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William Thomas Brande, Esq., President, in the Chair.

The following presents were announced to the Library of the Society : The last volume of the Transactions and 2 volumes of the Proceedings of the Society of Natural History of Vienna, presented by the Society ; the current numbers of the American Journal of Science ; the Journal of the Franklin Institute ; the Pharmaceutical Journal, the Chemical Gazette, and the Agricultural Journal, presented by their respective Editors.

The following communications were read :

Upon the chemical composition of Pollen, by THORNTON J. HERAPATH, Esq.
—By treating the pollen of the red and white lily (*Lilium bulbiferum* and *candidum*) with water, alcohol, and ether successively, a number of matters, already described by other authors, were removed, leaving pollenin as a lemon-yellow coloured residue, possessing the properties usually accorded it, with these few exceptions. The pollenin from these sources was soluble without alteration in nitric acid, when too much heat was not applied, and water precipitated it unchanged from the acid solution. On boiling the solution in nitric acid, decomposition ensued, the tallow-like substance, mentioned by Berzelius, appeared upon the surface of the liquid, and no pollenin could then be precipitated by water ; no oxalic or carbazotic acids were found amongst the products of this decomposition. Starch was not detected in the pollen from the lily ; a peculiar colouring matter was found in that from the red, which did not exist in that of the white lily.

The author likewise examined the pollen from the *Cactus speciosissimus*, in which starch appeared to occupy the internal parts of the pollen granules. The amounts of pollenin yielded by 100 parts of these varieties of pollen, were as follows :

from <i>Lilium bulbiferum</i>	. .	43·012.
„ <i>Lilium candidum</i>	. .	36·936.
„ <i>Cactus speciosissimus</i>	. .	46·575.

I. On CUMIDINE; a new Organic Base. By EDWARD CHAMBERS NICHOLSON, ESQ.

The recognition of a close connection between the physical properties and chemical constitution of bodies, which has latterly attracted the attention of chemists, has chiefly been arrived at by comparing substances of corresponding series, which present a close and simple relation to each other. Our knowledge in this direction is, as yet, but limited, and certainly can only be extended by a careful comparison of the members of various parallel groups.

The beautiful relation, between the boiling point, and the number of equivalents of carbon and hydrogen of various compounds, which the researches of H. Kopp have pointed out, can only be verified and fully established, by a still more complete investigation of analogous substances.

It was in consequence of these considerations that Dr. Hofmann occasioned a series of experiments to be carried on in his laboratory, on the derivatives of cuminic acid, a substance which the researches of Gerhardt and Cahours have proved to be an analogue of benzoic acid, the products from which latter substance have been more completely studied than those from any other body.

As a part of these researches, some of which have already been communicated to the Chemical Society, I had undertaken the study of the derivatives of cumol; the bodies corresponding to nitrobenzol, dinitrobenzol, azobenzol, aniline and nitraniline. None of these bodies were known when I commenced this investigation: some time since, however, M. Cahours gave notice in a paper, "On the action of a mixture of sulphuric and nitric acids on several organic substances," that he was engaged with an investigation of the same subject.

In this notice, M. Cahours gives the composition of nitrocumol and dinitrocumol, and briefly mentions that these bodies are converted into basic substances by the action of reducing agents.

In consequence of this announcement, I refrain from a further prosecution of this subject, and will give here only the results I

A NEW ORGANIC BASE.

have obtained, by examining the member, which is the representative of aniline in the benzol series.

PREPARATION OF CUMIDINE.

The preparation of this base from cumol is exactly analogous to that of aniline from benzol.

Cumol was treated with fuming nitric acid until it was entirely dissolved, heat being evolved during the reaction, and a large quantity of red vapours given off. On the addition of water, a dark red oily body precipitated, which was nitrocumol. An alcoholic solution of this substance was saturated first with ammoniacal gas, and then with hydrosulphuric acid. After the lapse of a few days, the liquid lost the smell of that gas, and a large quantity of sulphur separated; it was again treated with hydrosulphuric acid and distilled. This process was continued until the whole of the nitrocumol was decomposed. Alcohol and sulphide of ammonium having been removed by the last distillation, the residue in the retort was dissolved in hydrochloric acid, filtered from a small quantity of sulphur, and evaporated, until upon cooling, the whole became a crystalline mass.

