of water, in consequence of which hydrochloric acid and cyanic acid are formed :

The exchange of chlorine for oxygen in this case is remarkable ; it does not occur in the presence of ammonia ; by saturating an aqueous solution of ammonia with chloride of cyanogen and subsequent evaporation I did not obtain crystals of urea.

Anilo-urea is but sparingly soluble in cold water ; boiling water dissolves it in large quantities ; if the saturated solution be boiled with an excess of the substance, the crystals fuse and sink to the bottom of the vessel in the form of an oily fluid. The compound is likewise very soluble in alcohol and ether. It can be boiled with dilute acids and alkalis, without the slightest decomposition. I have repeatedly studied this reaction, because at the first glance it appeared to point out the possibility of thus producing anthranilic acid :

I have not, however, been able to effect this transposition ; both alkalis and acids, when employed in concentrated solutions, produce different changes.

When boiled with a concentrated solution of potash, or when heated with hydrate of potash, anilo-urea yields aniline and ammonia, carbonate of potash remaining in the retort :

Anilo-urea dissolves in concentrated sulphuric acid without decomposition ; on heating the solution, a brisk evolution of pure carbonic acid takes place, the residue contains sulphate of ammonia, and the conjugated sulphuric acid which M. Gerhardt* obtained by the action of sulphuric acid on various anilides. The brown residuary liquid solidifies, on the addition of water, to a slightly reddish crystalline mass, which may be purified by solution in boiling water and treatment with animal charcoal. A slowly cooling solution

* Journal de Pharmacie, 3 Sér. t. x. p. 1.

deposits splendid rhombic crystals, of considerable size and remarkable lustre.

The following equation illustrates this transposition:

Although the behaviour of the acid, produced in this reaction, left no doubt respecting its identity with anil-sulphuric acid, a sulphur determination was nevertheless made.

0.4268 grm. of the acid, burned with a mixture of carbonate and nitrate of potash, gave:

0.5835 grm. of sulphate of baryta corresponding to 18.75 per cent. of sulphur.

The formula:

requires the following values:

				Theory.	Experiment.	
12 equiv. of Carbon	.	.	.	72	41.62	—
7 „ „ Hydrogen	.	.	.	7	4.04	—
1 „ „ Nitrogen	.	.	.	14	8.09	—
2 „ „ Sulphur	.	.	.	32	18.49	18.75*
6 „ „ Oxygen	.	.	.	48	27.76	—
1 „ „ Sulphanilic acid	.	.	.	173	100.00	

The method by means of which I first obtained anilo-urea, viz.: the action of hydrated cyanic acid on aniline, very naturally suggested the idea that this compound must be considered as an analogue of urea; as urea containing the elements $\text{C}_{12} \text{H}_4$.

and hence the name under which I have described it.

This mode of regarding it is, however, not supported by the chemical deportment of the compound; in anilo-urea we no longer find a remnant of basic properties. I have vainly endeavoured to combine it with acids, in order to produce compounds analogous to nitrate or oxalate of urea. The presence of these acids does not increase the solubility of the aniline compound in water, and the crystals deposited

* The slight excess of sulphur arose from the presence of a trace of sulphate in the carbonate used.

on cooling retain no acid. My attempts to form a platinum-salt have likewise been unsuccessful.

The formula of anilo-urea admits, however, of another interpretation, which is strikingly supported by experimental evidence. The following equation :

shows that we may consider this substance, likewise, as a double compound of carbamide with its conjugated analogue. The existence of such double compounds is by no means isolated ; in a Memoir on the metamorphosis of cyaniline, which I intend shortly to present to the Society, I shall have to describe a body of perfectly similar construction, viz. a compound of oxamide with oxanilide, corresponding in every respect to the preceding substance.

Carbamide-carbanilide . . . $\text{NH}_2, \text{CO} ; \text{C}_{12} \text{H}_6 \text{N}, \text{CO}$

Oxamide-oxanilide . . . $\text{NH}_2, \text{C}_2 \text{O}_2 ; \text{C}_{12} \text{H}_6 \text{N}, \text{C}_2 \text{O}_2$.

I was very curious to submit this idea to the test of experiment, and was fortunate enough to meet with a reaction, which leaves little doubt regarding the structure of anilo-urea, or carbamide-carbanilide, as the substance more properly should be called. I found that, when submitted to the action of heat, this compound actually splits into its proximate constituents ; one of which, the carbanilide, is the principal product of the reaction, whilst the other, unable to exist at the temperature at which the separation takes place, undergoes a further metamorphosis, and can be recognized only in its derivatives.

In submitting anilo-urea to the action of heat, the substance fuses without decomposition ; on increasing, however, the temperature above the fusing point, torrents of ammonia are evolved, while the liquid in the retort solidifies to a crystalline mass, which again liquifies, and ultimately distils on a further elevation of the temperature. If the process be interrupted as soon as the evolution of ammonia ceases, and the solid begins to liquefy again, the residue in the retort consists of carbanilide and cyanuric acid. On treating this mixture with a large quantity of boiling water, the whole of the cyanuric acid, together with a small quantity of the other substance, is dissolved. In order to obtain the cyanuric acid, the aqueous solution is evaporated to dryness, and the residue extracted with alcohol, when carbanilide is dissolved, and the acid remains in a state of purity. The properties of cyanuric acid are so marked, that I have omitted to analyse the product ; its comportment with solvents, and emitting also the well-known odour of cyanic acid when heated, appearing quite sufficient to obviate all chance of mistake.

The production of carbanilide, of ammonia, and of cyanuric acid in this reaction, admits of an easy explanation, if we recollect that carbamide is actually a submultiple of urea, which, as is well known, when submitted to dry distillation, is converted into ammonia and cyanuric acid.

Two equivalents of the compound contain the elements of two equivalents of carbanilide and one of urea :

and the following equation exhibits the final results of the destruction of carbamide-carbanilide by heat :

The substance which I have described in the preceding pages claims some interest, as the first conjugated amide which was discovered, and as the first member of a class of compounds, which has been enriched in so remarkable a manner by the investigations of MM. Gerhardt and Laurent.

CARBAMIDE-NITROCARBANILIDE.

Before passing to the description of carbanilide itself, I have to say a few words respecting a compound closely connected with the above double amide, the existence of which I have pointed out in my Memoir on melaniline.* When studying the action of chloride of cyanogen on nitraniline, I noticed that along with basic dinitromelaniline a neutral substance was formed, which separated in long yellow needles from the solution of the crude product of the reaction in boiling water.

Analysis, as might have been anticipated, proved this body to be the double amide : carbamide-nitrocarbanilide.

0.2706 grm. of substance gave :

0.4575 „ „ carbonic acid = 46.10 per cent of carbon, and

0.1015 „ „ water = 4.16 per cent of hydrogen.

The formula :

requires the following values :

* Journal of the Chemical Society, v. 1. p. 305.

				Theory.		Experiment.
14 eq. of Carbon	.	.	.	84	46·40	46·10
7 „ Hydrogen	.	.	.	7	3 86	4·16
3 „ Nitrogen	.	.	.	42	23·22	—
6 „ Oxygen	.	.	.	48	26·52	—
				<hr/>	<hr/>	
1 „ Carbamide-nitrocarbanilide	.	.	.	181	100·00	

The formation of this compound will be evident from the following equation :

An analogous iodine compound :

is produced in the reaction of chloride of cyanogen on iodaniline along with diiodomelaniline. I have not analysed this compound.

CARBANILIDE.

This substance is but very slightly soluble in water ; it dissolves more readily in alcohol and ether. The boiling alcoholic solution deposits, on cooling, beautiful satiny needles, which have frequently a reddish tint, from which they may be freed by recrystallization from alcohol with animal charcoal. It is inodorous, but emits, when heated, a suffocating odour resembling that of benzoic acid. It fuses at 205° C., and distils without alteration.

When speaking of the formation of anilo-urea, by passing the vapour of cyanic acid into aniline, I mentioned that care must be taken to avoid the liquid getting very hot, in order to prevent the formation of a secondary product. I need scarcely say that this secondary product is nothing but carbanilide, which may be easily separated from the accompanying compound.

The nature of carbanilide being once understood, other methods presented themselves for its preparation. The simplest plan

appeared to be a reproduction of the circumstances under which carbamide was first obtained by M. Regnault. On exposing phosgene gas,* the interesting chloride of carbonic oxide, for the discovery of which we are indebted to Dr. John Davy, to the action of ammonia, the two gases solidified into a mixture of chloride of ammonium and carbamide.

This mixture admits of no complete separation of its two ingredients, both compounds exhibiting about the same behaviour with solvents, and it was by its reactions only, that M. Regnault succeeded in establishing its true nature.

The action of phosgene gas on aniline is perfectly analogous to that on ammonia, and the products of the reaction being easily separable, it affords a striking confirmation of M. Regnault's original explanation of the phenomenon. Aniline when introduced into an atmosphere of phosgene gas, solidifies at once into a crystalline mixture of carbanilide and hydrochlorate of aniline. The process is attended with a powerful evolution of heat.