These crystals constituted the hydrochlorate, of the representative in the cumol series, of aniline and toluidine in their respective series, and for which I propose the name of "Cumidine." On treating the boiling aqueous solution of this salt with caustic potash, the base immediately separated in oily drops, which collected in an uniform layer, on the surface of the fluid. The purification of the base was very simple. The distillate was saturated with a concentrated solution of oxalic acid, and evaporated to dryness:—the residue dissolved in boiling alcohol, and treated with animal charcoal. On cooling, the oxalate was deposited in colourless crystalline plates, which were absolutely pure. The solution of this salt in water was decomposed by hydrate of potash. On separating the oily liquid, by means of a pipette, and distilling rapidly, the base was obtained pure and colourless; traces of water having been previously removed by contact with potash.

COMPOSITION OF CUMIDINE.

The preparation and properties of this base, being analogous to those of aniline and toluidine, left no doubt in my mind as to its composition. Nevertheless, I have made the following determination of carbon, hydrogen and nitrogen, which proves that cumidine, like the above-mentioned substances, is free from oxygen.

I. 0·2017 grm. of substance, burnt with oxide of copper, gave 0·5902 grm. of carbonic acid and 0·1755 grm. of water.

II. 0·4944 grm. of substance, burnt in an atmosphere of carbonic acid gave 45 c. c. of moist nitrogen. Bar. 768·9 mm. (30·27 in.) Therm. 18° C. (64·5 F.) which calculated for 100 parts, give :

	I.	II.
Carbon	79·82	„
Hydrogen	9·66	„
Nitrogen	„	10·67

Agreeing exactly with the formula :

as will be seen when the numbers are placed in comparison with the calculated numbers :

		Theory.	Experiment.
18 equiv. Carbon	108	80·00	79·82
13 „ Hydrogen	13	9·63	9·66
1 „ Nitrogen	14	10·37	10·67
1 „ Cumidine	135	100·00	

To prove the accuracy of the formula for this base, and control its atomic weight, I submitted the platinum double compound to a careful analysis. Two determinations, which I shall hereafter mention in detail, gave 28·85 and 28·93 per cent of platinum, the corresponding numbers to which closely agree with the calculated atomic weight.

		Mean.	Theory.
I. Atomic weight by experiment .	135·82	135·32	135·00
II. „ „ „ .	134·82		

The formation of cumidine from nitrocumol, is analogous to that of aniline and toluidine from nitrobenzol and nitrotoluol :

PROPERTIES OF CUMIDINE.

This body, as previously stated, is obtained in the form of a slightly yellowish oil, dispersing and refracting light in an eminent degree, and possessing a peculiar smell and burning taste. In a mixture of ice and salt, it solidifies to a mass of square plates, which rapidly disappear when the temperature increases. It seems, that under peculiar circumstances, this body becomes crystalline at ordinary temperatures. On one occasion, in the winter, I obtained this body in beautiful square plates, resembling those obtained when

the oil is exposed to a frigorific mixture, and which have continued solid up to the present time. It is also well known that toluidine and naphthalidine often remain liquid for a considerable period.

Cumidine is very soluble in alcohol, ether, pyroxilic spirit, bisulphide of carbon, and the fatty oils. Water also dissolves it in small quantity. The base has no action on reddened litmus or turmeric papers. It evaporates but slowly at ordinary temperatures, and leaves a stain on paper, which disappears after some time. Cumidine is lighter than water, its spec. grav. being 0.9526.

I was very anxious to ascertain the boiling point of cumidine:—in two experiments made with different specimens, the liquid boiling in contact with a coil of platinum wire, and nearly an ounce distilling over, the thermometer became stationary at 225° C. (437° F.) Bar. 761.1 mm. (29.965 in.).

On comparing this result with the number calculated by H. Kopp's empirical rule, a considerable discrepancy is obvious.

If we take as a starting point, the boiling temperature of aniline, which has lately been verified in several experiments by Dr. Hofmann, we obtain the following calculated numbers, for the series of bases between aniline and cumidine:

	Theory.	Experiment.
Aniline	182° C.	182° C. Hofmann.
Toluidine	201 „	198 „ Muspratt and Hofmann.
Unknown base . .	220 „	„ „ „
Cumidine	239 „	225 „ Nicholson.

Cumidine, when recently distilled, is nearly colourless, but on a few minutes' exposure to the air, rapidly changes, first to a yellow, and finally to a dark red colour; this alteration takes place with greater rapidity at high temperatures. Its vapour is highly inflammable, burning with a yellowish flame, and depositing large quantities of carbon.

Cumidine, like aniline and toluidine, imparts an intense yellow colour to fir-wood, but it does not afford the beautiful reaction with hypochlorite of lime which characterizes the former base.

The basic properties of this substance, although very feeble, are rendered obvious by its comportment with the salts of weak mineral oxides. An aqueous solution of cumidine separates hydrated sesquioxide of iron from the sesquichloride, but gives no precipitate with the salts of zinc or alumina.

COMPOUNDS OF CUMIDINE.

The basic character of this substance is moreover exhibited in the

extraordinary facility with which it forms crystalline compounds with acids; a property in which it also resembles aniline and toluidine. All these salts, except some metallic double compounds, are colourless when recently prepared; but some of them, especially when moist, or exposed to a high temperature, assume a pinkish hue. They are soluble in water, and more so in alcohol. When decomposed by the caustic alkalis, the base separates in dark oily globules if the solution be concentrated; if dilute, as a white curdy precipitate. All the salts of cumidine, like those of aniline, are anhydrous. They are acid to litmus paper. When rapidly boiled in water for some time, they are partially decomposed, the base volatilising.

SULPHATE OF CUMIDINE.

I obtained this salt by dissolving the base in boiling dilute sulphuric acid; upon cooling, the whole became a crystalline mass. When dissolved in water, and decolourised by animal charcoal, crystals of perfect purity were obtained on cooling.

This salt is only slightly soluble in water, but more soluble in alcohol; it is inodorous, but possesses a disagreeable bitter taste. At 100° C. (212° F.) it emits the odour of the base, but is not otherwise altered in properties, except that it assumes a faint pink tint.

I. 0.2357 grm. of substance, burnt with oxide of copper, gave 0.5070 grm. of carbonic acid and 0.1687 grm. of water.

II. 0.2994 grm. of substance, precipitated with chloride of barium, gave 0.1902 grm. of sulphate of barytes, which quantities accord with the following composition in 100 parts:

	I.	II.
Carbon	58.66	„
Hydrogen	7.94	„
Sulphuric acid	„	21.77

corresponding to the formula:

as is seen by the following calculation:

		Theory.	Experiment.
18 equivs. of Carbon	108 . .	58.70 . .	58.66
14 „ Hydrogen	14 . .	7.60 . .	7.94
1 equiv. of Nitrogen	14 . .	7.61 . .	„
1 „ Oxygen	8 . .	4.35 . .	„
1 „ Sulphuric acid	40 . .	21.74 . .	21.77
1 „ Sulphate of cumidine . .	184	100.00	

NITRATE OF CUMIDINE.

This salt is obtained by gently heating the base with dilute nitric acid. On cooling, the fluid becomes filled with long needle-like crystals, which are colourless, if the acid be not too concentrated, and are otherwise of a reddish tint.

It is soluble in water and alcohol, and is not decomposed at a temperature of 100° C. (212° F.).

I. 0.3231 grm. of substance, burnt with oxide of copper, gave 0.6460 grm. of carbonic acid and 0.2145 grm. of water, which yield the following numbers per cent :

Carbon	54.52
Hydrogen	7.37

agreeing with the formula :

as is seen by the following calculation :

		Theory.	Experiment.
18 equivs. of Carbon	108 . .	54.54 . .	54.52
14 „ Hydrogen	14 . .	7.07 . .	7.37
2 „ Nitrogen	28 . .	14.15 . .	„
6 „ Oxygen	48 . .	24.24 . .	„
1 equiv. of Nitrate of cumidine . .	198	100.00	

HYDROCHLORATE OF CUMIDINE.