It suffices to extract the crude product of the reaction with boiling water, when the hydrochlorate of aniline is dissolved, carbanilide remaining, which may be obtained in a state of purity by a single recrystallization from alcohol. This is certainly the simplest manner of obtaining carbanilide.†

The substances employed in the following analyses were partly obtained by this process (I. and II.), and partly by the action of cyanic acid on aniline (III. and V.) Combustion IV. was made with a product formed in the dry distillation of anilo-urea.

I. 0.4270 grm. of substance gave :

1.1400 „ „ carbonic acid, and

0.2200 „ „ water.

* The name phosgene gas was originally framed by Dr. Davy, on account of the remarkable manner in which solar radiation promotes the combination of carbonic oxide with chlorine. The co-operation of sun-light, however, is not absolutely necessary; Dumas when studying the action of this compound on alcohol, ascertained that the combination likewise took place in reflected light, but much more slowly; I have lately found that phosgene gas may be readily obtained by passing carbonic oxide through boiling pentachloride of antimony, which by this treatment is reduced to the state of ter-chloride, and this reaction affords even a simple method of qualitatively ascertaining the presence of carbonic oxide in a mixture of gases; for the odour of phosgene gas is so peculiar, that it cannot be mistaken by a person who has once smelt it.

† Care must be taken, however, that the phosgene gas contain no free chlorine, which gives rise to the formation of a chlorinated compound, imparting a violet colour to the carbanilide, and can only be separated with great difficulty.

II.	0.3325	grm. of substance gave :
	0.9020	„ „ carbonic acid, and
	0.1771	„ „ water.
III.	0.3019	„ „ substance gave :
	0.8182	„ „ carbonic acid, and
	0.1610	„ „ water.
IV.	0.2534	„ „ substance gave :
	0.6812	„ „ carbonic acid, and
	0.1328	„ „ water.
V.	0.4160	„ „ substance gave :
	0.3835	„ „ platinum.

Per-centage composition :

	I.	II.	III.	IV.	V.
Carbon . .	72.81	73.90	73.91	73.31	„
Hydrogen .	5.72	5.90	5.92	5.82	—
Nitrogen .	—	—	—	—	13.07

The formula :

requires the following values :

		Theory.	Mean of experiments
13 eq. of Carbon . .	. .	78 73.58	73.48
6 „ Hydrogen . .	. .	6 5.66	5.84
1 „ Nitrogen . .	. .	14 13.01	13.07
1 „ Oxygen . .	. .	8 7.75	—
1 „ Carbanilide . .	. .	106 100.00	

The behaviour of carbanilide, with both concentrated acids and alkalies, agrees perfectly with the formula deduced by analysis. When boiled with concentrated sulphuric acid, this substance is converted into sulphanilic acid, pure carbonic acid being evolved.

Ebullition with concentrated potash solution, or fusion with solid hydrate of potash gives rise to the formation of carbonate of potash, while aniline distils over.

The same decomposition takes place, although less perfectly, even without the assistance of potash, if moist carbanilide is rapidly

exposed to a high temperature, and hence the invariable presence of small quantities of carbonic acid and aniline among the products of the distillation of anilo-urea, if this substance has not been perfectly dried before the experiment.

The peculiar decomposition which anilo-urea exhibits under the influence of heat, induced me to study the phenomena attending the dry distillation of the corresponding sulphur compound, hydrosulphocyanate of aniline.

Hydrosulphocyanate of aniline is easily prepared by saturating free hydrosulphocyanic acid with an excess of aniline. The acid used in my experiments had been prepared by decomposing sulphocyanide of lead by hydrosulphuric acid. On evaporating the solution of hydrosulphocyanate of aniline, the compound separates in the form of deep red oily drops, which only gradually solidify into a crystalline mass. In repeated operations, I never succeeded in obtaining the salt perfectly colourless.

Action of heat on Hydrosulphocyanate of Aniline.

Dry hydrosulphocyanate of aniline, when exposed to the action of heat, fused at a very moderate temperature, and entered soon into a sort of ebullition, torrents of hydrosulphuric acid and of sulphide of ammonium being evolved, whilst on increasing the temperature, a colourless oily liquid distilled over, solidifying in the water of the receiver to a semi solid crystalline mass. The residue in the retort is a slightly coloured resinous substance. In order to purify the crystalline compound, the whole distillate was subjected to another distillation. The liquid which now came over, separated into two distinct layers, of which the upper one contained a large quantity of hydrosulphuric acid and ammonia, whilst the lower one consisted of pure bisulphide of carbon. The products of the dry distillation of hydrosulphocyanate of aniline are, therefore, an *amorphous body* remaining in the retort, *ammonia*, *hydrosulphuric acid*, *bisulphide of carbon*, and a *crystalline substance*, which, as the subsequent analysis will prove, is a compound corresponding to carbanilide, in which the oxygen of the latter is replaced by an equivalent quantity of sulphur, a compound represented by the formula :

for which I propose the name of *Sulphocarbanilide*.