The base combines directly with hydrochloric acid, with the evolution of heat. By re-crystallization from water or alcohol, the salt is obtained in large well-formed prisms, perfectly white and inodorous. If moist or exposed to the air, it assumes a pink colour. It is not altered at a temperature of 100° C. (212° F.), but at a higher temperature it melts and sublimes.

I. 0.1810 grm. of substance, burnt with chromate of lead, gave 0.4178 grm. of carbonic acid and 0.1360 grm. of water.

II. 0.3908 grm. of substance, precipitated with nitrate of silver, gave 0.3267 grm. of chloride of silver, which, calculated for 100 parts, is equivalent to :

	I.	II.
Carbon	62.94	„
Hydrogen	8.34	„
Chlorine	„	20.67

agreeing with the formula :

as will be seen by a comparison with the following calculated numbers:

		Theory.	Experiment.
18 equivs. of Carbon	108	62.97	62.94
14 „ Hydrogen	14	8.17	8.34
1 equiv. of Nitrogen	14	8.17	„
1 „ Chlorine	35.5	20.69	20.67
1 „ Hydrochlorate of cumidine	171.5	100.00	

Cumidine, when added to a boiling aqueous solution of oxalic acid, dissolves, and upon cooling, a salt crystallizes in beautiful pearly tables, which are difficultly soluble in water, but more so in alcohol.

I have made several analyses of this substance, and from the great difference in the numbers obtained, there remains no doubt that it is a mixture of the neutral with an acid oxalate. The small amount of substance at my command, has prevented me from separating these two bodies in a state of purity.

CUMIDINE AND BICHLORIDE OF PLATINUM.

This beautiful compound is obtained when an excess of bichloride of platinum is added to a hot solution of hydrochlorate of cumidine in water. Upon cooling, the compound is deposited in long yellow needles, which, after washing with a small quantity of water, are perfectly pure. This substance is decomposed when boiled with water. Its deportment with alcohol and ether is very singular. On adding a few drops of alcohol to a large quantity of this substance, it immediately dissolves, and after a short time, is precipitated in the form of a dark red oil, which, after evaporation of the alcohol, solidifies to a mass of crystals, of a magnificent orange-yellow colour. At a temperature of 100° C. (212° F.) it becomes rather darker in colour, but is not otherwise altered in properties. At a higher temperature it is decomposed into hydrochlorate of cumidine, which sublimes, and metallic platinum.

I. 0.3468 grm. of substance, burnt with chromate of lead, gave 0.3985 grm. of carbonic acid and 0.1400 grm. of water.

II. 0.4793 grm. of substance gave 0.1383 grm. of platinum.

III. 0.4967 grm. of substance gave 0.1437 grm. of platinum, which quantities accord with the following composition per cent :

	I.	II.	III.
Carbon	31.33	„	„
Hydrogen	4.48	„	„
Platinum	„	28.85	28.93

and with the formula :

as may be seen by the following calculation :

		Theory.	Experiment.
18 equivs. of Carbon	108	31·65	31·33
14 „ Hydrogen	14	4·12	4·48
1 equiv. of Nitrogen	14	4·12	„
3 equivs. of Chlorine	106·5	31·21	„
1 equiv. of Platinum	98·68	28·90	28·89
1 „ Chloride of platinum and cumidine	341·18	100·00	

I have not examined the other salts of this base, and shall only remark, that the hydrobromate, hydriodate, hydrofluante, metaphosphate, phosphate, acetate and tartrate, are immediately produced, when these acids are brought into contact with anhydrous cumidine. The hydriodate of cumidine seems to be the most soluble of its compounds.

Besides the simple salts mentioned, cumidine forms a great number of double compounds.

Bichloride of palladium produces a yellow precipitate, very similar in appearance to the platinum salt ; it is soluble in water and alcohol, and crystallizes from the latter solvent in yellow needles.

An alcoholic solution of this base produces a violet precipitate with sesquichloride of gold, rather darker in colour than ferrocyanide of copper. It is soluble in alcohol, to which it imparts an intense colour.

Nitrate of cumidine combines with nitrate of silver, and forms a beautiful compound, crystallizing in long needles, which are soluble in water and alcohol without decomposition.

An alcoholic solution of cumidine produces with chloride of mercury, a white granular precipitate, which is decomposed by boiling water, with the formation of a yellow powder. With cyanide of mercury, cumidine also gives a crystalline precipitate.

Sulphate of copper produces a beautiful grass-green precipitate, in an alcoholic solution of the base, which is insoluble in water and alcohol.

PRODUCTS OF THE DECOMPOSITION OF CUMIDINE.

The great number of changes which oil of cummin undergoes before its conversion into cumidine : the treatment of the oil with hydrate of potash, in order to separate the cymol and to convert the cuminol into cuminic acid : the distillation of this acid with caustic lime, to procure cumol : the conversion of the cumol into

nitrocumol, by fuming nitric acid: and finally, the reduction of nitrocumol by hydrosulphuric acid, render the preparation of this base, in any quantity, a long and laborious process. In consequence of this difficulty, I could but briefly study the products of its decomposition.

Potassium, when heated in the vapour of cumidine, is converted into cyanide of potassium.

Concentrated nitric acid dissolves the base with a beautiful purple colour. On adding water to the solution, a flocculent precipitate is produced, which partakes of the character of an acid.

Dry chromic acid acts very powerfully on cumidine; great heat is evolved, but the base does not inflame like aniline.

On treating cumidine with bromine, a violent action ensues, with the disengagement of heat and evolution of hydrobromic acid. The base is converted into a solid grey mass, which is soluble in alcohol and ether, but insoluble in water, and crystallizes from the former solvents in long white needles. The great analogy in the properties and in the mode of formation of this body to those of tribromaniline, render it very probable that it is tribromocumidine:

When treated with a mixture of hydrochloric acid and chlorate of potash, the base is powerfully attacked and converted into a brown viscid mass, which had exactly the smell of chlorophenissic acid. When boiled in alcohol, it partially dissolves, and leaves a crystalline substance.

Aniline, when treated in a similar manner, yields, as is known, a mixture of chloranil and chlorophenissic acid; whether the products obtained in the decomposition of cumidine are identical with those of aniline, or whether they only represent these products in the cumol series, has to be decided by further experiments, which I soon hope to undertake.

Cumidine also produces a class of substances analogous to the amides and anilides.

The base, when exposed to an atmosphere of phosgene gas, immediately solidifies, with the evolution of heat; when washed with water to free it from hydrochlorate of cumidine, and then dissolved in boiling alcohol, it deposits on cooling, large crystals, very similar in appearance to nitrate of potash.

A mixture of bisulphide of carbon and cumidine, after the lapse of a few hours, evolves a large quantity of hydrosulphuric acid; upon the addition of water, an oily body separates, which soon solidifies to

a crystalline mass. It is soluble in boiling alcohol, from which it is deposited in colourless needles.

These two latter substances are evidently carbo-cumidide and sulphocarbo-cumidide, corresponding to carbanilide and sulphocarbanilide, lately described by Dr. Hofmann.

Oxalate of cumidine, when submitted to dry distillation, yields a crystalline substance, which is but difficultly soluble in water, and shows in every respect the comportment of oxicumidide.

I have not made an analysis of these bodies, but there is little doubt that their composition may be represented by the following formulæ :

Messrs. Muspratt and Hofmann, in their paper on Toluidine, have proved that the formation of azobenzol, by the action of an alcoholic solution of hydrate of potash on nitrobenzol, is always accompanied by a simultaneous production of aniline. I was anxious to ascertain, whether nitrocumol would undergo an analogous metamorphosis.

On distilling an alcoholic solution of nitrocumol with caustic potash, a violent reaction ensued, and a deep red coloured oil collected in the receiver, which perfectly resembled azobenzol, before it has solidified ; in the latter stage of the process, a large quantity of cumidine passed over ; the residue in the retort contained considerable quantities of oxalate of potash.

The formation of these substances is accompanied and, as it seems, preceded by others ; but the final reaction may be represented by the following equation :

These experiments have been carried on in the laboratory of the Royal College of Chemistry ; and I cannot refrain from expressing my greatest thankfulness to Dr. Hofmann, for his superintendence and advice during their prosecution.