The decomposition which hydrosulphocyanate of aniline undergoes when submitted to destructive distillation is perfectly analogous

to that of anilo-urea. Two equivalents of the hydrosulphocyanate split into two equivalents of sulphocarbanilide and one equivalent of sulphocyanide of ammonium, according to the equation :

Of course we cannot expect in a decomposition of this kind actually to separate the sulphocyanide of ammonium ; this compound, like urea, being unable to exist at the temperature at which the decomposition takes place. But there is no difficulty in tracing it in its products of decomposition. From the experiments of Professor Liebig, we know that sulphocyanide of ammonium, when exposed to the action of heat, evolves ammonia, hydrosulphuric acid and bisulphide of carbon, whilst a residue remains, described by Liebig under the name of melam, splitting on the further application of heat again into mellon and ammonia. Now I have mentioned already that the distillate of hydrosulphocyanate of aniline, along with sulphocarbanilide, actually contains a large quantity of sulphide of ammonium and bisulphide of carbon. The residue in the retort seems to consist of mellon or melam, mixed with a small quantity of an aniline compound. The comparatively small scale in which I had to work, and the difficulty of purifying the mellon compounds, prevented me from entering upon a more minute investigation.

There is, however, but little doubt that the dry distillation of hydrosulphocyanate of aniline is illustrated by the above equation.

The preparation of sulphocarbanilide by the action of heat on the hydrosulphocyanate of aniline being rather a circuitous process, I tried to obtain the same compound by means of a different method. The ready production of carbanilide, by the action of phosgene gas on aniline, appeared to point out the course to be pursued. There was but little doubt that the compound in question would easily be formed by submitting aniline to the influence of a sulphur compound analogous to phosgene gas. A substance of this kind is known, but very imperfectly. In his remarkable paper on the conversion of bisulphide of carbon into the bichloride,* Dr. Kolbe states that the first product of the action of chlorine on bisulphide of carbon at high temperatures is the compound :

* Liebig's *Annalen*, Bd. *XLV.* S. 41.

The purification, however, of this substance appears to have been attended with so much difficulty, that a very satisfactory analysis of it is still wanting. Before recurring, therefore, to this difficult and still doubtful reaction, I tried whether sulphocarbamilide might not be formed by treating aniline with bisulphide of carbon.

Action of Bisulphide of Carbon on Aniline.

Aniline and bisulphide of carbon may be mixed in every proportion. A mixture of this kind, when left for some hours, begins to evolve hydrosulphuric acid, and gradually solidifies into a scaly crystalline mass, which, after purification, is easily identified with sulphocarbamilide. The reaction is represented by the following equation :

At the common temperature, weeks are required for the completion of the process ; with the aid of heat, the conversion may be effected rapidly. The simplest plan is to fix a large Liebig's condensor vertically into a flask containing the mixture, which is gently heated for a day or two in a sand-bath over a gas flame. The presence of alcohol, I find, considerably accelerates the conversion. As soon as the evolution of hydrosulphuric acid ceases, the digestion is interrupted, and the crystals are freed from the remaining bisulphide of carbon by ebullition. One or two crystallizations from alcohol render them perfectly pure.

The action of bisulphide of carbon on aniline presents a most remarkable analogy with the decomposition occurring in a mixture of the same compound with ammonia. The experiments of Zeise have proved that an alcoholic solution of bisulphide of carbon, when saturated with ammonia, is gradually converted into the same ammonium compound, which Mr. Porret long ago obtained by saturating his hydrosulphocyanic acid with ammonia, viz. into sulphocyanide of ammonium. Now sulphocyanide of ammonium, although widely different in its chemical nature from sulphocarbamilide, nevertheless presents a striking analogy to this compound. Sulphocyanide of ammonium is a multiple of sulphocarbamide.

The modes of production of sulphocyanide of ammonium and sulphocarbamilide thus become perfectly parallel, as may be seen by the two following corresponding equations :

For the following analyses, the compound was obtained in different preparations. The product employed in the first combustion was formed in the dry distillation of hydrosulphocyanate of aniline; the other analyses were made with the compound obtained by the action of bisulphide of carbon on aniline.

- I. 0.2477 grm. of substance gave :
 0.6219 „ „ carbonic acid, and
 0.1204 „ „ water.
 II. 0.2891 „ „ substance gave :
 0.7253 „ „ carbonic acid, and
 0.1365 „ „ water.
 III. 0.3259 „ „ substance gave :
 0.8120 „ „ carbonic acid, and
 0.1542 „ „ water.

- IV. 0.4593 grm. of substance gave :
 54.5 C.C. of moist nitrogen at 21° C. and 0m, 7596 Bar.

Of the following two sulphur determinations, the first was made by gradually deflagrating a mixture of the substance with nitrate of potash and carbonate of soda. A small quantity of the compound having been volatilized in this operation, a second experiment was made, in which the sulphocarbonilide was dissolved in fuming nitric acid, which converts it into a substitution-body, which is no longer volatile. The solution was evaporated to dryness, and the residue deflagrated in the usual manner with nitre and carbonate of soda.

- V. 0.3809 grm. of substance gave :
 0.3825 „ „ sulphate of baryta.
 VI. 0.4985 „ „ substance gave :
 0.5105 „ „ sulphate of baryta.

Per-centage composition :

	I.	II.	III.	IV.	V.	VI.
Carbon . .	68.47	68.42	67.95	—	—	—
Hydrogen . .	5.41	5.27	5.26	—	—	—
Nitrogen . .	—	—	—	12.63	—	—
Sulphur . .	—	—	—	—	13.67	14.04

the mean of which closely agrees with the values of the formula :

as may be seen from the following table :

					Theory.	Mean.
13 equiv. of Carbon	.	.	.	78	68.42	68.28
6 „ „ Hydrogen	.	.	.	6	5.24	5.28
1 „ „ Nitrogen	.	.	.	14	12.29	12.63
1 „ „ Sulphur	.	.	.	16	14.03	13.85
					<hr/>	<hr/>
1 „ „ Sulphocarbonilide	.	.	.	114	100.00	100.04

Sulphocarbonilide is but slightly soluble in water, it dissolves more readily in alcohol and ether, the boiling solutions deposit the compound, on cooling, in beautifully iridescent plates of remarkable lustre. Sulphocarbonilide is distinguished by its bitter taste, it is in fact one of the bitterest substances I ever met with. It has a peculiar smell, which becomes more perceptible on heating. It fuses at 140°C . (284°F .) and distils without decomposition.

Dilute acids and alkalies have no action on sulphocarbonilide; when concentrated, they decompose the compound, and these decompositions are analogous to the corresponding changes of carbonilide. Sulphocarbonilide dissolves in concentrated sulphuric acid; on gently heating this substance a brisk effervescence takes place, carbonic and sulphurous acids being evolved; the remaining solution solidifies on the addition of water into a crystalline mass of sulphanilic acid.

The equation :

illustrates the decomposition; it is evident that the hydrosulphuric acid of this equation, when coming into contact with concentrated sulphuric acid, is decomposed with the formation of sulphurous acid and the deposition of sulphur. In fact, on adding to the liquid a sufficient quantity of water to dissolve the sulphanilic acid, a muddy solution is obtained, from which a large quantity of free sulphur is deposited :

On fusing sulphocarbonilide with solid potash, pure aniline distils, a mixture of carbonate of potash, and sulphide of potassium remaining in the retort :

If instead of solid potash, an alcoholic solution of that base be employed, the reaction is considerably modified. In this case the oxygen is simply exchanged for sulphur, sulphide of potassium and carbanilide being formed, which crystallizes, on cooling, from the alkaline solution in long beautiful needles.

The alcoholic solution of potash may be advantageously replaced by protoxide of mercury. Indeed, on boiling an alcoholic solution of sulphocarbanilide with protoxide of mercury, the red colour of the oxide at once disappears, black protosulphide being deposited, whilst carbanilide crystallizes from the solution.

The rapid action of protoxide of mercury on the sulphur compound, induced me to examine its behaviour with chloride, bromide, iodide, and cyanide of mercury, in order to form the corresponding chlorine, bromine, iodine, and cyanogen compounds. These salts, however, are without action on sulphocarbanilide.

The following table embraces the compounds, the analysis of which I have communicated on the preceding pages.

Carbamide-carbanilide	. NH ₂ , CO ;	C ₁₂ H ₆ N, CO
Carbamide-nitrocarbanilide	. NH ₂ , CO ;	C ₁₂ { $\frac{\text{H}_5}{\text{NO}_4}$ } N, CO
Carbanilide	. . .	C ₁₂ H ₆ N, CO
Sulphocarbanilide	. . .	C ₁₂ H ₆ N, CS